

**VOLUME 2
APPENDICES**

SAN JUAN WATERFRONT PROJECT

Declaración de Impacto Ambiental - Preliminar

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Submitted to:

Environmental Quality Board
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APPENDIX A

Regulatory Overview

APPENDIX A REGULATORY OVERVIEW

A.1 Topography, Geology, and Soils

This section describes the federal, commonwealth and local laws, ordinances, regulations, and permits pertaining to topography, geology, and soils, which are applicable to the Proposed Action.

A.1.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. There are no applicable federal regulations related to topography, geology, and soils.

A.1.2 Commonwealth of Puerto Rico Regulations

The regulations of the Commonwealth of Puerto Rico include those laws and regulations adopted by the commonwealth government and implemented by commonwealth agencies. The Commonwealth of Puerto Rico regulation pertaining to topography, geology, and soils is Law No. 75, which adopted the Uniform Building Code. This regulation and associated permitting is described below.

A.1.2.1 Law No. 75

The Commonwealth of Puerto Rico has adopted under the provisions of Law No. 75 of June 24, 1975 (1997 edition) of the Uniform Building Code via amendments as stated in Law No. 75 (Regulation and Permits Administration 1999). This code establishes two zones of danger (on a scale of 0-to-4, where 4 indicates the maximum danger) with regard to seismicity within the Proposed Action area. The Island of Puerto Rico is designated Zone 3 (Puerto Rico Seismic Network [PRSN] 2005a). Consequently, due to the seismic potential of the region, all structures are required to meet the Uniform Building Code standards for seismic safety.

A.1.2.2 Required Commonwealth of Puerto Rico Permits

Permits for the Proposed Action would be required for construction work related to earth movement, building construction, erosion control and sedimentation, and waste disposal. Details on these required permits are provided below:

Regulations and Permits Administration (ARPE)

- Dredging, excavation and other similar activities would require a permit for earth movement.
- Construction of the Canal Walk and piers would require a building permit.
- Infrastructure improvements and building construction would require a building permit.

Environmental Quality Board (EQB)

- A General Consolidated Permit for Fugitive Dust, Erosion Control and Sedimentation would need to be obtained.
- The abovementioned permit would also cover the permitting for construction waste disposal.

Department of Natural and Environmental Resources (DNER)

- Dredging, excavation, and other similar activities would require an Incidental Earth Extraction Permit.

A.1.3 Local Regulations

Local regulations include those laws and regulations adopted by the Municipality of San Juan. There are no applicable local regulations related to topography, geology, and soils.

A.2 Air Quality

This section describes the federal, commonwealth and local laws, ordinances, regulations, and guidelines pertaining to air quality which are applicable to the Proposed Action.

A.2.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. The federal regulation which pertains to air quality and is described below is the Clean Air Act (CAA). This section also includes discussions of particular rules and reviews which take place under the CAA and are applicable to the Proposed Action.

A.2.1.1 Clean Air Act

Air quality in a given location is determined by the concentration of various pollutants in the atmosphere. The USEPA is the federal agency responsible for enforcing the CAA of 1970 and its amendments of 1977 and 1990. By exclusive authority of the

federal government, this agency also regulates emission sources such as aircraft, certain types of ships, and locomotives, and it establishes various emission standards.

The CAA establishes primary and secondary national ambient air quality standards (NAAQS) for ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), fine particulate matter (PM₁₀) and lead (Pb). NAAQS represent maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health and welfare. In 1997 the USEPA announced changes to the NAAQS for O₃ and particulate matter. The federal O₃ standard was lowered to 0.08 parts per million (ppm) and the averaging period was changed from 1-hour to an 8-hour running average. A new particulate matter standard for 2.5 micron particulates (PM_{2.5}) was created in addition to the standard for PM₁₀. Areas that violate federal air quality standards are designated as non-attainment areas for the relevant pollutants; areas that comply with federal air quality standards are designated as attainment areas for the relevant pollutants; areas of questionable status generally are designated as unclassifiable areas. Each of the criteria air pollutants is described in greater detail below:

- **Ozone (O₃).** O₃ is considered a photochemical oxidant, which is a chemical that is formed when reactive organic compounds (ROC) and nitrogen oxides, both byproducts of combustion, react in the presence of ultraviolet light. O₃ is considered a respiratory irritant and prolonged exposure can reduce lung function, aggravate asthma, and increase susceptibility to respiratory infections. Children and those with existing respiratory diseases are at greatest risk from exposure to O₃.
- **Carbon monoxide (CO).** Carbon monoxide is a product of incomplete combustion. The main source of carbon monoxide in the San Juan area is from motor vehicle exhaust. CO is an odorless, colorless gas. CO affects red blood cells in the body by binding to hemoglobin and reducing the amount of oxygen that can be carried to the body's organs and tissues. CO can cause health effects to those with cardiovascular disease, and can also affect mental alertness and vision.
- **Nitrogen dioxide (NO₂).** NO₂ is also a by-product of fuel combustion, and is formed both directly as a product of combustion and in the atmosphere through the reaction of nitric oxide with oxygen. NO₂ is a respiratory irritant and may affect those with existing respiratory illness, including asthma. NO₂ can also increase the risk of respiratory illness.
- **Fine particulate matter (PM₁₀).** PM₁₀ refers to particulate matter with an aerodynamic diameter of 10 microns or less. Particulate matter in this size

range has been determined to have the potential to lodge in the lungs and contribute to respiratory problems. PM₁₀ arises from a variety of sources, including road dust, diesel exhaust, combustion, tire and break wear, construction operations, and windblown dust. PM₁₀ can increase susceptibility to respiratory infections and can aggravate existing respiratory diseases such as asthma and chronic bronchitis. In 1997, the USEPA proposed a new standard for PM_{2.5}, which is particulate matter with an aerodynamic diameter of 2.5 microns or less. These finer particulates are considered to have the potential to lodge deeper in the lungs.

- **Sulfur dioxide (SO₂).** SO₂ is a colorless, reactive gas that is produced from the burning of sulfur-containing fuels such as coal and oil, and by other industrial processes. Generally, the highest concentrations of SO₂ are found near large industrial sources. SO₂ is a respiratory irritant that can cause narrowing of the airways leading to wheezing and shortness of breath. Long-term exposure to SO₂ can cause respiratory illness and aggravate existing cardiovascular disease.

Federal programs implemented under the CAA which are applicable to the Proposed Action are described in the sub-sections below.

A.2.1.2 Federal New Source Review (NSR)

New Source Review refers to the pre-construction review and permitting programs under CAA Title I, Parts C and D that must be satisfied before new construction or major modifications can begin on major sources. The Prevention of Significant Deterioration (PSD) program (CAA Title I, Part C) is USEPA's NSR permitting program for sources located in areas that attain the NAAQS (attainment areas), also for sources in unclassified areas. Its counterpart, (CAA Title I, Part D), is for sources located in nonattainment areas, and is often called the nonattainment NSR (NNSR) program.

A.2.1.3 Prevention of Significant Deterioration (PSD)

The PSD regulations (Title 40 Code of Federal Regulations [CFR], Section 52.21) apply to the construction of major sources in areas that are currently in attainment or unclassified for the NAAQS. A major source is defined as a facility with potential to emit equal to or greater than 250 tons per year (TPY) of any criteria pollutant (i.e., the pollutants discussed above). In addition, the rules provide a list of 28 major facility categories that are subject to the PSD provisions if they have the potential to emit greater than 100 TPY.

The PSD program is designed to prevent further significant deterioration of areas that are currently in attainment or unclassified. The PSD regulations accomplish this by imposition of Best Available Control Technology (BACT) and computer dispersion modeling analyses to ensure that allowable increments of degradation will not be exceeded.

A.2.1.4 Nonattainment New Source Review (NNSR)

NNSR (Title 40 CFR, Section 51.165) applies to new “major sources” or major modifications at existing sources in nonattainment areas for the pollutants at issue. A “major source” under NNSR is defined as a facility with a potential to emit between 10 to 100 TPY of criteria pollutants, depending on the particular classification for the nonattainment area. All NNSR programs have to require: 1) the installation of the lowest achievable emission rate (LAER); 2) emission offsets; and 3) opportunity for public involvement.

A.2.1.5 General Conformity Rule

The CAA also states that a federal agency cannot support an activity unless the agency determines that the activity will conform to the most recent USEPA-approved state implementation plan (SIP). This means that projects using federal funds or requiring federal approval must not: 1) cause or contribute to any new violation of a NAAQS; 2) increase the frequency or severity of any existing violation; or 3) delay the timely attainment of any standard or interim emission reduction or other milestone. A General Conformity Rule determination is required for each pollutant where the total of direct and indirect emissions in a nonattainment or maintenance area would equal or exceed specified thresholds, or are deemed to be regionally significant (Title 40 CFR Part 51, Subpart W and Part 93, Subpart B). All areas of Puerto Rico are in compliance with the NAAQS; therefore, a general conformity analysis is not required for the Proposed Action.

A.2.1.6 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the government of Puerto Rico and are implemented under the direction of commonwealth agencies. The Commonwealth of Puerto Rico regulations which pertain to air quality and are described below include the Puerto Rico Regulation for the Control of Atmospheric Pollution and the Law of Public Environmental Policy.

A.2.1.7 Puerto Rico Regulation for the Control of Atmospheric Pollution

The EQB, Division of Air Quality is the commonwealth agency responsible for enforcing the Regulation for the Control of Atmospheric Pollution. This regulation

establishes threshold levels for criteria pollutants significant impacts to air quality in Puerto Rico. Under this regulation, a permit is required from the EQB prior to constructing or installing a new stationary source of emissions and mitigation is required to offset additional emissions. In addition, all air quality impact analyses must be prepared in agreement with this regulation. This includes any increase in temporary and permanent emissions either above or below the stated thresholds. Permanent emissions must be considered not only from the construction of a new stationary source but also as a result of residential, commercial, or industrial growth.

A.2.1.8 Puerto Rico Regulation for the Presentation, Evaluation and Processing of Environmental Documents

Under the Puerto Rico Regulation for the Presentation, Evaluation and Processing of Environmental Documents (EQB 2002), a Declaración de Impacto Ambiental (DIA) must provide emission estimates of atmospheric pollutants that contribute to the greenhouse effect in TPY. The greenhouse effect or “stratospheric O₃ depletion” refers to the slow destruction of naturally occurring O₃, which lies in the upper atmosphere (called the stratosphere) and which protects Earth from the damaging effects of solar ultraviolet radiation. Certain compounds, including chlorofluorocarbons (CFCs,) halons, carbon tetrachloride, methyl chloroform, and other halogenated compounds, accumulate in the lower atmosphere and then gradually migrate into the stratosphere. In the stratosphere, these compounds participate in complex chemical reactions to destroy the upper O₃ layer. Destruction of the O₃ layer increases the penetration of ultraviolet radiation to the Earth’s surface, a known risk factor that can increase the incidence of skin cancers and cataracts, contribute to crop and fish damage, and further degrade air quality.

Some gases in the atmosphere affect the Earth’s heat balance by absorbing infrared radiation. This layer of gases in the atmosphere functions much the same as glass in a greenhouse (i.e., both prevent the escape of heat). This is why global warming is also known as the “greenhouse effect.” Gases responsible for global warming and their relative contribution to the overall warming effect are carbon dioxide (55 percent), CFCs (24 percent), methane (15 percent), and nitrous oxide (6 percent). It is widely accepted that continued increases in greenhouse gases will contribute to global warming although there is uncertainty concerning the magnitude and timing of the warming trend. The Montreal Protocol on Substances That Deplete the Ozone Layer controls the phase-out of O₃ depleting compounds (ODCs). Under this international agreement, several organizations report on the science of O₃ depletion, implement projects to help move away from ODCs, and provide a forum for policy discussions.

Greenhouse gases and ODCs include, but are not limited to, the following:

- **Carbon dioxide.** Carbon dioxide results from fossil fuel combustion in stationary and mobile sources. It contributes to the greenhouse effect, but not to stratospheric O₃ depletion.
- **Chlorofluorocarbons.** CFCs are emitted from blowing agents used in producing foam insulation. They are also used in air conditioners and refrigerators and as solvents to clean electronic microcircuits. CFCs are primary contributors to stratospheric O₃ depletion and to global warming. Federal regulations require service practices that maximize recycling of O₃-depleting compounds (CFCs, hydro-chlorofluorocarbons, and their blends) during the servicing and disposal of air-conditioning and refrigeration equipment. Some CFCs are classified as toxic air contaminants (TACs).
- **Halons.** These compounds are used in fire extinguishers and behave as both O₃-depleting and greenhouse gases. Halon production ended in the U.S. in 1993, and its incidence is being gradually phased out as halon-containing fire extinguishers are being removed from service.
- **Hydro-chlorofluorocarbons.** HCFCs are solvents, similar in use and chemical composition to CFCs. The hydrogen component makes HCFCs more chemically reactive than CFCs, allowing them to break down more quickly in the atmosphere. These compounds deplete the stratospheric O₃ layer, but to a much lesser extent than CFCs.
- **Methane.** Methane is emitted from biogenic sources, incomplete combustion in forest fires, landfills, leaks in natural gas pipelines, and petroleum production, refining and distribution. It is a greenhouse gas and traps heat 40 to 70 times more effectively than CO₂.
- **1,1,1,-trichloroethane (TCA).** TCA (methyl chloroform) is a solvent and cleaning agent commonly used by manufacturers. It is less destructive to the environment than CFCs or HCFCs, but its continued use will contribute to global warming and O₃ depletion. TCA is a synthetic chemical that does not occur naturally in the environment. TCA has not been manufactured for domestic use in the U.S. after January 1, 2002. TCA had many industrial and household uses, including use as a solvent to dissolve other substances, such as glues and paints; to remove oil or grease from manufactured metal parts; and as an ingredient of household products such as spot cleaner.

A.2.2 Local Air Rules and Regulations

Clean air within the Municipality of San Juan is addressed under Article 5.10, Environmental and Natural Resources, of the San Juan Citizen Urban Environmental Standards. Policies applicable to the Proposed Action are listed below:

- B3. During the clearing of estates or demolition activities, one will use water or another suitable chemical compound to control the rise of dust.
- B4. One will not cause or allow any materials to be manipulated, transported, or stored in a building without taking due precautions to avoid the emissions of particulate matter.
- B5. One will not cause visible fugitive dust emissions beyond the boundary of the property where the dust originated.

A.3 Flora and Fauna

This section describes the federal, commonwealth and local laws, ordinances, regulations, and guidelines pertaining to flora and fauna which are applicable to the Proposed Action.

A.3.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. Federal regulations which pertain to flora and fauna and are described below include the Endangered Species Act (ESA) of 1973, and the Migratory Bird Treaty Act of 1918.

A.3.1.1 Endangered Species Act

The principal federal law addressing flora and fauna is the ESA of 1973, as amended. These regulations forbid any person to “take” an endangered or threatened species. “Take” is defined by Section 3 of the ESA as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct.” The USFWS administers the ESA for terrestrial and aquatic species by listing and delisting species as appropriate, designating critical habitat for listed species, and conducting federal consultation under Section 7 of the ESA in order to permit incidental take of listed species for particular projects. The NMFS administers the ESA and conducts Section 7 consultation for marine species.

Section 7 of the ESA directs all federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the USFWS and NMFS, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to management of federal lands

as well as other federal actions that may affect listed species, such as federal approval of private activities through the issuance of federal permits, licenses, or other actions. With regard to the Proposed Action, the Section 7 process would be initiated by the USACE prior to approval of the Clean Water Act Section 404 permit application (discussed further in Section 2.4, *Natural Environmental Systems*). After completion of the formal Section 7 consultation and after all measures are taken by the federal agency to conserve threatened and endangered species and protect designated critical habitat, USFWS and NMFS have the authority to make a determination regarding issuance of an incidental take permit for listed species.

A.3.1.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918, as amended, establishes a federal prohibition to “pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention...for the protection of migratory birds...or any part, nest, or egg of any such bird.” This Act affirms and implements the U.S.’ commitments to four international conventions for the protection of a shared migratory bird resource. The USFWS has enforcement provisions over this statute as well.

A.3.2 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the government of Puerto Rico and are implemented under the direction of commonwealth agencies. Commonwealth of Puerto Rico regulations which pertain to flora and fauna and are described below include the Wildlife Law of Puerto Rico, the Regulation for the Threatened and Endangered Species of the Commonwealth of Puerto Rico, and the Puerto Rico Planting, Cutting, and Forest Regulation.

A.3.2.1 Wildlife Law of Puerto Rico (Law 241 of August 15, 1999) and Regulation 6766 – Regulation for the Threatened and Endangered Species of the Commonwealth of Puerto Rico

This law and its regulation are the legal framework that mandates the DNER to protect the wildlife resources of Puerto Rico. Regulation 6766 identifies species of conservation priority and their status within the commonwealth. The DNER adopted five categories from the International Union for the Conservation of Nature (IUCN) Red List to classify these priority species: critically endangered, endangered, vulnerable, low risk, and data deficient. Similar to the federal ESA, this regulation

prohibits the taking of individual, nests, eggs, or young of species considered vulnerable or endangered. The regulation also prohibits the modification of designated Essential Critical Natural Habitat without an approved mitigation plan as well as the export of any vulnerable or endangered species.

A.3.2.2 Planning Regulation No. 25, Puerto Rico Planting, Cutting, and Forestation Regulation

This regulation, adopted by the Puerto Rico Planning Board (PRPB) and the DNER, is intended to promote the planting and reforestation of trees in Puerto Rico to provide a healthy environment and natural surroundings. To mitigate the impact of growth and development, this regulation promotes planned planting in association with construction projects, controls and regulates the cutting of trees in Puerto Rico, and promotes the utilization of existing trees in future designs. Additionally, this regulation requires that corresponding authorizations and permits are obtained before the cutting or removal of trees.

A.3.3 Local Rules and Regulations

The preservation of biological resources within the Municipality of San Juan is addressed under Article 5.10, *Ambient and Natural Resources*, of the San Juan Urban Environmental Standards Atmosphere. Policies applicable to the Proposed Action are listed below:

- A1. One will not mutilate, cut, start, burn, poison, or damage any tree or healthy vegetation in public spaces.
- A3. The following acts are prohibited, except when a permit from the DNER and the Department of Urbanism of the Municipality of San Juan has previously been obtained:
 - to mutilate, start, remove, destroy, decorate, or anyway damage:
 - ornamental plants, turf, and shrubs placed by the Municipality in public spaces;
 - trees on a property which grow toward the highway and provide shade without affecting visibility; or
 - rare species in danger of extinction danger or critical element listed in the DNER database of the Division of Natural Patrimony.
- A8. During construction, one will incorporate the existing trees in the estate and will plant new trees according to the DNER Regulation of Planting, Cutting, and Forestation for Puerto Rico.

- A9. One will plant the types of trees specified in the plans that have been developed by the Municipality of San Juan for certain sectors of the City, or which have been established by special regulation. In addition, one:
- will replace any dead trees that is removed with equal species; and
- will not plant in the intersections of streets to less than eight meters from the corner of the frontal edges.

A.4 Natural Systems and Sensitive Ecological Areas

This section describes the federal, commonwealth and local laws, ordinances, regulations, and guidelines pertaining to natural systems and sensitive ecological areas which are applicable to the Proposed Action.

A.4.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. Federal regulations which pertain to natural environmental systems and are described below include the CWA of 1972, the Coastal Zone Management Act (CZMA), the ESA of 1973, the Marine Mammal Protection Act, and the Magnuson-Stevenson Fisheries Conservation and Management Act.

A.4.1.1 Clean Water Act of 1972

Wetland protection under the CWA extends to special aquatic sites, which are generally characterized as "geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values." These areas are generally recognized as "significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a Region" (CWA Section 230.3(q-1); USEPA website). As such, potential impacts to aquatic habitat supporting SAV (e.g., seagrass beds) and coral reefs (also addressed by Executive Order 13089 Coral Reef Protection) in the vicinity of the Proposed Action area would be subject to a higher level of review when CWA Section 404 permits are considered.

A.4.1.2 Coastal Zone Management Act

The U.S. Congress recognized the importance of meeting the challenge of continued growth in the coastal zone by passing the CZMA in 1972 which serves to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." The Act, administered by NOAA, provides for management

of the nation's coastal resources. The CZMA outlines two national programs, the National Coastal Zone Management Program and the National Estuarine Research Reserve System. The Puerto Rico Coastal Zone Management Plan is the local plan regulating coastal development in Puerto Rico and is discussed in greater detail in Section 2.5, *Land Use*. Compliance with the Puerto Rico Coastal Zone Management Plan would be achieved by obtaining a consistency determination from the PRPB.

The SJBE is one of several estuaries designated as national laboratories for environmental research and is part of the USEPA's NEP (refer to Section 2.4.3.2 below for more information).

A.4.1.3 Endangered Species Act of 1973

The ESA of 1973 provides protection of threatened and endangered species under the authority of the USFWS (for upland and aquatic species) and the NMFS (for marine-dependent species). Species listed as threatened or endangered under the ESA are regulated through the granting of permits under Section 7 of the Act, which permit limited impacts to protected species under specific conditions. Species management plans for individual listed species designate critical habitat, which is considered vital to the recovery of the endangered species.

A.4.1.4 Marine Mammal Protection Act

The 1972 Marine Mammal Protection Act established a federal responsibility to conserve marine mammals with management vested in the USFWS for the manatee, among others. The NMFS is responsible for cetaceans and pinnipeds (other than the walrus). With certain specified exceptions, the Act establishes a moratorium on the taking and importation of marine mammals as well as products taken from them, and establishes procedures for waiving the moratorium and transferring management responsibility.

A.4.1.5 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (amended in 1996 by the Sustainable Fisheries Act) provides a regulatory framework for management of fishery resources. Among the goals of the Act are the prevention of overfishing, rebuilding overfished stocks, and protecting EFH. In the context of the Proposed Action, implementation of the Act is achieved through the designation of EFH. Compliance with the Act would be achieved through consultation by USACE with NMFS as part of the CWA Section 404 permitting process.

A.4.2 Commonwealth of Puerto Rico Regulations

Commonwealth of Puerto Rico regulations and plans which pertain to Natural Environmental Systems include the new Wildlife Law of Puerto Rico, Regulation 6766, and Planning Regulation No. 25, and the SJBE Comprehensive Conservation and Management Plan. With the exception of the SJBE Plan, all pertinent regulations have been described in the previous section, Section 2.3, *Flora and Fauna*. The SJBE Plan is described below.

A.4.2.1 SJBE Comprehensive Conservation and Management Plan

The SJBE Comprehensive Conservation Management Plan (SJBEP 2000) is the principal management plan for the SJBE and has established objectives and actions in relation to water and sediment quality (Chapter 3) and habitat, fish and wildlife (Chapter 4). Primary objectives related to water and sediment quality as they pertain to natural environmental systems include: 1) elimination of sewage discharges, 2) improving circulation, 3) reducing nutrient and toxics loading, 4) avoid detrimental effects of oil and other contaminants (through management tools), and 5) reduce levels of oil and grease, nutrients, sediments, toxics and other pollutants in point discharges (through the permitting process). Objectives of Chapter 4 of the Comprehensive Conservation Management Plan include: 1) preservation and restoration of ecologically important habitat, 2) protection of species in terms of abundance and diversity, and 3) enhance fisheries.

A.4.3 Local Regulations

The Municipality of San Juan has issued regulations protecting the natural environment under Rule 5.10 of the Urban Environmental Standards. Rule 5.10 governs processes which may degrade the air, water, and vegetative quality of areas within the city. These regulations generally prohibit: 1) actions which result in degradation of existing resources through redevelopment, and 2) emissions of gases, odors, and contaminants which may affect human or ecological health. The Rule also establishes administrative fines for violations.

A.5 Land Use and Zoning

This section describes the federal, commonwealth and local laws, ordinances, regulations, and guidelines pertaining to land use and zoning which are applicable to the Proposed Action. These include commonwealth land use and zoning plans as well as the Puerto Rico Coastal Management Program requirements.

A.5.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. The federal regulation pertaining to land use that is relevant to the Proposed Action is the Coastal Zone Management Act. This act is summarized in Section 2.4, *Natural Environmental Systems* and described in detail below.

A.5.1.1 Coastal Zone Management Act

In an effort to encourage states to better manage coastal areas, Congress enacted the CZMA in 1972. CZMA provides grants to states that develop and implement federally-approved coastal zone management plans. It also allows states with approved plans the right to review federal actions to ensure they are consistent with those plans, and it authorizes the National Estuarine Research Reserve System.

To date, 33 of the 35 eligible coastal states and U.S. territories (including Puerto Rico) have federally-approved plans. In Puerto Rico, the DNER has developed and oversees the Puerto Rico Coastal Zone Management Program compliant with CZMA (see discussion in Section 2.5.2.2.6).

The CZMA requires that approved state management programs include the following:

1. the boundaries of the coastal zone affected by the program;
2. an inventory and designation of areas of particular concern in the coastal zone;
3. a definition of permitted land and water uses that directly impact coastal waters;
4. an identification of how those uses will be controlled;
5. an outline of broad guidelines to determine priority of uses in coastal areas;
6. a description of the administrative structure that will operate the approved management program;
7. a definition of "beach" and a planning process for dealing with access to public coastal areas;
8. a planning process for energy facilities likely to be located in or to significantly affect the coastal zone; and
9. a planning process for studying both the effects of coastal erosion and alternative ways to control it.

A.5.2 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the government of Puerto Rico and are implemented under the direction of commonwealth agencies. Commonwealth of Puerto Rico regulations, which pertain to land use and are described below include the Land Use Plan for the San Juan Metropolitan Region, Planning Regulation 23, the Draft Puerto Rico Land Use Plan (PRLUP), and the Puerto Rico Coastal Zone Management Program.

A.5.2.1 Comprehensive Development Plan: Public Policies and Specific Objectives (April 1979)

This document groups the set of public policies for the different planning areas; Economic, Social and Physical, as well as their specific objectives.

This Plan recognizes the tourism as an important industry with great potential for the development of the economy. It also recognizes that it is a highly competitive industry at the international level, susceptible to changes in the national and international level,. The policy in this area is aimed for the government action to strengthen the industry, making it more competitive, to expand the tourism market, to provide help focused to improve the financial situation of hotels and to expand the aerial routes.

The Plan indicates that lands where tourism activities take place should have special conditions or characteristics compatibles with the nature of the projects to be developed. The tourism has been oriented to the use of landscape, climate and environmental resources of the Island. Based on this it is necessary to consider the needs of this industry in the land use planning and to protect lands with tourism potential from contamination. The public policy regarding this subject is aimed to maximize the tourism industry, by stimulating its development in areas where the land use is compatible. It also indicates that infrastructure projects should be developed to contribute to such tourism and recreational development.

The Construction is recognized in the Plan as an activity with potential to generate jobs and to induce economic growth. Among the specific objectives to support this policy there are:

- To designate for the construction of housing units and other projects, lands with no agricultural capacity
- To plan the construction of multi-family housing in areas with adequate infrastructure and optimum land conditions.
- To develop incentives that promote the intensive use of urban and suburbs lands, by constructing medium and high density (housing) units.

In the Social Area, the Plan proposes the involvement of the community in recreational activities to develop their emotional balance. Among the specific objectives that support this policy there are:

- To develop natural areas with recreational value, such as forest and beaches, among others; and to establish open and green areas in urban zones.
- To develop recreational activities and facilities of cultural nature

A.5.2.2 Objectives and Public Policies of the Puerto Rico Land Use Plan (Objetivos y Políticas Públicas del Plan de Usos de Terrenos de Puerto Rico) (October 1995)

This planning document guides the public policies that cover the physical space context of Puerto Rico. It provides a guideline for the public agencies in formulating policies, plans and programs, as well as in decision making process and actions related to public and private projects, zoning process and other public interests. It provides goals and objectives (general and specific) on different areas, including tourism and urban development areas, among others.

According to this plan the goal of the tourism area it is to promote a competitive economic and social activity, considering the international market dynamics. The plan proposes for these purposes those lands with the maximum potential for tourism use, without undermining the existing natural resources. Public policies related to this area are summarized below:

- To promote the tourism development improving the quality of the tourism facilities..
- To promote the tourism as an essential economic activity for the sustainable economic process
- To promote, stimulate and implement tourism incentives to promote the investment of capital from local and foreign companies.
- To promote the image of Puerto Rico as a tourism destination.

The goal of the urban development area it is to promote dense, compact and attractive communities that allow the intensive use of lands inside the urban perimeters. It should obtain more efficiency in the installation and operation of the public services and facilities making viable the mass transportation and improvement of urban quality. General public policies related to this area are summarized below:

- To intensify the land use in urban areas

- To improve the design of communities as an instrument to improve the quality of life of its inhabitants and making such communities attractive for living, working and coexisting.
- To promote a comprehensive planning process that leads to a better land use, conserving the natural resources, revitalizing the urban centers, protecting the quality of the environment and providing housing units and services at a reasonable cost for the population, in close coordination among the central, regional and municipal planning.

A.5.2.3 Land Use Plan for the San Juan Metropolitan Region

The PRPB has prepared Regional Plans for each of the seven planning regions in Puerto Rico, including the Metropolitan Region where the Proposed Action is located. The purpose of these Regional Plans is to provide land use and development guidance for the municipalities.

The Land Use Plan for the San Juan Metropolitan Region provides the following strategies for land use which are applicable to the Proposed San Juan Waterfront Project:

- Promote incentives for the construction of high-density residential developments;
- Establish a preferential deal for companies that develop high-density projects in cities;
- Partially or totally eliminate governmental subsidies that stimulate construction of low-density housing;
- Encourage industrial or commercial development of abandoned land by deducting the taxes to be paid for the remediation of such lands;
- Reform the property taxes in urban areas so that the land is taxed more than the structure; and
- Establish an incentive program for families that live and work, and whose children study, in the same municipality.

A.5.2.4 Land Use Plan and Special Zoning Regulation for the Entrance to the Isleta of San Juan (PRPB Regulation 23)

Zoning Regulation 23, the Special Area Plan for the Entrance to the Isleta of San Juan, was created specifically for the entrance to the Isleta due to its geographic location and importance to attractions in the vicinity. The Plan for the Entrance to the Isleta of San Juan has the following objectives:

- Improve the quality of the public space, reaffirming its importance to urban development, civic headquarters, and setting for everyday life in the city.
- Create an identifiable entrance, with public and symbolic character that integrates the existing public spaces (Luis Muñoz Rivera Park and Escambrón Beach).
- Recover the waterfronts of the Condado Lagoon and the San Antonio Channel by creating a new entrance (traffic and pedestrian) to the Caribe Hilton Hotel and to the San Geronimo Fort, and the restructuring of the channel-front parcels to promote the future development of the Waterfront in that sector.
- Reorganize the north side of Intersection 5 to establish a road plot with urban characteristics that allows pedestrian and traffic movement and incorporates mass transit.
- Establish a high-density residential and hotel development, with urban character, and with compatible commercial uses on the first floor.
- Favor development that complements both public and private sector interests, augments the area for building and increases property value as middle to ensure the construction of better public infrastructure.

Zoning Regulation No. 23 also defines open areas, ROWs, vehicle and pedestrian access points, parking requirements and architectural design criteria, among others. Three parcels within the Proposed Action area are within this zoning designation and have been sub-zoned according to use. Land uses allowed within each of these sub-zones are defined below:

- ZDE-B — Services – office (general and professional), allocation (Civic) – libraries, museums, theaters, cinemas and concert halls.
- ZDE-C1 — Residential – residential apartments, Commerce – night club, fast foods (without drive-ins), restaurants, cafeteria and ice cream parlors, general commerce, regional commerce and local commerce, Service – car rentals, financial institutions, home businesses (services) (ocupación domiciliaria), general or professional offices, medical offices and personal services, Allocation – day care.
- ZDE-C2 — Residential – residential apartments, Allocation (Educational) – day care.

A.5.2.5 Draft Puerto Rico Land Use Plan

The Draft PRLUP (February 2006) identifies general goals as well as specific objectives to guide land use and development throughout the commonwealth. The general goals of the PRLUP are to identify, evaluate, and classify land uses in Puerto Rico so as to:

- Protect environmental quality, natural resources, and agricultural lands without compromising their future use and availability;
- Promote the establishment and redevelopment of livable urban cores that have a compact form, are attractive and functional, which promote a healthy social environment that substantially increase the quality of life of its citizens;
- Stimulate economic development through the adequate location and integration of industrial, agricultural, commercial, recreational, public, and private activities;
- Rationally adjust socioeconomic and physical development of the Island to its geographic, social, and cultural factors that condition the Puerto Rican reality.

The PRLUP also defines and provides objectives for a number of land use classifications. The Proposed Action area is defined as urbanized land (Suelo Urbano, SU) (PRLUP San Juan Cuadrangle). The objectives for urbanized land include:

1. Balanced growth throughout the city, incorporating compatible mixed uses to achieve pedestrian oriented mixed communities;
2. Strengthening of the economic, social and physical structure within each neighborhood according to their particular characteristics, empowering communities with a wide variety of needed and desired services;
3. Protection, defense and conservation of structures with a historic, architectural, cultural or archaeological interest;
4. Protection of the traditional central business district, avoiding the exclusive location of commercial and retail uses in the inner core and protecting and promoting residential uses in those sectors;
5. Promotion of comprehensive development in all peripheral areas of the city, including the suburbs, providing them with the necessary social and economic infrastructure so they do not depend on the central city;

6. Protection of the roadway continuity and the transportation network and the physical integration of the city through its roadways, including the suburbs and other outlying areas not connected to road systems;
7. Rescue and improvement of public spaces through the promotion, protection and development of open space areas as well as the planting of trees and vegetation to improve environmental quality in the cities;
8. Development of mass transit systems to improve communication and mobility within the cities and between its neighborhoods;
9. Facilitate citizens' access to public spaces within cities;
10. Coordination and integration of physical and spatial aspects with economic development, social and environmental strategies promoted by the Commonwealth of Puerto Rico and its municipalities;
11. Harmony of the urban morphology and the road network within municipalities in those instances where urban lands from different municipalities meet; and
12. Intense use of the urban land, including the suburbs.

A.5.2.6 Puerto Rico Coastal Zone Management Program

The Puerto Rico Coastal Management Program was adopted July 12, 1978 as the coastal element of the PRLUP. The Coastal Program is housed in the DNER, whose fundamental responsibility is the protection of the natural resources of Puerto Rico. The PRPB is responsible for administering the Federal Consistency Certification Process with the Coastal Zone Management Program. Other federal and local agencies share responsibilities and management of the coast, including the Council on Environmental Quality, Department of Parks and Recreation, National Park Service, Department of Agriculture, Institute of Puerto Rican Culture, USEPA, USACE, as well as coastal municipalities.

The Coastal Zone Management Program has jurisdiction up to 1 kilometers inland from the coast. This boundary expands as necessary to include essential natural coastal ecosystems. The marine component of the coastal zone extends to 9 nautical miles (or 10.35 terrestrial miles), the oceanic floor under these, as well as all the islands and keys inside the territorial water.

A.5.2.7 Regulation for the Zoning of the Coastal Zone and Access to the Beaches and Coasts of Puerto Rico (PRPB Regulation 17)

PRPB Regulation 17, *The Regulation for the Zoning of the Coastal Zone and Access to the Beaches and Coasts of Puerto Rico*, was adopted in recognition of the growing

need for recreational facilities and development trends to develop coastal land and limit the public's access to beaches and the Puerto Rico coastline. Section 3.0 of this regulation discusses general provisions regarding public access to the coast. Under this section, all projects located adjacent to a coastline, the maritime zone, or a lake are required to provide one or more access points for the public. These access areas must be properly labeled with the name of the beach or coastline and any other pertinent information advertising the area to the public. In addition, public views of beaches, coasts, and litoral zones must be maintained free of obstructions. For buildings along the coast, the PRPB has the authority to maintain a strip of land twenty meters wide parallel to the coast for public access and viewing. The regulation also prohibits any new development project that may deteriorate or destroy areas of nature reserves, coasts, or beaches which have been recognized by the EQB and any project which could lead to the degradation of areas of historical significance, aesthetics, recreational, or cultural which have been recognized by the DNER, EQB, or the Institute of Puerto Rican Culture (ICP).

A.5.2.8 Reclaimed Lands

The Ports Act of 1886 and Joint Resolution No. 53 of July 31, 1923 allowed for the reclamation of lands. Under this Resolution, the Legislative Assembly of Puerto Rico, acting under an Act of Congress of the United States (H.R. 4285),, ordered the reclamation of lands in the vicinity of the San Antonio Channel in 1917.

Per Section 2 of Joint Resolution No. 53, the Legislative Assembly of Puerto Rico recognized and acknowledged a reimbursement obligation owed to the United States Government in the amount of \$600,000 for the dredging of San Juan Harbor. As a source of funding to pay its reimbursement obligation, the Legislative Assembly ordered the disposition or lease of all lands lying south of Insular Road Number One (1), commonly and currently known as Avenida Fernández Juncos.

The Ports and Piers Act, No. 151 of June 28, 1968 (23 L.P.R.A. §2101 et seq.), included all reclaimed lands as part of the maritime terrestrial zone, which had the effect of characterizing all reclamations after September 26, 1968 as public domain lands. Public domain lands cannot be sold or encumbered without proper legislative authorization. The Piers Act of 1886 governs all reclamations not covered by Joint Resolution No. 53.

Article 2 of the Piers Act of 1886 established that natural accretions produced by a withdrawal of the sea, which are not within the maritime terrestrial zone, are State property which may be sold when said accretions are neither necessary for maritime purposes nor useful for public purposes. Recently, the Court of First Instance of the Commonwealth of Puerto Rico, Superior Section of San Juan ruled that all reclaimed

lands outside the maritime terrestrial zone caused by human interventions are not within the public realm, and as a result may be sold, leased or encumbered by the government entity holding its title.

A.5.3 Local Regulations

Local regulations include those plans and regulations developed by the Municipality of San Juan. Land use in the municipality is guided by the Municipal Zoning Plan for the San Juan Autonomous Municipality (Plan de Ordenamiento [POT]). This plan is described below.

A.5.3.1 Municipal Zoning Plan for the San Juan Autonomous Municipality

The Autonomous Municipalities Act, (Ley de Municipios Autónomos, Law Number 81 of August 30, 1991, as amended), authorizes the municipalities to adopt Municipal Zoning Plans (Planes de Ordenamiento Territorial [POT]). The zoning plans deals with different aspects of the municipal land use. The purposes of these plans are to protect lands as well as to promote a balanced, beneficial land use and to favor the development of the municipality.

The zoning in the Municipality of San Juan is governed by the Municipal Zoning Plan for the San Juan Autonomous Municipality, as mentioned previously.

A.6 Hydrology

This section describes the federal, commonwealth, and local laws, ordinances, regulations, and guidelines pertaining to hydrology which are applicable to the Proposed Action. These include several sections of the Federal CWA, as well as commonwealth and local water quality standards.

A.6.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. The federal regulation which pertains to hydrology and is described below is the Federal CWA of 1977.

A.6.1.1 Clean Water Act of 1977 (33 USC 1251 et seq.)

- The CWA is the primary law regulating water quality protection in the U.S. The statute employs a variety of tools to sharply reduce direct pollution discharges into waterways and manage runoff. Compliance with the CWA would be achieved through the permitting process.

Two sections of the CWA which apply to this Proposed Action are Section 401 and Section 404, which cover achievement of water quality standards and regulation of fill materials in Waters of the U.S.

Section 401 compliance is achieved primarily through the National Pollutant Discharge Elimination System (NPDES), under which permits for discharges are issued. In relation to the Proposed Action, permits for water quality impacts related to both construction and deposition of fill material are required, and would likely be issued in concert with the Section 404 permit. The Section 401 Water Quality Certificate will be granted by the EQB, under authority delegated by USEPA.

- Section 404 of the CWA authorizes the USACE regulatory authority over “Waters of the U.S.” Waters of the U.S. are defined as navigable surface waters and all tributaries of surface waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide and wetlands. Groundwater is not considered a Water of the U.S.. Under Section 404, a permit is required to discharge dredged or fill material into any Waters of the U.S. The USACE is granted discretionary authority over the review and approval of permit applications, with USEPA oversight. In addition, other federal and commonwealth agencies are consulted prior to the issuance of a permit, including USFWS, NMFS, and DNER. These agencies also assess the project with regard to their regulatory purview and provide guidance to the USACE

A.6.2 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the government of Puerto Rico and are implemented under the direction of commonwealth agencies. Commonwealth of Puerto Rico regulations which pertain to hydrology and are described below include the Regulation for the Control of Buildings and Land Development in Floodable Zones and the Puerto Rico Water Quality Standards Regulation.

A.6.2.1 Puerto Rico Planning Regulation No. 13 of 1971 (updated 2005)

The Puerto Rico Planning Regulation No. 13, *Regulation for the Control of Buildings and Land Development in Floodable Zones*, is the primary regulation guiding construction in designated flood zones within Puerto Rico and empowers the PRPB to implement its provisions. Among the PRPB’s responsibilities under this regulation is to declare floodable zones and classify them by taking into consideration the limits reached by the maximum historical flooding or coastal surges, the degree to which flooding threatens life or property, and elements such as water depth and velocity. In

addition, the regulation requires that floor elevation of all structures be at least 0.3 meters above the designated base flood elevation as determined by designated flood zones. As part of the National Flood Insurance Program, the PRPB has adopted the FEMA FIRMs and associated flood zones as described below:

- Zone A (100-year Special Flood Hazard Area) – Determined by approximate methods and no base flood elevation is determined.
- Zone AE (100-year Special Flood Hazard Area) – Determined by detailed methods, and for which the base flood elevation has been identified. Can also show the floodway determination.
- Zone AO – Areas subject to inundation by 1 percent annual chance shallow flooding where average depths are between 1 and 3 feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone.
- Zone D – Areas in which flood hazards are undetermined but possible.
- Zone V – Coastal flood with velocity hazard for which no base flood elevation is determined.
- Zone VE – Coastal flood with velocity hazard for which base flood elevation is determined.
- Zone X (shaded) – Areas of 0.2 percent annual chance flood and areas of 100-year flood with average depths of less than 0.3 meter or with drainage area less than 2.6 square kilometers and areas protected by levees from the 100-year flood.
- Zone X (no shading) – Areas determined to be outside the 500-year floodplain.

A.6.2.2 Puerto Rico Planning Regulation No. 3 of 2005

The Puerto Rico Planning Regulation No. 3, *Regulation for Lotificacion and Urbanization*, is the primary regulation guiding the control of storm water within Puerto Rico and empowers the PRPB to implement its provisions. Among the PRPB's responsibilities under this regulation is to preserve the quality of the natural environment within the storm water catchment area. In addition, under this rule, the PRPB regulates the control of erosion, sedimentation, and runoff to avoid altering the level of water bodies that may be potentially caused by proposed developments. Specifically, PRPB Regulation No. 3 regulates:

- Site storm water runoff;
- Easements;

- Storm water control measures such as, retention ponds and drains. Such measures should be evaluated by the DNER and the measure selected must have the endorsement of such an agency;
- Erosion control and sedimentation related to the stabilization of slopes, cuts and fills, planting vegetation and the construction of fences and walls, and compliance with regulations established by the EQB for these purposes;
- Aquifer recharge from storm water controls;
- Controlled trawling sediment through the establishment of protection measures for sinks, such as the installation of filters or construction of ponds for retention;
- Any proposal for storm water discharge to a water body (i.e., rivers, canals, gulches, and collected water) and design considerations to prevent erosion problems in the channels of these bodies of water. The agency or entity responsible for maintaining the water body should endorse the storm water discharge of the proposed development;
- Any work on or in the water or from natural drainage system of a bridge or canal design, ensuring the design allows the discharge of a rain event with a time of recurrence of 100 years in its catchment area; and
- The integrity of bodies of water devoted to public use in the general interest of the conservation of body water, in conjunction with the DNER.

A.6.2.3 Puerto Rico Water Quality Standards Regulation

The EQB, through the promulgation of the Puerto Rico Water Quality Standards Regulation, has designated uses such as drinking, irrigation, fishing, swimming, or recreation, for which water quality shall be maintained and protected; and has prescribed the water quality standards required to sustain these designated uses. The most recent revision of the Water Quality Standards Regulation was completed in 2003. The Proposed Action site is adjacent to the San Antonio Channel which is classified as SC, *Coastal Waters*. Waters within this classification are subject to the following standards:

- Dissolved oxygen – No less than 4 milligrams/liter (mg/L) except when natural conditions cause a depression in value.
- Coliform – Geometric average of samples shall not exceed 1 colony/100 milliliters (mL) total coliform or 2 colony/100 mL fecal coliform.
- pH – pH shall remain between 7.3 and 8.5, except when altered by natural phenomenon.

- Color – Color shall not be altered except by natural phenomenon, except when it can be proven that the change is not harmful to biota and is aesthetically acceptable.
- Turbidity – Turbidity shall not exceed 10 nephelometric turbidity units (NTU).
- Substances that cause scent or flavor- Substances shall not be present in amounts that can cause flavor or undesirable scent to consumable aquatic life.
- Sulfates – Sulfates shall not exceed 2.8 mg/L.
- Tensoactivos agents as reactive substances with blue methylene – Such substances shall not exceed 500 mg/L.

A.6.3 Local Regulations

Local regulations include those regulations adopted by the Municipality of San Juan and plans adopted by organizations located within the Municipality. The local plan which pertains to hydrology and is described below is the SJBE Comprehensive Conservation and Management Plan.

A.6.3.1 San Juan Bay Estuary Comprehensive Conservation and Management Plan (July 2000)

The SJBE is part of the NEP as designated by the USEPA. The SJBE Comprehensive Conservation and Management Plan is a joint product of the government of Puerto Rico (Governor's office, DNER, EQB, PRPB, Puerto Rico Infrastructure Financing Authority [PRIFA]), members of the academic community in Puerto Rico, community representatives, and the USEPA. The SJBE Comprehensive Conservation and Management Plan identifies the cause of environmental problems in the estuary, relates hydrodynamic modifications and pollutant loads to observed impacts on the estuary, and recommends priority corrective actions and implementation schedules to address impacts to the estuary. Objectives and corrective actions applicable to the Proposed Action include:

- Objective 1 – Eliminate direct and indirect sewage discharges to the various canals and lagoons of the SJBE to reduce nutrient and pathogen loadings and increase human use of estuarine waters.
- WS-3 – Eliminate unauthorized raw sewage discharges (bypasses) from Puerto Rico Aqueduct and Sewer Authority's (PRASA's) collection system and pump stations into the SJBE.

- Objective 3 – Reduce nutrient and toxic loadings from non-point sources which result in impairments of the estuary's habitats and uses.
- WS-9 – Minimize sediment loadings into the SJBE system.

A.7 Infrastructure

This section describes the federal, commonwealth and local laws, ordinances, regulations, and guidelines pertaining to infrastructure which are applicable to the Proposed Action. These include commonwealth and local plans for water use, recycling, handling of solid waste and sewage, and maintenance of these utility systems.

A.7.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. There are no applicable federal regulations which pertain to infrastructure and utility systems.

A.7.2 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the government of Puerto Rico and are implemented under the direction of commonwealth agencies. Commonwealth of Puerto Rico regulations which pertain to infrastructure and are described below include the *Law for the Conservation, Development, and Use of Water Resources in Puerto Rico*, *Rules and Regulations for the Supply of Water and Sewer Service*, the *Regulation for the Handling of Non-Hazardous Solid Waste*, *Law No. 411 of 2000*, *Law No. 61 of 2002*, and the *Strategic Plan for the Handling of Solid Waste in Puerto Rico*. Another applicable commonwealth Regulation, PRPB Regulation No. 3, regulates the creation and maintenance of storm water infrastructure. This regulation has been discussed in detail in Section 2.6, *Hydrology*.

A.7.2.1 Law for the Conservation, Development, and Use of Water Resources in Puerto Rico

Law No. 136 of June 13, 1987, the *Law for the Conservation, Development, and Use of Water Resources in Puerto Rico*, amended 1998, is designed to maintain the level of water quality that is required for the well-being, security, and development of Puerto Rico; to ensure equitable and fair distribution of water for domestic uses, particularly for human consumption; and to assure that the water supply meets the needs of present and future generations through the establishment of water reserves and utilization of water resources. This law establishes that PRASA, among other agencies, will be a part of the Committee of Water Resources, and will advise the

Secretary of the DNER in the preparation of an integral plan of conservation and development of water resources (Associated Free State of Puerto Rico 1998).

A.7.2.2 Rules and Regulations for the Supply of Water and Sewer Service

The PRASA's *Rules and Regulations for the Supply of Water and Sewer Service* (adopted June 19, 2003) are designed to facilitate the rendering of public water and sewer services in an orderly way; protect Puerto Rico's water supply source, treatment works, and water system; safeguard public health; and establish the rights and obligations of the PRASA's customers and users, the public, and the PRASA itself. More specifically, the Rules and Regulations establish requirements applicable to all dischargers of waste to treatment works of the PRASA, including, without limitation, discharge prohibitions and limitations, permitting procedures, sampling and monitoring requirements, and a fee system for use of the treatment works.

The objectives of these Rules and Regulations are also:

1. To prevent the introduction of pollutants into treatment works that will damage or interfere with their operations, including interference with the treatment works' use or disposal of sludge;
2. To prevent the introduction of pollutants into treatment works that will pass through, inadequately treated, into receiving waters, causing a violation of the treatment works, NPDES permit or Water Quality Standards, or which otherwise will be incompatible with the treatment works;
3. To protect both the general public and Authority personnel who may be affected by wastewater and sludge in the course of their employment;
4. To prevent sludge contamination and improve opportunities to recycle and reclaim wastewater and sludge from treatment works;
5. To provide for fees for the equitable distribution of the cost of operation, maintenance and improvement of the treatment works; and
6. To enable PRASA to comply with the conditions of its NPDES permits, the requirements concerning the use and disposal of sludge, and any other federal or Commonwealth of Puerto Rico laws to which the treatment works are subject.

A.7.2.3 Regulation for the Management of Non-Hazardous Solid Waste

The *Regulation for the Management of Non-Hazardous Solid Waste* (adopted December 1997) establishes requirements for the handling, storage, transportation, processing, and disposal of non-hazardous solid waste; establishes the Solid Waste Authority as the administrative body responsible for monitoring activities related to non-hazardous solid waste facilities; and establishes a program for the design, construction, operation, closure, and post-closure for non-hazardous solid waste facilities. This regulation also requires the Solid Waste Authority to develop a plan for the management of solid wastes in Puerto Rico. This plan is discussed below in the following section.

A.7.2.4 Law No. 411 of 2000

This law amends the Law for Solid Waste Reduction and Recycling of 1992. This Law requires that any industry, factory, store, and any other type of institution (commercial or non-commercial), educational, university, and tourism institutions among others, profit or non-profit organizations, that employ ten or more people, partial or full-time, have to implement a recycling plan. This plan should explain the procedures to reduce and to separate in the sources those recyclable materials generated by the institutions. Such plans are submitted to the Puerto Rico Solid Waste Management Authority.

A.7.2.5 Law No. 61 of 2002

This law requires the provision of storage areas for recyclable materials in residential projects.

A.7.2.6 Strategic Plan for the Management of Solid Wastes in Puerto Rico

The *Strategic Plan for the Management of Solid Wastes in Puerto Rico*, developed by the Solid Waste Authority, sets out short-, medium-, and long-term strategies for the handling of solid waste with the purpose of fulfilling environmental policy that establishes the protection and conservation of natural resources and the protection of public health. The plan is intended to ensure that solid waste management practices:

- Are environmentally safe, economically viable, and technologically integrated;
- Fulfill the needs of communities, commerce, and industry;
- Protect water, air, and geological resources without jeopardizing future availability; and

- Foster investment and use within public sectors in the development of programs or projects for the handling of solid waste (Solid Waste Authority 2004).

A.7.3 Local Rules and Regulations

Infrastructure systems within the Municipality of San Juan, Department of Urbanism are regulated under various articles of the San Juan Urban Environmental Standards Atmosphere; herein referred to as the Plan. Policies applicable to the Proposed Action are listed below:

- Article 5.09, *Limpieza y Ornato* – A1. One will use individual containers for the storage of wastes. Such containers must be easy to handle during gathering, be equipped with adequate covers; and be stored on a smooth and impermeable surface.
- Article 5.09, *Limpieza y Ornato* – A10. One will place recyclable material in the containers provided by the Municipality according to the *Plan for the Handling and Disposal of Recyclable Materials* or the Solid Waste Authority. One will not deposit non-recyclable material in containers provided for recycling.
- Article 5.09, *Limpieza y Ornato* – H1. All persons or organizations proposing construction, reconstruction, rehabilitation, or demolition of any structure will have to obtain a permit for the Department of Urbanism prior to commencing work. This permit will specify the actions that are required to reduce impacts created by delivery, loads, earth transport, accumulation and disposition, rubbish, and other construction equipment. In addition the permit will specify the handling and location of the containers for the storage, gathering, transport, and disposal of waste; the size and type of receiver to be used, the time in which the space will be able to be occupied by the public, and any other disposition necessary to protect these spaces and the general well-being.
- Article 5.09, *Limpieza y Ornato* – H2. All persons or organizations in charge of the construction, demolition, or rehabilitation or any structure will make sure that the following norms of urbanisms are fulfilled:

To maintain a work environment clean and free of construction rubbish and to quickly remove any dirt or other matter that has come off the site, its trucks or the use of equipment from public roadways.

When transporting wastes, construction equipment, or materials of another nature, the contractor shall cover the area of load with

canvas or awnings so that wastes or materials are completely covered to prevent spilling in the public route.

The entrance and exit of the construction site shall be cleaned of all unloaded material or equipment deposits.

To guarantee the security of pedestrians and vehicles that circulate in the proximity of the construction site, the contractor shall:

- construct fences throughout all of the site fronts that isolate construction and protect pedestrians, vehicles, and contiguous properties;
 - when necessary, construct tubes for the loading and unloading of materials and products of demolition;
 - use water or another chemical compound suitable for controlling dust; and
 - use suitable methods of containment around the earth, construction equipments, stone, sand, and other rubbish of the work.
- Article 5.09, *Limpieza y Ornato* – H7. One will maintain all property or construction sites in such form that it does not affect the route or public spaces with mud, dust, sticky substances, sweepings, or viscous or strange material.
 - Article 5.10, *Environment and Natural Resources* – D2. One will not construct or install some form of industrial wastewater or sewer water infrastructure; nor will one make changes, extensions, reconstruction, or alteration of any existing system.

A.8 Transportation

The following section provides a discussion of the federal, commonwealth, and local laws and regulations which pertain to the transportation and circulation.

A.8.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. With regard to transportation and circulation, the Federal Highway Administration (FHWA) is the federal agency responsible for carrying out federal highway programs. In Puerto Rico, the FHWA carries out these programs in partnership with the Puerto Rico DTOP and local agencies to meet the

commonwealth's transportation needs. Federal regulations governing highways and transportation can be found at 23 CFR Parts 1-1399 and 49 CFR Parts 1-1599.

A.8.2 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the government of Puerto Rico and are implemented under the direction of commonwealth agencies. The Commonwealth of Puerto Rico regulation which pertains to transportation and is described below is the Regulation for Control of Transit and Public Use of Local Streets.

A.8.2.1 Puerto Rico Planning Regulation No. 20, Regulation for Control of Transit and Public Use of Local Streets (1989)

PRPB Regulation No. 20, *the Regulation for Control of Transit and Public Use of Local Streets* (1989) is intended to establish guidelines and procedures necessary to obtain authorizations and permits for the control of the transit of motor vehicles and use of public streets in areas that are described in Law No. 21 of May 20, 1987. In accordance with this regulation, municipalities are responsible for determining which communities are permitted to control motor vehicle transit and use of public roadways. This is determined largely by the communities' geographic location in relation to areas of control (PRPB 1989).

A.8.3 Local Regulations

Local regulations include those laws, regulations, and plans set by the Municipality of San Juan. No local regulations regarding transportation exist.

A.9 Hazardous Materials and Wastes

This section describes the federal, commonwealth and local laws, ordinances, regulations, and guidelines pertaining to hazardous materials and wastes which are applicable to the Proposed Action.

A.9.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. Federal regulations pertaining to hazardous materials which are described below include the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), National Emission Standards for Hazardous Air Pollutants (NESHAP), and the NPDES permit program.

A.9.1.1 Resource Conservation and Recovery Act

RCRA (40 CFR Sections 240-299 USEPA), established a system for controlling solid and hazardous waste from its point of origin to its final disposal. RCRA provides the general guidelines for the waste management program envisioned by Congress, and the USEPA was mandated to develop a comprehensive set of regulations to implement the law. The USEPA develops and issues guidance documents to provide instructions for implementing and complying with these regulations. RCRA covers handling, storage, and disposal requirements for materials ranging from household garbage to industrial solid and hazardous waste. Some wastes, such as animal waste, radioactive waste, and medical waste, are managed by other federal agencies or state laws. RCRA focuses only on active and future facilities and does not address abandoned or historical sites that are managed under CERCLA.

A.9.1.2 National Emission Standards for Hazardous Air Pollutants

NESHAP establishes emissions standards set by the USEPA for an air pollutant not covered by NAAQS that may cause an increase in fatalities or in serious, irreversible, or incapacitating illness. The standards for a particular source category require the maximum degree of emission reduction that the USEPA determines to be achievable, which is known as the Maximum Achievable Control Technology. These standards are authorized by Section 112 of the Clean Air Act (see Section 2.2, *Air Quality*) and the regulations are published in 40 CFR Parts 61 and 63. Regulations which pertain to hazardous materials and are applicable to the Proposed Action include 40 CFR Part 61, Subpart M, *Asbestos*. This regulation for demolition activities involving buildings which are suspected to contain asbestos-containing materials (ACM) outlines specific notification requirements as well as applicable removal and disposal requirements of identified ACM. In addition, the regulation requires that an asbestos survey be conducted by a Certified Asbestos Inspector prior to demolition of such buildings.

A.9.1.3 National Pollutant Discharge Elimination System

As authorized by Section 402 of the CWA, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into Waters of the U.S. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. In most cases, the NPDES permit program is administered by authorized states. However, Puerto Rico is not an authorized state; therefore, the NPDES permit program in Puerto Rico is administered by the USEPA Region 2

Headquarters in New York City through its Caribbean Environmental Protection Division.

A.9.2 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the government of Puerto Rico and are implemented under the direction of commonwealth agencies. Commonwealth of Puerto Rico regulations which pertain to hazardous materials and are described below include the Regulation for the Control of Hazardous Materials and UST Control Regulations.

A.9.2.1 Regulation for the Control of Hazardous Materials

The Commonwealth of Puerto Rico has adopted the Regulation for the Control of Hazardous Materials. Essentially, this document covers all the regulations and guidance pertaining to hazardous materials including, but not limited to, the movement, generation, transportation, handling, operation, permitting, recycling, and treatment of hazardous materials within Puerto Rico as well as the associated public notification requirements. It also sets guidelines and regulations for non-hazardous materials and solid waste.

A.9.2.2 Underground Storage Tank Control Regulations

Section 9004 of RCRA authorizes USEPA to approve state administered UST programs. The EQB issued UST control regulations in 1990 (USEPA 1997). The EQB UST program received USEPA approval in 1998. Through this program, the EQB is responsible for the development of standards and criteria for the design, installation, operation, maintenance, and monitoring of USTs to prevent UST related ground and surface water contamination through the Commonwealth of Puerto Rico UST Law (USEPA 1998).

A.9.3 Local Regulations

No local regulations/municipal hazardous materials regulations exist. All facilities within the boundaries of the municipality are required to follow commonwealth and federal law.

A.10 Noise

This section describes the federal, commonwealth and local laws, ordinances, regulations and guidelines pertaining to noise which are applicable to the Proposed Action.

A.10.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. Federal regulations which pertain to airborne noise and ground-borne noise are described below.

A.10.1.1 Airborne Noise

At the federal level, the USEPA has in the past set forth guidelines for noise levels that it feels are adequate to protect human health and welfare, but it does not currently regulate general environmental noise. General environmental noise at the federal level is regulated by specific agencies that have established guidelines and criteria for determining land-use noise impacts. These agencies include the U.S. Department of Housing and Urban Development (HUD), Department of Defense (DOD), and the Department of Transportation (DOT), which includes sub-administrations FTA, FAA, and FHWA to further develop noise and land use criteria based on their particular mobile source.

In the past, the USEPA coordinated all federal noise control activities through its Office of Noise Abatement and Control that was established through USC, Chapter 65 commonly known as the *Noise Control Act of 1972*. In 1981, the Administration at that time concluded that noise issues were best handled at the state or local government level. As a result, the USEPA phased out the office's funding in 1982 as part of a shift in federal noise control policy to transfer the primary responsibility of regulating noise to state and local governments. The *Noise Control Act of 1972* and the *Quiet Communities Act of 1978*, however, were not rescinded by Congress and remain in effect today. Note that all federal noise regulations remain in effect, and are enforced by either USEPA or a designated federal agency. These regulations cover standards for transportation equipment, motor carriers, low-noise-emission products, and construction equipment.

In 1974, and on the basis of its interpretation of available scientific information, the USEPA identified a range of L_{dn} values sufficient to protect public health and welfare from the effects of environmental noise. It is very important that these noise levels, summarized in Table A.10-1, not be misconstrued. Since the protective levels were derived without concern for technical or economic feasibility, and contain a margin of safety to insure their protective value, they must not be viewed as standards, criteria, regulations, or goals. Rather, they should be viewed as levels below which there are no reasons to suspect that the general population will be at risk from any of the identified effects of noise.

Table A.10-1. Yearly L_{dn} and L_{eq} Values That Protect Public Health and Welfare with a Margin of Safety

Effect	Level	Area
Hearing	$L_{eq} (24) < 70$ dB	All areas (at the ear)
Outdoor activity interference and annoyance	$L_{dn} < 55$ dB	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
Outdoor activity interference and annoyance	$L_{eq} (24) < 55$ dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{dn} < 45$ dB	Indoor residential areas
Indoor activity interference and annoyance	$L_{eq} (24) < 45$ dB	Other indoor areas with human activities such as schools, etc.

L_{dn} = A-weighted day/night average daily sound level
 L_{eq} = Equivalent continuous sound level
 (24)= (time in hours)
 Source: USEPA 1979.

Outdoor yearly levels on the L_{dn} scale are sufficient to protect public health and welfare if they do not exceed 55 dB in sensitive areas (e.g., residences, schools, and hospitals). Inside buildings, yearly levels on the L_{dn} scale are sufficient to protect public health and welfare if they do not exceed 45 dB. Maintaining 55 L_{dn} outdoors should ensure adequate protection for indoor living. To protect against hearing damage, one's 24-hour noise exposure at the ear should not exceed 70 dB.

A.10.1.2 Ground-borne Vibration and Noise

The DOT FTA provides criteria for acceptable levels of ground-borne vibration for various types of special buildings that are sensitive to vibration. The FTA criteria were used for this analysis. The human reaction to various levels of vibration is highly subjective, and varies from person to person. The upper end of the range shown for the threshold of perception, or roughly 65 VdB, may be considered annoying by some people. Vibration below 65 VdB may also cause secondary audible effects such as a slight rattling of doors, suspended ceilings/fixtures, windows, and dishes; any of which may result in additional annoyance. Table A.10-2 shows the FTA ground-borne vibration and noise impact criteria.

Table A.10-2. Ground-Borne Vibration and Noise Impact Criteria

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 micro inch/sec)			Ground-Borne Noise Impact Levels (dBA) re 20 micro Pascals)		
	Frequent Events	Occasional Events	Infrequent Events	Frequent Events	Occasional Events	Infrequent Events
Category 1 Buildings where low ambient vibration is essential for interior operations.	65	65	65	n/a	n/a	n/a
Category 2 Residences and buildings where people normally sleep.	72	75	80	35	38	43
Category 3 Institutional land uses with primarily daytime use.	75	78	83	40	43	48

Notes:

1. "Frequent Events" is defined as more than 70 vibration events per day.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
3. "Infrequent Events" is defined as fewer than 70 vibration events per day.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels.
5. Vibration-sensitive equipment is not sensitive to ground-borne noise.

Source: DOT FTA, "Transit Noise and Vibration Assessment" manual (April 2006).

A.10.2 Commonwealth of Puerto Rico Regulations

A.10.2.1 Regulation for the Control of Noise Pollution

Airborne Noise

The 1976 *Regulation for the Control of Noise Pollution* defines noise as "any sound which annoys or disturbs humans psychologically or physiologically, and that exceed the limitations established in this Regulation." The regulation further defines noise pollution as "any emission of sound that endangers, or injures the safety or health of humans, affects real property or its lawful use and enjoyment of property, according to the standards set forth in this Regulation."

This regulation defines four different zone types, each with different sound level tolerance limits (Table A.10-3 and A.10-4). These noise zones and criteria are for noise receptors with the noise source being beyond the noise receptor property boundary. In addition, no person shall cause or permit from any emission source the emission of a sound level which exceeds the established limits for a period greater than 10 percent of the time (L_{10}), during any measurement period, which shall not be shorter than 30 minutes. An L_{10} noise level is an averaged sound level that is exceeded by 10 percent of noise data during any given sampling period.

Table A.10-3. Zone Definitions

Zone	Use	Example
Zone I Residential	Residences	Permanent homes, rural or country homes, and summer homes
	Commercial dwellings	Including hotels, motels, apartments, house trailer parks, campsites, cabins, guest houses and student dormitories
	Community services	Orphanages, elderly asylums, correctional institutions, charity and schools
Zone II Commercial	Commercial food establishments	Restaurants, luncheon shops, cafeterias, ice cream parlors, night clubs, and open air or mobile cafeterias
	Vehicle service stations	Gas stations, auto sales and rental businesses, parking lots, car washes, and auto repair services
	Property uninhabited by humans, miscellaneous commercial services	Funeral parlors, dog pounds, kennels, and veterinary clinics
	Recreation and entertainment (property uninhabited by humans)	Theaters, stadiums, race tracks, golf courses, amusement and recreation parks, beaches, rivers, lakes, lagoons, and public squares
	Uninhabited community services	Churches, cultural centers, hunting and fishing tracts, and state or national forests
Zone III Industrial	Loading/Unloading establishments	Hardware stores, warehouses, lumberyards, wholesale shops, truck terminals, and docks
	Industrial areas	Mining, light and heavy industry, petrochemical plants, refineries, extraction of materials of the earth crust, foundries, quarries, and thermoelectric generating plants
	Agriculture – areas used to produce or cultivate crops	Poultry farms, dairy farms, greenhouses, and barns
Zone IV Quiet Zone	Hospitals, Clinics, Mental Health Institutes, and Courts of Justice	

Source: Commonwealth of Puerto Rico 1976.

Table A.10-4. Puerto Rico Regulation for the Control of Noise Pollution L₁₀ Noise Level Limits in dBA

Noise Emitting Source	NOISE RECEIVING ZONES							
	Zone I (Residential)		Zone II (Commercial)		Zone III (Industrial)		Zone IV (Quiet)	
	Day Time	Night Time	Day Time	Night Time	Day Time	Night Time	Day Time	Night Time
Zone I Residential	60	50	65	55	70	60	50	45
Zone II Commercial	65	50	70	60	75	65	50	45
Zone III Industrial	65	50	70	65	75	75	50	45

Source: Commonwealth of Puerto Rico 1976.

The following activities and noise sources are exempt from the above guidelines:

- daytime maintenance and repair activities;
- firing ranges; and
- emergency vehicles and personnel.

Construction noise limits differ from regular noise limits. Use or operation of any equipment for construction, repair, or demolition work must not produce noise pollution as defined above. Additionally, construction, except for emergency work, is limited to the daytime period of 7:00 A.M. to 10:00 P.M.

Ground-borne Vibration and Noise

Section 3.1.13 of the *Regulation for the Control of Noise Pollution* addresses *Vibration from Sound* and states that “no person shall cause or permit the operation of any equipment that generates vibrations that can be perceived without instrumentation by a person within or beyond the limits of a property adjacent to the origin of the source.” Given that this regulation is subjective and not quantitative, and that the Commonwealth of Puerto Rico has not developed ground-borne noise regulations and criteria, regulations and criteria determined by the DOT FTA for ground-borne vibration and noise will be used for resource assessment.

A.10.3 Local Regulations

Local regulations include those laws, ordinances, plans, and policies which are adopted by the Municipality of San Juan. Policies which pertain to noise are described below.

A.10.3.1 Airborne Noise

Noise within the Municipality of San Juan is addressed under *Article 5.11, Ambient Night Watchmen*, of the *San Juan Urban Environmental Standards Atmosphere*. Policies applicable to the Proposed Action are listed below:

- One will avoid unnecessary, unexpected or unusual noises in a radius of one hundred meters of the vicinity of hospitals, houses of health, schools, courts of justice or other areas designated and properly labeled like zones of tranquility;
- One will not operate industrial equipment for construction, repair, or works of demolition so that it constitutes unnecessary noise; or during the nocturnal period, between 8:00 P.M. and 7:00 A.M., except when one is to make emergency works to protect the health, security, or immediate well-being of the community or individuals of the community.

A.10.3.2 Ground-borne Vibration and Noise

The Municipality of San Juan has not developed regulations addressing ground-borne vibrations or noise; therefore, regulations and criteria determined by the EQB and outlined within the *Regulation for the Control of Noise Pollution* for this resource should be used.

A.11 Cultural Resources

This section describes the federal, commonwealth and local laws, ordinances, regulations, and guidelines pertaining to cultural resources which are applicable to the Proposed Action.

A.11.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. The applicable federal regulation which pertains to cultural resources and is described below is the National Historic Preservation Act (NHPA).

A.11.1.1 National Historic Preservation Act

The principal federal law addressing cultural resources is the NHPA of 1966, as amended (16 USC Section 470), and its implementing regulations (36 CFR 800). The regulations, commonly referred to as the Section 106 process, describe the procedures for identifying and evaluating historic properties; assessing the effects of federal actions on historic properties; and consulting to avoid, reduce, or minimize adverse effects. As part of the Section 106 process, agencies are required to consult with the State Historic Preservation Officer (SHPO). The term “historic properties” refers to cultural resources that meet specific criteria for eligibility for listing on the National Register of Historic Places (NRHP); historic properties need not be formally listed on the NRHP. Section 106 does not require the physical preservation of historic properties, but ensures that the decisions of federal agencies concerning the treatment of these places result from meaningful considerations of cultural and historic values and of the options available to protect the properties. In order for a cultural resource to be considered significant, it must meet at least one of the following criteria for inclusion on the NRHP:

- Criterion A – the property is associated with events that have made a significant contribution to the broad patterns of our history.
- Criterion B – the property is associated with the lives of persons significant in our past.
- Criterion C – the property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D – the property has yielded, or may be likely to yield, information important in prehistory or history (CFR, Title 36, Part 60:4).

A.11.1.2 State Historic Preservation Office

The *Oficina Estatal de Conservación Histórica* (OECH) is the Commonwealth of Puerto Rico governmental entity responsible for the preservation of historic properties in accordance with the NHPA and its implementing regulation, 36 CFR 800. Puerto Rico’s *2006-2010 State Historic Preservation Plan*, developed by the OECH, sets out general guidelines to direct and coordinate historic preservation efforts in Puerto Rico until 2010. This document serves as a reference for various agencies, institutions, associations, and individuals interested in sustainable development, revitalization of communities, and the integral development of Puerto Rican citizens. The plan’s mission is to promote and coordinate the identification

and preservation of historic resources through the accomplishment of the following goals:

- Educate the community about the importance of historic properties and the opportunities and benefits of their preservation;
- Promote and coordinate the identification, documentation, and evaluation of archaeological and cultural resources in Puerto Rico;
- Promote the inclusion of historic properties in governmental registers that encourage and regulate adequate treatment, as well as promoting new methods for better protection;
- Establish that the integration of historic preservation is an essential element for sustainable development and community revitalization; and
- Assist and educate the community about programs, practices, and techniques appropriate for the preservation of historic resources.

A.11.1.3 Guidelines for Conducting Archaeological Investigations, Phases I, II and III

The OECH published Guidelines for Conducting Archaeological Investigations, Phases I, II and III in 1993. This document summarizes the OECH requirements in terms of content and format for archaeological studies (Phases I, II and III).

The terrestrial and underwater archaeological studies conducted to support the Proposed Action comply with the guidelines established by the OECH in these guidelines.

A.11.2 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the Government of Puerto Rico and are implemented under the direction of commonwealth agencies. The Commonwealth of Puerto Rico regulations which pertain to cultural resources and are described below include Puerto Rico Law 112 of July 20, 1988, PRPB Regulation No. 5, and Law 10 of August 7, 1987.

A.11.2.1 Puerto Rico Law 112 of July 20, 1988

This Law declares of public utility and heritage of the Peoples of Puerto Rico all places, objects, sites, artifacts, documents or archaeological materials that are relics of the human past, be it natural materials or man made; that exists or is located on or under the surface of the earth, within the jurisdiction of the Commonwealth of Puerto Rico.

This Law also creates the *Consejo para la Protección del Patrimonio Arqueológico Terrestre de Puerto Rico (the Consejo)*, which is the Commonwealth's governmental entity responsible for the management and protection of Puerto Rico's archaeological heritage. This law states that any construction or reconstruction activity which requires movement of earth crust material shall obtain an authorization from the Consejo prior to commencing any construction activities. Law 112 also states that the ARPE and the DNER can not grant permits unless the project's developer can present evidence of having obtained the Consejo's authorization.

The terrestrial archaeological study conducted to support the Proposed Action complies with the parameters established by the Consejo in the *Reglamento para la Radicación y Evaluación Arqueológica de Proyectos de Construcción y Desarrollo* (1992).

A.11.2.2 PRPB Regulation No. 5 – Rules for the Nomination, Registration and Conservation of Historic Sites and Areas in Puerto Rico

PRPB Regulation No. 5 outlines the requirements for nominating historic sites to the NRHP, registering historic sites, and methods for conservation and protection of designated historic sites and areas. The regulation also lists the permits required for construction, reconstruction, alterations, or any other amendment or works to properties designated as historic sites or areas. Permits listed in the regulation require the endorsement of the Institute of Puerto Rican Culture prior to issuance.

A.11.2.3 Law 10 of August 7, 1987

This Law declares as areas of public interest all underwater sites and archaeological resources located within the internal and coastal waters under the jurisdiction of the Commonwealth of Puerto Rico.

This Law also creates the *Consejo para la Conservación y Estudio de Sitios y Recursos Arqueológicos Subacuáticos (the Consejo Subacuático)*, which is the Commonwealth's governmental entity responsible for the management and protection of Puerto Rico's underwater archaeological heritage. This law states that any activity which might impact underwater archaeological resources shall be previously authorized by the *Consejo Subacuático*. This entity functions under the parameters established in its *Reglamento No. 2; Para Regular los Procedimientos a Seguirse al Efectuar una Operación de Estudio, Exploración, Excavación, Recuperación o Salvamento en un Sitio Arqueológico Subacuático* (1988).

The underwater archaeological study conducted to support the Proposed Action complies with the parameters established by the *Consejo Subacuático* in the *Para Regular los Procedimientos a Seguirse al Efectuar una Operación de Estudio,*

Exploración, Excavación, Recuperación o Salvamento en un Sitio Arqueológico Subacuático (1988).

A.11.3 Local Regulations

The preservation of cultural resources within the Municipality of San Juan is addressed under Article 5.07, *Regulation for the Concession of Subventions for the Rehabilitation and Improvements of Construction in Historical Zones*, of the San Juan Urban Environmental Standards. These policies outline the documentation requirements that must be met prior to improving a building or commencing construction within a designated Historical Zone.

A.12 Socioeconomics and Environmental Justice

This section describes the federal and commonwealth laws, regulations, and guidelines pertaining to socioeconomics and environmental justice which are applicable to the Proposed Action.

A.12.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the U.S. and implemented by federal agencies. Federal regulations regarding socioeconomics and environmental justice include Executive Orders 12898 and 13045, which are described below.

A.12.1.1 Executive Orders

In 1994, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was issued to focus attention of federal agencies on human health and environmental condition in minority populations and in low-income communities. In addition, its purpose is to ensure that disproportionately high and adverse human health or environmental effects on these communities are identified and addressed. However, based on the ethnic make-up of the population of Puerto Rico, local considerations have been described by the USEPA when addressing the existing socioeconomic conditions. These considerations are described below. In Puerto Rico, a Community of Concern may be virtually indistinguishable from any of its neighbors for a given environmental justice demographic factor. This is because every community in Puerto Rico is classified as Hispanic, even though additional racial differences may exist. Therefore, in Puerto Rico the Hispanic factor is cancelled out and environmental justice assessments must be based on the outcome of the low-income factor, any

other minority differences, and the disproportionate and adverse burden factor (USEPA 2007).

Since children are more susceptible to environmental health risks and safety risks, Executive Order 13045, *Protection of Children from Environmental Health and Safety Risks*, was introduced in 1997 to prioritize the identification and assessment of environmental health risks and safety risks that may affect children. In addition, its purpose is to ensure that federal agencies' policies, programs, activities, and standards address environmental health risks and safety risks to children.

A.12.2 Commonwealth of Puerto Rico Regulations

Commonwealth regulations include those laws and regulations set by the government of Puerto Rico and implemented under the direction of commonwealth agencies. No commonwealth regulations exist with regard to socioeconomics and environmental justice.

A.13 Public Services

This section describes the federal, commonwealth and local laws, ordinances, regulations, and permits pertaining to Public Services related to the Proposed Action.

A.13.1 Federal Regulations

Federal regulations include those laws and regulations set by the federal government of the United States and implemented by federal agencies. There are no applicable federal regulations related to the Proposed Action.

A.13.2 Commonwealth of Puerto Rico Regulations

The regulations of the commonwealth of Puerto Rico include those laws and regulations adopted by the commonwealth government and implemented by commonwealth agencies. There are no commonwealth government regulations related to the Proposed Action.

A.13.3 Local Rules and Regulations

The Municipality of San Juan requires that it provide and coordinate conservation and development of recreational (green) areas. To implement these goals, the Municipality will:

- Promote projects, such as the San Juan Re-vegetation Program;

- Promote the use of arboricultural practices necessary to help maintain healthy trees on streets, sidewalks, parks, and squares;
- Provide advice on the conservation and development of green areas and help to develop a plan to manage these areas; and
- Coordinate with the Department of Public Works and Environment to promote the cultivation and planting of an appropriate variety of plants.

Through the Department of Police and Public Safety, the Municipality also implements public safety services to enable citizens to enjoy streets, parks, and public places. To achieve this, the Municipality will take the following measures:

- Ensure compliance of bylaws and applicable regulations;
- Inform the Department of Public Works and Department of Urban Development and Environment regarding areas or sectors where, for lack of adequate lighting, should be developed for public lighting projects to prevent crime and protect lives and property; and
- In coordination with the Department of Urban Development, carry out inspections to identify and provide special attention to the problem of illegal dumps, dimly lit areas, abandoned establishments and other damage to public property and the environment.

A.14 Visual Resources

The regulatory setting below provides a brief discussion of federal, Commonwealth, and local laws and regulations which pertain to visual resources.

A.14.1 Federal Regulations

Federal regulations include laws, regulations, and programs adopted by the federal government and implemented and enforced by federal agencies. The only federal program which pertains to visual resources is the National Scenic Byways Program. This program is briefly discussed below.

A.14.2 National Scenic Byways Program

The National Scenic Byways Program run under the administration of the Federal Department of Transportation (US DOT) was established to help recognize, enhance, and preserve selected roads throughout the United States. There are no designated scenic byways in the Commonwealth of Puerto Rico (US DOT 2007).

A.14.3 Commonwealth of Puerto Rico Regulations

Commonwealth of Puerto Rico regulations include laws and regulations adopted by the Commonwealth of Puerto Rico and implemented by Commonwealth agencies.

A.14.3.1 Shading and Shadow Regulations

PRPB requires, under Section 8 of Regulation Number 3424, that a horizontal setback from Terrestrial Maritime Limit, to the base of any building or structure of at least 2.5 times the building's height for construction sited within 1,312 feet (400 meters) of the Terrestrial Maritime Limit. A concession can be granted by PRPB "as long as a shadow study indicates that the area within the maritime zone will not receive shadows for more than one (1) hour between the hours of ten in the morning (10:00 AM) and and four in the afternoon (4:00 PM) in the following cases:

- (1) "In the case of proposed construction for ports, fishing, marinas or similar facilities or installations, and its proposed use requires a closer proximity to the terrestrial maritime zone due to its direct relationship to the sea. (This will be the only exemption to the set back from the Terrestrial Maritime Zone requirement.)
- (2) "When the proposed structure is to be constructed in lots adjacent to the Terrestrial Maritime Zone, and open spaces, free of visual obstruction are provided on both sides of the proposed structure or building, of a lineal distance of at least fifty (50) percent of the lineal dimension of the side of the lot which is contiguous to the Terrestrial Maritime Zone. For such purposes, the first floor of a building or any portion, in which the height does not exceed one (1) meter, shall be considered an open space as long as there is no visual obstruction of the coast. Parking areas shall not be considered open spaces for purposes of Section 8.03 if the height of a car is at least one (1) meter from the curb level.
- (3) "If an amount of at least five (5) percent of the construction costs of the upper level of the building which exceeds the required height is invested in physical improvements dedicated for public use, and such investment is not required by Regulation Number 17 or any other regulation. Such improvements must be harmonious with the sector's urban development, shall be related exclusively to the recreational use of the maritime coast line, and be dedicated to the enjoyment of the general public. Its design will be integrated with the area's topography and natural elements, with the existing or permitted uses of properties nearby, and the existing or proposed public facilities."

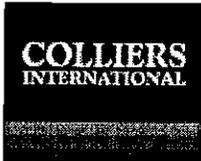
A.14.4 Local Rules and Regulations

Local rules and regulations include those ordinances, rules, regulations, and plans adopted by the Municipality of San Juan. There are no applicable local rules or regulations which address visual resources.

Law No. 416 requires that a DIA discuss how the Proposed Action is consistent with or conflicts with the specific objectives and terms of current land use plans and public policies applicable to the project area. Applicable regulations are discussed within each resource area in Section 2.

APPENDIX B

Preliminary Geotechnical Report
October 31, 2007



SAN JUAN WATERFRONT REDEVELOPMENT

Preliminary Geotechnical Report

Prepared for:

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Document Number
7-660-00004.2000

Submitted:
October 31, 2007

October 31, 2007
7-660-00004

Colliers TMT of Puerto Rico, LLC
221 E. Fourth Street
Cincinnati, Ohio 45202

Attention: Ms. Karen McShea
Senior Vice President, Project Director

Subject: Preliminary Geotechnical Engineering Report
San Juan Waterfront Project
San Juan, Puerto Rico

Dear Karen:

AMEC E&E Caribe, LLC (AMEC) is pleased to submit this report describing our preliminary geotechnical engineering evaluation for the above-referenced project. The purpose of our evaluation was to derive preliminary conclusions and general recommendations for issues concerning site re-development, including: site preparation, excavations, dredging, pile foundations, retaining walls, underground utilities, drainage, and structural fill. Due to the preliminary nature of this evaluation, a design-phase geotechnical engineering evaluation will be required before final design can proceed.

As outlined in our Exhibit 1 Scope of Services of the Agreement for Professional Services dated March 22, 2007, our scope of work comprised a field exploration, laboratory testing, geotechnical research, geotechnical analyses, and report preparation. We received your written authorization for our evaluation on March 22, 2007. This report has been prepared for the exclusive use of Colliers TMT of Puerto Rico, LLC, the Puerto Rico Port Authority (PRPA) and their consultants, for specific application to this project, in accordance with generally accepted geotechnical engineering practice.

We appreciate the opportunity to be of service on this project and would be happy to answer any questions you may have.

Sincerely,

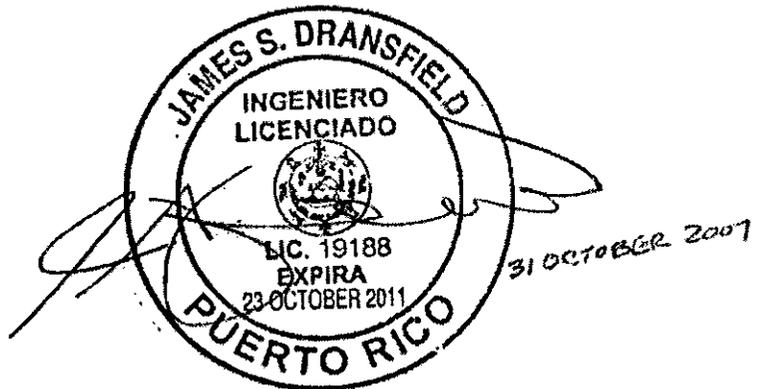
AMEC E&E Caribe, LLC



James S. Dransfield, P.E.
Partner, Project Geotechnical Engineer

**San Juan Waterfront Redevelopment
Colliers TMT of Puerto Rico**

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7-660-00004

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1.0 SUMMARY

The following summary of project geotechnical considerations is presented for introductory purposes and, as such, should be used only in conjunction with the full text of this report.

- **Project Description:** Improvement plans call for redevelopment of the waterfront from Pier 6 on the west to Navy/Frontier Pier on the east, a total distance of approximately 1.4 miles (2.3 kilometers). Work generally includes renovation or replacement of waterfront piers and utility replacement, to provide public access, parks along the waterfront, a new marina, and mixed commercial and residential development in upland areas.
- **Exploratory Methods:** We explored subsurface conditions by means of 19 borings advanced at strategic locations across the project site, to depths ranging from about 25 to 76 feet below existing grades. Additionally, nine groundwater monitoring wells were installed across the project site in conjunction with our environmental study for the project, results of which are provided under separate cover. We also reviewed the logs of approximately 90 subsurface explorations conducted by other geotechnical engineering firms for previous projects across the site.
- **Soil Conditions:** Soils underlying the site generally consist of a variable thickness of fill soil placed during original development of the project site. These fill soils varied from gravelly clay to silty, fine to medium sand. Native soils encountered beneath the fill soils consisted of soft silty clay which mantles, in most areas across the site, a variable thickness of peat. Below the peat deposits, medium stiff fine-grained deposits were encountered that varied from a sandy clay to a silty sand across the site. Bedrock, consisting of completely weathered limestone was encountered at depths varying from 53 to 65 feet below existing grade at the piers located along the southern edge of the project site.
- **Groundwater Conditions:** Groundwater was encountered within each of our explorations, varying in depth from 3 to 7½ feet at the time of drilling. Subsequent groundwater measurements obtained from the nine groundwater monitoring wells installed across the site disclosed groundwater levels varying in depth from 2½ to 4½ feet. Groundwater levels can be expected to vary slightly dependent upon seasonal precipitation fluctuations, tidal influence and both on- and off-site utilization.
- **Seismic Analysis:** Previous geologic mapping of the area suggests the majority of fill soils at this site are susceptible to liquefaction during moderate to strong earthquakes. Our analysis confirms that liquefaction and lateral spreading are likely under moderate to strong ground motions. Recommendations for mitigation include ground improvement in the upper fills, and support of critical structures on piles.
- **Waterfront Facilities:** We evaluated lateral earth pressures for sheet pile bulkheads, with either tieback anchor or cantilevered pile support, presented in Figures 3A through

3G. We provided axial and lateral capacities for precast concrete piles, for support of waterfront structures, presented in Tables 6 and 7.

- **Utilities and Site Grading:** Because of the great depth of compressible soils, ongoing subsidence of the area is anticipated. Pile support of major settlement-sensitive utilities should therefore be considered. However, pile support of all utilities may not be desirable since it will create relatively hard spots within the site that are more likely to lead to future pipe shearing. Instead we recommend utilities be provided with constrained joints and flexible connections to accommodate some differential movement.
- **On-Site Soil Considerations:** Because the on-site soils are moisture-sensitive and would be readily disturbed when wet, the contractor should install appropriate temporary drainage systems at the construction site and should minimize traffic over exposed subgrades.

2.0 SITE AND PROJECT DESCRIPTION

The project site consists of approximately 54 acres of land along the waterfront on the north side of the San Antonio Channel in the Old San Juan area of San Juan, Puerto Rico, extending from Pier 6 eastward to the Navy/Frontier Pier, as shown on the enclosed *Location Map* (Figure 1). Portions of the site are currently utilized as docking points for barges and commercial importing/exporting activities. Other uses include light industrial and commercial activities. Several areas within the project site have been abandoned or condemned for use because of structural deterioration and related safety concerns.

Figures 1A to 1C illustrate preliminary re-development plans within or immediately adjacent to the existing San Antonio Channel, which include: replacement of waterfront bulkheads at the existing Piers 6 and 7; removal of existing Pier 8 to accommodate a marina; strengthening of existing Pier 9 to support a hotel; construction of a widened promenade/ plaza area north of Piers 8 and 9; construction of waterfront park pier at Pier 10 (involving modification to the alignment of Pier 10 and infilling at the "La Coal" Fishing Facility); replacement of Piers 11-14; installing bulkhead across the Corps of Engineers Pier (excluding the boat ramp); renovations of Navy/Frontier Pier, and installing bulkhead across the Harbor Pilots Dock area (including DEA boat ramp and DEA boat house), to create a continuous waterfront edge and Canal Walk. These improvements are discussed in more detail below. Further re-development of the upland Puerto Rico Port Authority property includes park areas designated as: the Gateway, the East and West Cross Island Parks, and other mixed use development.

Site boundaries are generally delineated by Pier 6 to the west, Fernandez Juncos Avenue on the north, by Club Nautico Marina on the east, and by San Antonio Channel on the south. The enclosed *Site & Exploration Plan* (Figure 2) illustrates these site boundaries and adjacent existing features.

The following description of work has been developed based on the conceptual drawings and available as-built plans. Actual dimensions presented herein will need to be reviewed and updated as more detailed site surveys and designs are developed.

2.1 Pier 6

Pier 6 renovation includes the removal of the existing buildings, followed by restoration of the pier and bulkhead. The upland area will be redeveloped as a canal walk and plaza area with landscaping. No new structures are planned north of the new Pier 6 bulkhead, with the exception of possible some shade awnings, light posts, trees, etc. A final off-shore dredge depth of -38 feet is planned in this area.

During construction, the following work on Pier 6 would occur:

- Remove the building structures;
- Remove the deck structure concrete slabs and pile caps;
- Excavate underlying soil on the land side (north) of the existing bulkhead to mean higher high water (MHHW);
- Remove existing piles on land-side of the bulkhead;
- Install a new sheet pile bulkhead along the 1000 feet (304.8 meters) of waterfront, approximately 8 feet water-ward of the existing bulkhead;
- Dredge soil on water-side of the new bulkhead at a 2H:1V slope to a toe trench elevation of -36 feet (-11.0 meters);
- Backfill on waterside of the new bulkhead to create a rock revetment with an outside slope inclination of 1.5H:1V;
- Re-excavate on land-side of the new bulkhead for installation of cast-in place concrete deadman anchors and tie rods;
- Install driven concrete piles (after ballast, before armoring) on waterside (south) of the new bulkhead as necessary for deck support; and
- Install new concrete deck structure (new waterfront edge to match existing edge), and install on-shore slab on grade.

2.2 Pier 7

Pier 7 would require bulkhead replacement. The existing structure would be demolished, requiring the removal of approximately 536 feet (163.4 meters) of waterfront structures. A new bulkhead and pier structure would be installed in its place. Pier 7 work would include:

- Remove or cut at dredge depth the reinforced concrete slabs, pile caps to approximately 60 feet (18.3 meters) landward (west) of the waterfront edge of the structure;
- Install a new steel sheet pile bulkhead along the 536 feet (163.4 meters) of waterfront, at the existing waterfront edge, approximately 18 feet (5.5 meters) waterward of existing bulkhead;
- Backfill the zone between the old bulkhead and the new bulkhead;

- Re-excavate on land-side of the new bulkhead for installation of cast-in place concrete deadman anchors and tie rods; and
- Install new on-shore pile-supported concrete deck structure and on-shore slab-on-grade and paving.

2.3 Pier 8

Existing Pier 8 would be demolished and removed. Pier 8 is approximately 405 feet by 550 feet (123.4 meters by 167.6 meters) in size. Current ground elevation on the pier is approximately +5.9 feet (1.8 meters) above mean sea level, based on the PRVD O2 datum used. The final excavation and dredging depth would be elevation -20 feet (-6.1 meters). Work would be as follows:

- Remove the reinforced concrete slabs, pile caps and other paving across the entire Pier 8 area to an average depth of approximately 2 feet (0.6 meters). Excavation of underlying soil would proceed down to mean higher high water (elevation +0.8 feet (0.24 meters));
- Dredge below elevation +0.8 feet (+0.24 meters), down to elevation -20 feet (-6.1 meters); and
- In the final stage of dredging to elevation -20 feet (-6.1 meters) across the area, the existing bulkhead piles would be extracted or cut at dredge depth.

Proposed San Juan Waterfront Marina, Service Road and Finger Piers: A new marina is to be constructed in the basin between Pier 7 and Pier 9 (after removal of Pier 8). This marina facility would consist of fixed and floating piers and a marina service road, providing up to 100 slips for various sized yachts. The pile-supported marina service road would be constructed along the west side of Pier 9. The service road pier would be a total of 602 feet (183.5 meters) long and 20 feet (6.1 meters) wide. In addition, two sets of piers and walkways would be constructed west of the service road. The North Floating Pier would be 665 feet (202.7 meters) long by 10 feet (3.0 meters wide), with 10 finger piers at 50 feet (15.2 meters) long by 5 feet (1.5 meters) wide, 15 finger piers at 60 feet (18.3 meters) long by 6 feet (1.8 meters) wide, and a T-head end pier at 120 feet (36.6 meters) long by 10 feet (3.0 meters) wide. The South Fixed Pier would be 626 feet (190.8 meters) long by 20 feet (6.1 meters wide), with 10 finger piers at 70 feet (21.3 meters) long by 7 feet (2.1 meters) wide, one finger pier that is 115 feet (35.1 meters) long by 14 feet (4.3 meters) wide, 4 finger piers ranging from 135 feet (41.1 meters) to 215 feet (65.5 meters) long by 18 feet (5.5 meters) wide, and a T-head end pier at 330 feet (100.6 meters) long by 20 feet (6.1 meters) wide. A floating dock is to be located along the northern edge of the marina, 523 feet (159.4 meters) long by 8 feet (2.4 meters) wide. The road and finger piers would be either floating or pile-supported fixed structures. Work is as follows:

- Working from off-shore barge, drive piles for the marina piers and service road. Piles would fully support the fixed structures, and piles would be used to tether the floating docks;
- Install off-shore marina piers and service road structures. A combination of precast concrete and cast-in-place concrete structures would be used. The forming and pouring of concrete decking for fixed structures would occur from an off-shore barge for erecting

temporary false work beneath the outer portions of the deck. No temporary offshore fills would be required for this work;

- For the area at the north end of the Pier 7/8 basin, existing mudline is at approximately elevation -15 feet to -20 feet. This is shallower than the desired marina basin elevation of -20 feet, so that dredging of approximately 5 feet (1.5 meters) will be required, over an approximate area of 18,600 square feet (1,728 square meters).

2.4 Pier 9

Pier 9 is to remain in place, with strengthening of the perimeter bulkheads on all three sides, in order to accommodate a new multistory hotel. This would increase the width of Pier 9 by 2 feet 3 inches to the west, and 2 feet 3 inches to the east. No change would be made in pier edge location on the south side of Pier 9. This slight increase in size to reinforce the existing pier is an approach that allows re-use of existing Pier 9 for the planned hotel and upland development. This has the benefit of minimizing disturbance to the site and waterway, compared to removal and replacement of pier edge structures and portions of the Pier 9 fill. Overall, the renovated Pier 9 will be approximately 340 by 520 feet (103.6 by 158.5 meters) in size. Current ground elevation on Pier 9 is approximately +5.3 feet (1.6 meters). Strengthening of Pier 9 will also require installation of a new rock revetment on the west side of the pier. Proposed work would include:

- Install a new steel sheet pile bulkhead and cap beam adjacent to the existing western edge of the pier, along 500 feet (152.4 meters) of waterfront. The outside edge of the new cap beam and sheet pile wall would be 2 feet-3 inches outside the existing pier edge. The void between the old and new sheet pile wall would be backfilled with lean mix concrete;
- Install a new steel sheet pile bulkhead and cap beam adjacent to the existing eastern edge of the pier, along 520 feet (158.5 meters) of waterfront. The outside edge of the new cap beam and sheet pile wall would be 2 feet-3 inches outside the existing pier edge. The void between the old and new sheet pile wall would be backfilled with lean mix concrete;
- On the west side of Pier 9, over a total length of 500 feet (152.4 meters), dredge a toe trench. The toe trench excavation is to be 6 feet (1.8 meters) deep below existing mudline grade by 6 feet (1.8 meters) wide, with side slopes of 1H:1V on the water side and 2H:1V on the land side, for a total excavation width of 31 feet (9.5 meters);
- On the west side of Pier 9, over a total length of 500 feet (152.4 meters), backfill on the water-side of the new bulkhead to create a rock revetment with an outside slope inclination of 1.5H:1V;
- In the south-east and south-west corners of Pier 9, working from an offshore barge, remove the existing deck over an area of approximately 50 feet x 50 feet (15.2 x 15.2 meters). An area of deck approximately 100 feet long by 12 feet wide (30.5 x 3.7 meters) will also be removed along the east pier face;
- On the south side of Pier 9, the location of the existing bulkhead in relation to the existing pier edge varies from 31 feet (9.4 meters) at the east end to 5 feet (1.5 meters)

at the west end. The northernmost 14 feet (4.2 meters) of the existing concrete deck would be removed;

- On the south side of Pier 9, install new steel sheet pile wall on-shore north of the existing bulkhead. Drive new concrete battered piles on-shore using crane-mounted pile driving equipment. Construct new sheet pile capping beam and on-shore slab on grade.
- On the south side of Pier 9, rebuild the concrete deck.

2.5 Promenade

The Promenade would be located north of the proposed San Juan Waterfront Marina, between Piers 7 and 9, bordered by a bulkhead with an overall length of 835 feet (254.5 meters). The Promenade waterfront has three different bulkhead conditions, described as follows:

Promenade West: this is the existing Pier 7/8 north edge. The existing 220 feet (67.1 meters) of bulkhead along the north side of Pier 7/8 would be restored at its current location.

Promenade Central: a new bulkhead will be continued eastward, in line with the Pier 7/8 bulkhead, across the 400-foot (121.9-meter) width where Pier 8 is currently located.

Promenade East: a new 215-foot (65.5-meter) section of bulkhead will be constructed across the Pier 8/9 basin, in line with bulkheads at Promenade West and Promenade Central. This new bulkhead will be located 75 to 105 feet (22.9 to 32 meters) waterward (south) of the existing Pier 8/9 bulkhead.

Overall, the Promenade plaza area between Pier 7 and 9 will be approximately 180 feet (54.9 meters) wide, by 835 feet (254.5 meters) in overall length. The new bulkhead would be located at the water's edge, with tieback tendons connected to a cast-in-place concrete anchor trench in the wall backfill. A rock revetment would be constructed at the toe of the bulkhead. Work to construct the Promenade bulkhead would include:

- At Promenade West, approximately 155 feet of the 220 feet of bulkhead has failed. Remove the upper reinforced concrete slabs, pile caps and other paving back by approximately 38 feet (11.6 meters) north of the existing bulkhead waterfront edge, to an average depth of approximately 2 feet (0.6 meters);
- At the Promenade West, install a new steel sheet pile bulkhead along the 220 feet (67.1 meters) of waterfront, estimated to be approximately 2 feet (0.6 meters) south of the existing bulkhead. This will include installing sheet pile bulkhead across the 155 foot (47.2 meter) portion of failed bulkhead slope.
- At the Promenade Central area, install a steel sheet pile bulkhead along the 400-foot (121.9-meter) width of Pier 8. This work would be completed working from on-shore prior to completion of dredging activities at Pier 8;
- At the Promenade East area, drive a new sheet pile bulkhead. Install the new steel sheet pile bulkhead along the 215 feet (65.5 meters) of waterfront, estimated to be approximately 75 feet to 105 feet (22.9 meters to 32 meters) south of the existing Pier 8/9 bulkhead line. At Promenade West, over a total length of 220 feet (67.1 meters) of

waterfront, dredge a toe trench 6 feet (1.8 meters) deep below existing mudline grade, by 6 feet (1.8 meters) wide, with side slopes of 1H:1V on the water side and 2H:1V on the land side, for a total excavation width of 18 feet (5.5 meters);

- At Promenade Central, over a total length of 400 feet (121.9-meters), the new bulkhead will be in place prior to the mass dredging of the former Pier 8 area to elevation – 20 feet (-6.1 meters). In addition to the mass dredging, a toe trench will be dredged along the face of the new bulkhead. The toe trench excavation is to be 6 feet (1.8 meters) deep below existing mudline grade, by 6 feet (1.8 meters) wide, with side slopes of 1H:1V on the water side and 2H:1V on the land side, for a total excavation width of 26 feet (7.9 meters);
- At Promenade East, over a total length of 215-feet (65.5 meters) of waterfront, dredge a toe trench 6 feet (1.8 meters) deep below existing mudline grade, by 6 feet (1.8 meters) wide, with side slopes of 1H:1V on the water side and 2H:1V on the land side, for a total excavation width of 21 feet (6.4 meters);
- For the entire 835 feet (254.5 meters) of Promenade between Piers 7 and 9, backfill the new toe trench on water-side (south) of the new bulkhead to create a rock revetment with an outside slope inclination of 1.5H:1V;
- At Promenade East, backfill the 75- to 105-foot (22.9- to 32-meter) wide zone behind the new bulkhead. The diked off area will be partially dewatered prior to backfill placement, to improve soil compaction. As filling progresses, install anchor rods and cast concrete deadman anchors north of the new bulkhead;
- At Promenade West, backfill the 155 by 50-foot (47.2 by 15.2-meter) zone of failed bulkhead. Backfill the zone between the failed bulkhead slope and the new bulkhead;
- At Promenade West and Promenade Central, excavate trenches on the land side of the new bulkhead for installation of cast-in place concrete deadman anchors and tie rods. Once tie rods are attached between the anchors and the bulkhead, the trenches would be backfilled and compacted;
- Install new on-shore pile-supported concrete deck structure and on-shore slab-on-grade and paving.

2.6 Waterfront Park at Pier 10

A new Waterfront Park is planned for the north end of the Pier 9/10 basin to the southwest corner of Pier 11. A new waterfront edge is planned, requiring removal of existing Pier 9/10 North, Pier 10 West, Pier 10 South, as well as filling across the south edge of La Coal Fishing Facilities area.

Waterfront Park at Pier 9/10: The 170 feet (51.8 meters) of existing bulkhead at the north end of the Pier 9/10 basin will be replaced with a stair-step-edged deck in front of a new bulkhead. The new bulkhead will be 5 to 25 feet (1.5 to 7.6 meters) waterward of the existing bulkhead. The outer edge of the new deck will be 15 feet (4.6 meters) waterward of the new bulkhead, or a total distance of 20 to 40 feet (6.1 to 12.2 meters) waterward of the existing edge. The new bulkhead will be supported by tieback tendons connected to a cast-in-place concrete anchor

trench on the land side of the wall. A rock revetment would be constructed at the toe of the bulkhead. Work to construct the Waterfront Park at Pier 9/10 would include:

- At the Pier 9/10 edge, install a new steel sheet pile bulkhead along the 156 feet (47.5 meters) of waterfront, approximately 5 to 25 feet (1.5 to 7.6 meters) south of the existing Pier 9/10 bulkhead line;
- Backfill the zone behind the new bulkhead;
- Re-excavate trenches behind the new bulkhead on the land side of the new bulkhead for installation of cast-in place concrete deadman anchors and tie rods using conventional on-shore earthwork equipment. Once tie rods are attached between the anchors and the bulkhead, the trenches would be backfilled and compacted;
- Install piles for new off-shore deck and on-shore deck;
- Install on-shore and off-shore concrete deck structure and on-shore slab-on-grade and paving.

Waterfront Park at Pier 10 (West Side): At Pier 10 (west side) the existing structure would be demolished and removed to make way for a reconfigured stair-stepped edge. The new edge will be 450 feet (137.2 meters) in length, oriented at a diagonal to the existing Pier 10 West edge (see Figure 1A). At the north end, the new edge deck will be 30 feet (9.1 meters) waterward of the existing edge, while at the south end, the new pier edge will be 130 feet (39.6 meters) landward of the existing edge. The new bulkhead will be located 15 feet (4.6 meters) landward of the new stair-stepped edge. The former Pier 10 area would be dredged to an elevation of -20 feet (-6.1 meters). A rock revetment would be constructed at the toe of the new bulkhead. This work would include:

- Remove the reinforced concrete slabs, pile caps behind the waterfront edge of the structure. The width of the pier reconstruction zone varies from 0 feet at 100 feet (30.5 meters) south of the north end of Pier 10, to 130 feet (39.6 meters) at the south end of Pier 10;
- Install new steel sheet pile bulkhead along 458 feet (139.6 meters) of realigned pier, at a location 15 feet landward of the new pier edge;
- On the waterward side of the new bulkhead, excavate underlying soil down to MHHW elevation +0.8 feet (+0.24 meters), using conventional on shore earthwork equipment;
- Remove or cut the existing reinforced concrete piles on the waterward side of the new bulkhead at dredge depth;
- Dredge on water-side of the new bulkhead to remove former Pier 10 down to elevation of -20 feet (-6.1 meters). Over a width of 48 feet (14.6 meters) along the toe of the new bulkhead, continue to dredge at a 2H:1V slope down to a toe trench elevation of -26 feet (-7.9 meters);
- After dredging for the toe trench, backfill on water-side (south) of the new bulkhead to create a rock revetment with an outside slope inclination of 1.5H:1V;

- Install driven concrete piles (after ballast, before armoring) on water-side (south) of the new bulkhead to support the new deck;
- Backfill on land-side (north) of the new bulkhead;
- Re-excavate on land-side of the new bulkhead for installation of cast-in place concrete deadman anchors and tie rods; and
- Install new on-shore pile-supported concrete deck structure and on-shore slab-on-grade and paving.

Waterfront Park at Pier 10 (South Side): At Pier 10 (south side) the existing structure is to be demolished and removed, and grades dredged down to elevation -20 feet (-6.1 meters), as described above. Continuing east from Waterfront Park at Pier 10 West, a new bulkhead and deck would be constructed across the south end of "La Coal" Fishing Facilities. The outside edge of the pier would extend from the southeast corner of the former Pier 10 to the southwest corner of Pier 11, a distance of 352 feet (107.3 meters). The new park edge is approximately 100 to 125 feet (30.5 to 38.1 meters) south of the existing "La Coal" fishing dock edge. The new bulkhead would be located up to 87 feet (26.5 meters) north of the new pier edge. A pile-supported deck would be constructed south of the new bulkhead line. Work would include:

- Remove or cut at dredge depth the existing catwalk boat pier structures and reinforced concrete piles at "La Coal";
- Install a new steel sheet pile bulkhead inside the La Coal basin, in a U-shaped configuration along 425 feet (129.5 meters) of waterfront, 20 to 40 feet (6.1 to 12.2 meters) south of existing fishing facility bulkhead;
- For the northern-most 210-foot (64 meter) segment of the new bulkhead, dredge a 6 foot (1.8 meter) deep trench which is 21 feet (6.4 meters) wide to create a toe trench for a rock revetment;
- After dredging for the toe trench, backfill on water-side (south) of the new bulkhead to create a rock revetment with an outside slope inclination of 1.5H:1V;
- Backfill on land-side (north) of the new bulkhead;
- Install driven concrete piles on water-side (south) of the new bulkhead; and
- Install new off-shore concrete deck structure and on-shore slab on grade.

2.7 Piers 11 to 14

Existing Piers 11 to 14 are 2,103 feet (614 meters) in overall length; these piers are to be replaced with a new pier structure which will match the existing pier waterfront edge. Pier 14 Extension is 400 feet (121.9 meters) in length (located east of Pier 14); plans call for renovations to the pier face. A new pile-supported pier, 20 feet (6.1 meters) wide and extending 170 feet (51.8 meters) southward off of Pier 14 is also proposed. These improvements are described below.

Piers 11 to 14: The 2,103 feet (641 meters) of waterfront structures including bulkhead, concrete deck, and piles along Piers 11 to 14 have been condemned by PRPA due to structural deterioration. The existing structures would be reconstructed. Pier 11 to Pier 14 work would include:

- Remove the reinforced concrete slabs, pile caps and slabs to approximately 75 feet (22.9 meters) north of the waterfront edge of the structure;
- Remove or cut the existing reinforced concrete piles inside and outside of the bulkhead at dredge depth;
- Install a new steel sheet pile bulkhead along the 2,103 feet (641 meters) of waterfront, approximately 8 feet (2.4 meters) south of existing bulkhead;
- Dredge soil on water-side (south) of the new bulkhead at a 2H:1V slope down to a toe trench elevation of -33 feet (-10.1 meters);
- Backfill on water-side (south) of the new bulkhead to create a rock revetment with an outside slope inclination of 1.5H:1V;
- Install driven concrete piles on water-side (south) of the new bulkhead;
- Backfill on land-side (north) of the new bulkhead; and
- Install new off-shore concrete deck structure and on-shore slab on grade.

Pier 14 Extension: The Pier 14 Extension area is 400 feet (121.9 meters) in length. Pier 14 Extension is to remain in place, with strengthening of the perimeter bulkhead. This will increase the width of Pier 14 Extension by 2 feet 3 inches to the south. Current ground elevation on Pier 14 Extension is approximately +5.3 feet (1.6 meters). Strengthening of Pier 14 Extension will also require installation of a new rock revetment on the west side of the pier. Proposed work would include:

- Install a new steel sheet pile bulkhead and cap beam adjacent to the existing southern edge of the pier, along 400 feet (121.9 meters) of waterfront. The outside edge of the new cap beam and sheet pile wall would be 2 feet 3 inches outside the existing pier edge. The void between the old and new sheet pile wall would be backfilled with lean mix concrete;
- On the south side of Pier 14 Extension, over a total length of 400 feet (121.9 meters), dredge a toe trench. The toe trench excavation is to be 6 feet (1.8 meters) deep below existing mudline grade by 6 feet (1.8 meters) wide, with side slopes of 1H:1V on the water side and 2H:1V on the land side, for a total excavation width of 21 feet (6.4 meters);
- On the south side of Pier 14 Extension, over a total length of 400 feet (121.9 meters), and a width of 29 feet (8.8 meters), backfill on the water-side of the new bulkhead to create a rock revetment with an outside slope inclination of 1.5H:1V.

New Pier at Pier 14: A new pier with overall dimensions of 170 by 30 feet (51.8 by 9.1 meters) is planned at the end of Pier 14. This would be a pile-supported fixed pier with no earthwork planned, except for tie-in at the land-side end.

2.8 Corps of Engineers Pier

At the USACE property, the existing pier area would be filled to create a uniform straight edge aligned with Pier 14 Extension to the west and the Navy/Frontier Pier to the east. The proposed final depth along the face of the pier would be elevation -20 feet (-6.1 meters) at the top of the revetment, sloping down to meet existing grades at 1.5H:1V. An exception will be the 15-foot (4.6-meter) wide opening for the boat ramp, which will remain functional as a boat ramp. To accomplish this, the ramp will be rebuilt to extend out to the face of the new waterfront edge, and the retaining walls on the east and west will be extended south to meet the new waterfront edge. Slopes for the new revetment east and west of the boat ramp would begin outside this 15-foot (4.6-meter) wide zone. Work in this area would include:

- Demolish and remove the existing boat ramp. Remove the reinforced concrete slabs and pile caps and slabs back to the existing bulkhead at approximately 44 feet (13.4 meters) north of the existing ramp waterfront edge of the structure;
- Install a new steel sheet pile bulkhead along the 40 feet (12.2 meters) of waterfront west of the boat ramp, in line with the adjacent Pier 14 Extension to the west and Navy/Frontier Pier to the east, then turning perpendicular to the waterfront and install bulkhead 44 feet (13.4 meters) north to tie into the western edge of the existing boat ramp wall. Also install a new steel sheet pile bulkhead along the 200 feet (61 meters) of waterfront east of the boat ramp, in line with the adjacent Pier 14 Extension to the west and Navy/Frontier Pier to the east, then turning perpendicular to the waterfront and install bulkhead 44 feet (13.4 meters) north to tie into the eastern edge of the existing boat ramp wall;
- Dredge soil on water-side (south) of the new bulkhead at a 2H:1V slope to a toe trench elevation of -43 feet (-13.1 meters). The toe trench excavation is to be 6 feet (1.8 meters) deep below existing mudline grade by 6 feet (1.8 meters) wide, with side slopes of 1H:1V on the water side and 2H:1V on the land side (see Figure 37), for a total excavation width of 32 feet (9.8 meters);
- Backfill on water-side (south) of the new bulkheads to create rock revetments west and east of the existing boat ramp, with an outside slope inclination of 1.5H:1V, and a total width of 36 feet (11 meters);
- Backfill on land-side (north) of the new bulkhead with recycled on-site or imported granular fill to restore site grade; and
- Install new boat ramp concrete deck structure and on-shore slab on grade. During backfilling, a tieback, waler beam, and anchor would be installed to provide lateral support for the waterfront bulkhead.

2.9 Navy/Frontier Pier

The 1,105 feet (336.8 meters) of Navy/Frontier Pier is to be renovated to accommodate break-bulk cargo operations as a temporary condition, which will require strengthening of the existing pier and localized deepening of the channel adjacent to the structure. The strengthening will increase the width of the Navy/Frontier Pier by approximately 2 feet-3 inches. Work would include:

- Install a new steel sheet pile bulkhead and cap beam adjacent to the existing western edge of the pier, along 1,105 feet (336.8 meters) of waterfront. The outside edge of the new cap beam and sheet pile wall would be approximately 2 feet-3 inches outside the existing pier edge. The void between the existing and new sheet pile wall would be in-filled with lean mix concrete;
- Remove the existing deck slab upland of the existing sheet pile wall. Construct a new pile supported, concrete relieving platform upland of the new sheet pile wall. The platform will be suitable for break-bulk cargo loads and constructed using on-shore construction equipment;
- Depth soundings show existing depths vary along the Navy/Frontier Pier with an average elevation of -32 feet (-9.8 meters) at the pier face. Locally the depth is as shallow as -28 feet (8.4 meters) immediately adjacent to the pier face. Dredge as required along the 1,105 feet (336.8 meters) of waterfront by up to 73 feet (24.0 meters) wide to provide final elevation of -33.6 feet (10.1 meters). A 3.0 foot (0.9 meter) thick layer of armor stone will be provided to prevent toe scour.

2.10 Harbor Pilots Dock Area

At the Harbor Pilots Dock property, the existing boat dock area would be filled to create a uniform straight waterfront edge in line with the Navy/Frontier Pier to the west. This work would also include extending the bulkhead across the front of the DEA boat ramp and the DEA boat house to the east. The total length of new bulkhead from the east end of Navy/Frontier Pier to the east end of the DEA boat house is 245 feet (74.7 meters). Work would consist of the following:

- Remove or cut off at dredge depth the existing boat pier structures and reinforced concrete piles;
- Install a new steel sheet pile bulkhead along the 245 feet (74.7 meters) of waterfront, in line with the adjacent Navy/Frontier Pier;
- Dredge soil on water-side (south) of the new bulkhead at a 2H:1V slope to a toe trench elevation of -43 feet (-13.1 meters). The toe trench excavation is to be 6 feet (1.8 meters) deep below existing mudline grade by 6 feet (1.8 meters) wide, with side slopes of 1H:1V on the water side and 2H:1V on the land side, for a total excavation width of 24 feet (7.3 meters);
- Backfill on water-side (south) of the new bulkhead to create a rock revetment, with an outside slope inclination of 1.5H:1V, and a total width of 39 feet (11.9 meters);
- Backfill on land-side (north) of the new bulkhead with recycled on-site or imported granular fill to restore site grade; and
- Install new off-shore concrete deck structure and on-shore slab on grade. During backfilling, a tieback, waler beam, and anchor would be installed to provide lateral support for the waterfront bulkhead.

The preliminary conclusions and recommendations contained in this report are based on our understanding of the currently proposed utilization of the project site, as derived from layout drawings, written information, and verbal information supplied to us. After specific pier configuration, building locations, roadway geometrics and structural details have been established, AMEC should be retained to review the proposed layout plans; perform additional geotechnical explorations, tests, and analyses, as needed; and subsequently prepare a design-phase geotechnical engineering report for the project.

3.0 EXPLORATORY METHODS

We explored surface and subsurface conditions at the project site during May 2007. Our exploration and testing program comprised the following elements:

- A visual surface reconnaissance of the site;
- Nineteen borings (designated AB-1 through AB-19) with Standard Penetration Tests, advanced at strategic locations across the site;
- A review of 10 existing geotechnical reports and 5 addendum reports provided to us, which included descriptive logs of 91 explorations advanced across the subject site;
- Nine groundwater observation wells (designated AW-1 through AW-7, AW-9 and AW-10), installed in strategically located boreholes (see Table 5);
- Eighteen grain size analyses, performed on selected soil samples obtained from strategic locations beneath the site;
- Eleven Atterberg limit determinations, performed on selected samples of cohesive soil obtained from beneath the site, and;
- A review of published geologic and seismologic maps and literature.

Table 1 summarizes the approximate functional locations, surface elevations, and termination depths of all pertinent subsurface explorations, and Figures 2a through 2c depict their approximate relative locations. Appendix A of this report describes our field exploration procedures, and Appendix B describes our laboratory testing procedures.

Table 1 Approximate Locations, Elevations, and Depths of Explorations

Exploration	Functional Location	Surface Elevation feet (meters)	Termination Depth feet (meters)
AB-1	North end Pier 8	5.8 (1.76)	35.5 (10.82)
AB-2	South end Pier 8	5.7 (1.73)	35.5 (10.82)
AB-3	North end Pier 9	5.0 (1.51)	35.5 (10.82)
AB-4	South end Pier 9	4.8 (1.48)	35.5 (10.82)
AB-5	Northwest corner Lebron property	6 (1.8)**	45.5 (13.87)
AB-6	North end Pier 10	5.3 (1.63)	60.5 (18.44)
AB-7	South end Pier 10	5.1 (1.57)	76.5 (23.31)
AB-8	SW corner of Ave. Fernandez Juncos & Calle San Andres	6.1 (1.87)	50.5 (15.39)
AB-9	West end Pier 11	3.2 (0.97)	30.5 (9.30)
AB-10	Northeast corner Pier 11/12 open lot	5.2 (1.59)	29.7 (9.05)
AB-11	Southwest portion of Pier 12	4.7 (1.43)	25.5 (7.77)
AB-12	Northwest portion of Pier 13	4.7 (1.43)	30.5 (9.30)
AB-13*	South-central portion of Pier 13, adjacent bulkhead	5.6 (1.72)	50.5 (15.39)
AB-14	Northeast corner Pier 14	6.4 (1.95)	30.5 (9.30)
AB-15	Southeast corner Pier 14	5.2 (1.57)	40.5 (12.34)
AB-16*	Northwest corner Navy/Frontier Pier	8.1 (2.46)	25.5 (7.77)
AB-17	Southwest corner Navy/Frontier Pier	5.7 (1.75)	65.5 (19.96)
AB-18	Northeast corner Navy/Frontier Pier	7.7 (2.34)	30.5 (9.30)
AB-19*	Southeast corner Navy/Frontier Pier	3.7 (1.14)	60.5 (18.44)

Elevation datum: Mean Sea Level PRVD 02 by CSA Group

* Includes observation well

** No survey data available, estimated ground surface elevation

The specific number, locations, and depths of the explorations were selected and field-adjusted by AMEC in relation to the existing and proposed site features, under the constraints of surface access, underground utility conflicts, and budget considerations. We estimated the relative location of each exploration by measuring from existing features and scaling these measurements onto a layout plan supplied to us. Subsequent to our field work, a survey of the boring locations (by others) was completed, although two of the borings were not located. Consequently, the data listed in Table 1 and the locations depicted on Figures 2a through 2c should be considered accurate only to the degree permitted by our data sources and implied by our measuring methods.

It should be realized that the explorations performed and utilized for this evaluation reveal subsurface conditions only at discrete locations across the project site and that actual conditions in other locations could vary. Furthermore, the nature and extent of any such

variations would not become evident until additional explorations are performed or until construction activities have begun. If significant variations are observed at that time, we may need to modify our conclusions and recommendations contained in this report to reflect the actual site conditions.

3.1 Geotechnical Reports by Others

Several geotechnical studies have been performed across the project site for previously proposed site improvements. Copies of these studies were provided to us after initiation of our field work. In Appendix C, we have presented selected subsurface information from past reports pertinent to the subject site.

The currently available studies are summarized below, categorized by the areas in which the work was performed:

Geotechnical Reports for Piers 6-10:

- Geoconsult, *Informe De Geotecnic Trabajos de Reparacion del Muella 6*, dated March 2004, which included descriptive logs of four explorations (designated TEM6-1 through TEM6-4);
- Jaca & Sierra, Report on the Subsoil Investigation Performed for the Puerto Rico Ports Authority at Pier No. 6 and Pier No. 8 of the San Juan Harbor, dated November 10, 1964, which included descriptive logs of four borings (herein designated VJS-3 [B-3] through VJS-6 [B-6]);
- Ebrahim Murati and Associate, *Report on Foundation Recommendations Related to Subsoil Exploration Made for Modifications for Pier #7 and #8*, dated February 28, 1970, which included descriptive logs of twenty-one explorations (designated A-1 through A-7, B-1 through B-7 and C-1 through C-7);
- Soil Tech, *Geotechnical Report, Job No. 87130, Proposed Plaza del Obrero Portuario, Pier 7*, dated June 26, 1987, which included descriptive logs of three explorations (herein designated ST-1 [B-1] through ST-3 [B-3]);
- Jaca & Sierra, *Geotechnical Exploration Proposed Reconstruction and Improvements to P.R. Ports Authority Pier No. 9*, dated March 14, 1988, which included descriptive logs of six borings (designated B-1 through B-5, and B-16). However, no map showing the locations of these boring was found within our copy of the report.

Geotechnical Reports for Piers 11-14:

- Geoconsult, *Geotechnical Report; Reconstruction of Wharves Along Piers 11- 14*, dated December 10, 2003 and subsequent *Addendum No. 1*, dated January 30, 2004, *Addendum No. 2*, dated June 24, 2004, and *Addendum No. 3*, dated April 29, 2005, which included descriptive logs of the following explorations:
 - Ten borings performed during October and November, 2003 (designated RW-1 through RW-10);
 - Six borings performed during April and May, 2004 (designated RW-11 through RW-16);

- Carlos A. Ortiz Suarez, *Subsoil Exploration Report; Extension of P.R 14*, dated June 23, 1987, and subsequent *Addendum No. 1*, dated August 31, 1987, which included descriptive logs of the following explorations:
 - Five borings performed in June 1987 (herein designated GEOTEC 1 [B-1] through GEOTEC 5 [B-5]);
 - Three borings performed in July 1987 (herein designated GEOTEC 6 [B-6] through GEOTEC 8 [B-8]);
- Jaca & Sierra, *Report on the Geotechnical Exploration Proposed Reconstruction and Improvements to P.R. Port Authority - Pier No. 11*, dated January 4, 1989, which included descriptive logs of twenty-six borings (herein designated JACA-1 [B-1] through JACA-26 [B-26]);
- Geoconsult, *Recomendaciones De Cimentacion Para La Reconstruccion De Los Muelles 12, 13 Y 14*, dated November 28, 1992, which included descriptive logs of twenty-one explorations (designated MM-1 through MM-21);
- Geo Engineering, *Geotechnical Evaluation for Warehouse Building at Pier 13*, dated May 3, 2002, which included descriptive logs of five explorations (designated BOR-1 through BOR-5);

4.0 SITE CONDITIONS

The following sections of text present our observations, measurements, findings, and interpretations regarding development, utility, surface, pavement, soil, groundwater, and seismic conditions at the project site.

4.1 Development Conditions

The subject site is currently developed as an industrial waterfront facility, comprised of several piers, concrete paved storage/parking areas, several buildings, and associated improvements discussed in further detail below.

The majority of the southern edge of the project site, along San Antonio Channel, is developed with pile supported concrete piers and associated sheet pile bulkheads. The concrete piles and sheet piles along Piers 6, 7, 8, and 11 to 14 have been identified as being in poor condition, and in need of repair or replacement. In an extreme case, at the northeast and northwest corner of Pier 8, the bulkhead and pier have collapsed, exposing the retained soils that have subsequently been eroded by wave action. The concrete slab for the aforementioned piers is also in generally poor condition, with cracking and in some cases failure, resulting in holes within the deck structure. At Pier 6, a very large void behind the eastern end of the bulkhead was disclosed during previous studies, on the order of 60 feet long by 30 feet wide by an average of 15 feet deep (18.3 meters long 9.1 meters wide by 4.6 meters deep). The "La Coal" Fishing Facility, located immediately east of the Pier 10 (south) area, is comprised of a pile-supported catwalk and boat dock. Portions of the "La Coal" area do not appear to have bulkhead protection, instead relying upon rock armoring for bank protection. At the Corps of Engineers property the existing pier structure, planned to be replaced, is in adequate condition,

however, plans call for its removal and replacement to provide a uniform outside edge, in line with the piers to the east and west. Similarly, the Harbor Pilots dock is also in adequate condition, but will be removed and replaced to match the existing pier to the west.

Small out-buildings, both fixed and portable, are present across the active portions of the site (adjacent to Pier 9 and Pier 10, the "La Coal" Fishing Facility, Pier 13, and at the Corps of Engineers and Harbor Pilots Dock area). The permanent structures are typically small, concrete or wood-frame, one-story structures, appearing to be supported by shallow, spread footings. A large, abandoned warehouse structure, which is deteriorating and in poor condition, is present immediately adjacent to Pier 11/12. Immediately northeast of this structure is a large metal-framed warehouse structure, which is in current use and appears to be less than 10 years old. A tall chain link fence separates the majority of the site from the surrounding properties, with access controlled through designated gates staffed by security guards. The guard shacks are typically small wooden structures.

Evidence of the presence of previous structures was noted at several locations across the site. Old floor slabs, columns, and stem walls were noted during our field reconnaissance.

The LeBron property, located north of Pier 10, is approximately 200 feet by 400 feet in dimension. The site is fairly flat-lying, occupied by one building and a large asphalt-paved parking lot.

4.2 Utility Conditions

Existing underground utility lines near our proposed exploration locations were identified and marked in the field by the utility locating specialist sub-contracted to AMEC. These lines were located by review of the available site plans supplied to us, by ground penetrating radar (GPR) equipment, and by magnetic surveys to aid in identification of unknown subsurface utilities. Based on the results of this work, the subject site area appears to be traversed by numerous underground utility lines, consisting primarily of storm sewer lines, electrical lines for site lighting and security cameras, and several unidentified lines. Due to the level of development (both past and existing), it is anticipated that underground power, storm and sanitary sewer lines are likely to be found across the site. As such, it should be anticipated that during construction activities, it will be commonplace to encounter these unmarked utilities.

4.3 Surface Conditions

Surface grades across the site are essentially flat, with minor variations. Overall relief is generally less than 2 to 3 feet, with the exception of where no structures are present adjacent the shoreline. In these areas, relief on the order of 3 to 6 feet was observed. Immediately north of the abandoned warehouse at Pier 11, exists a topographic low area, measuring roughly 300 feet long by 75-feet wide, which was observed to collect approximately 6 to 12 inches of water during a heavy rainfall event. The surface of the subject site is completely paved with the exception of portions of the area around the "La Coal" Fishing Facility and an area immediately to the east of the "La Coal" Pier. Site vegetation is limited to primarily the perimeter of the property, consisting of scattered coconut trees, and occasional bushes and weeds.

4.4 Pavement Conditions

Both concrete and asphaltic concrete pavements are present on site. Based on the coring performed at the exploration locations, the pavement is highly variable in thickness, often consisting of a concrete layer mantled by asphaltic concrete. Overall pavement thicknesses varied from 3 to 18 inches. Pavement conditions were observed to be variable, with numerous areas of pavement failure, as exhibited by cracking, potholes, and settlement features.

Table 2 summarizes our approximate pavement thickness measurements and soil observations recorded at each exploration location.

Table 2 Approximate Pavement Thicknesses and Underlying Soils

Exploration	Thickness (inches)		Subbase or Subgrade Soil Type
	ACP	CCP	
AB-1	10	NP	Fine to medium SAND
AB-2	3	12	Silty, fine to medium SAND
AB-3	NP	13.5	Sandy SILT
AB-4	1	16	Silty SAND
AB-5	3	NP	Fine SAND some silt
AB-6	4.5	5.5	Fine to medium SAND
AB-7	2.5	NP	Base course (GRAVEL)
AB-8	2.5	6	Sandy SILT
AB-9	2.5	5	Silty CLAY
AB-10	6	6	Gravelly SILT
AB-11	NP	5	Fine to medium SAND
AB-12	NP	4.5	Gravelly SAND
AB-13	NP	14.4	Sandy CLAY
AB-14	NP	9.5	Sandy SILT
AB-15	NP	8	Gravelly SAND
AB-16	8.5	NP	Sandy GRAVEL
AB-17	7	NP	Sandy, silty GRAVEL
AB-18	2	NP	Gravelly sand
AB-19	NP	NP	Gravelly sand

ACP = asphalt concrete pavement

CCP = cement concrete pavement

NP = not present

4.5 Soil Conditions

According to published geologic maps, soil conditions in the site vicinity are characterized by man-placed fill (map unit: af – artificial fill) mantling Holocene deposits consisting of swamp

deposits (map unit: Qs), beach deposits (map unit: Qb), silica sand (map unit: Qss), alluvial deposits (map unit: Qa) and an older unit described as eolianite – a calcareous, cemented sandstone (map unit: Qe). Bedrock underlying these deposits is believed to be comprised of limestone (map unit: Tay) of Tertiary age.

Our on-site explorations revealed somewhat variable near-surface soil conditions but confirmed the mapped stratigraphy. In general, our explorations encountered variable thicknesses of fill soils mantling native deposits varying from swamp deposits to beach deposits. The fill generally thickened from north to south, mantling either peat or silty sand varying to clayey sand. Weathered bedrock was encountered at depth in a few borings. A description of the interpreted layers is presented below.

Af - Artificial Fill: Mapping indicates fill encompasses the entire southern waterfront of the Old San Juan, fronting the San Antonio Channel. The fill was placed over pre-existing mangrove swamps, tidelands, and alluvial fan deposits. The fill consisted of sand with varying amounts of silt and clay. Also noted within the fill soils were scattered coral fragments. Based upon anecdotal information and our observations of these fill soils, it appears the deeper fill was derived from dredging.

Qs - Swamp Deposits: Most borings encountered a soft fibrous peat layer below the fill soils (interpreted to represent the mangrove swamp deposits). In some areas the peat soils were interbedded with organic clay.

Qb – Beach Deposits: Beach deposits were interlayered with the swamp deposits in many borings. Beach deposits were found to consist of loose to medium dense sands, and medium stiff to stiff clays.

Qss – Silica Sand: Medium dense to very dense sands were encountered beneath the swamp deposits in several borings. These sands exhibited a strong odor of organic decay. In some portions of the site, these continuous sand deposits were interlayered with the alluvial deposits (Qa).

Qa - Alluvial Deposits: The alluvial deposits were most typically encountered below the swamp, beach and sand deposits, consisting of silty sand, clayey sand and sandy clay. In several borings this was the deepest layer encountered.

Qe – Eolian Deposits: This layer was not encountered in our borings.

Tay – Tertiary Limestone: The sand deposits were found to extend the full depths explored in the majority of the borings, however our deeper explorations (AB-6, AB-7, AB-17 and AB-19) encountered bedrock at depths varying from 55 to approximately 65 feet, appearing to be dipping to the west, based upon the depth at which the bedrock was first encountered. The bedrock was comprised of completely weathered bedrock, composed of sandy gravel varying to sand.

The enclosed exploration logs provide a detailed description of the soil strata encountered in our subsurface explorations. Table 3 summarizes the approximate thicknesses and depths and elevations of selected soil layers. Figures 2a through 2c show the interpreted elevation of top of bearing for deep foundations.

Table 3 Approximate Thicknesses, Depths, and Elevations of Soil Layers

Exploration	Thickness of fill soils in feet (meters)	Thickness of soft, compressible soils in feet (meters)	Depth of Bearing Soil in feet (meters)	Elevation of Bearing Soil in feet (meters)
AB-1	14 (4.3)	1 (0.3)	14 (4.3)	-8.2 (-2.50)
AB-2	16 (4.9)	10 (3.1)	27 (8.2)	-21.3 (-6.49)
AB-3	N/E	15 (4.6)	20 (6.1)	-15 (-4.6)
AB-4	18 (5.5)	8.5 (2.59)	27 (8.2)	-22.2 (-6.77)
AB-5	5.5 (1.68)	6 (1.8)	12 (3.7)*	-6 (-1.8)*
AB-6	16 (4.9)	6 (1.8)	23 (7.0)	-17.7 (-5.39)
AB-7	11.5 (3.51)	13 (4.0)	25 (7.6)	-19.9 (-6.07)
AB-8	3 (0.9)	9 (2.7)	13 (4.0)	-6.9 (-2.10)
AB-9	N/E	23 (7.0)	24 (7.3)	-20.8 (-6.34)
AB-10	6 (1.8)	6 (1.8)	13 (4.0)	-7.8 (-2.38)
AB-11	9.5 (2.90)	3 (0.9)	13 (4.0)	-8.3 (-2.53)
AB-12	14.5 (4.42)	7 (2.1)	22 (6.7)	-17.3 (-5.27)
AB-13	16 (4.3)	11 (3.4)	28 (8.5)	-22.4 (-6.83)
AB-14	5.5 (1.68)	11 (3.4)	17 (5.2)	-10.6 (-3.23)
AB-15	20.5 (6.25)	17 (5.2)	37 (11.3)	-31.8 (-9.69)
AB-16	6.5 (1.98)	11 (3.4)	18 (5.5)	-9.9 (-3.02)
AB-17	20.5 (6.25)	7 (2.1)	28 (8.5)	-22.3 (-6.80)
AB-18	7.5 (2.29)	6 (1.8)	25 (7.6)	-17.3 (-5.27)
AB-19	11 (3.4)	22 (6.7)	33 (10.1)	-29.3 (-8.93)

Elevation datum: Mean Sea Level PRVD 02 by CSA Group

N/E = not encountered within depth of exploration

* = No survey data available, estimated ground surface elevation

Our geotechnical laboratory tests revealed that the fill soils have a fines (silt and clay) content on the order of 16 to 50 percent, and a moisture content on the order of 3 to 91 percent. We interpret these soils to be currently above their optimum moisture contents, and to be highly sensitive to moisture content variations. The enclosed laboratory testing sheets graphically present our test results, and Table 4 summarizes these results.

Table 5 Approximate Depths and Elevations of Groundwater

Exploration	Observation Well	Depth of Groundwater feet (meters)	Elevation of Groundwater feet (meters)	Date of Measurement
AB-1	N/W	6 (1.8)	-0.2 (-0.06)	5/8/2007 ATD
B-2	N/W	6 (1.8)	-0.3 (-0.09)	5/8/2007 ATD
AB-3	N/W	5 (1.5)	0.0 (0.00)	5/9/2007 ATD
AB-4	N/W	3 (0.9)	1.8 (0.55)	5/9/2007 ATD
AB-5*	N/W	4 (1.2)	2 (0.6)	5/17/2007 ATD
AB-6	N/W	6 (1.8)	-0.7 (-0.21)	5/15/2007 ATD
AB-7	N/W	6 (1.8)	-0.9 (-0.27)	5/14/2007 ATD
AB-8	N/W	6 (1.8)	0.1 (0.03)	5/7/2007 ATD
AB-9	AW-3	2.5 (0.76)	0.7 (0.21)	5/23/2007
AB-10	N/W	7 (2.1)	-1.8 (-0.55)	5/7/2007 ATD
AB-11	N/W	3 (0.9)	1.7 (0.52)	5/10/2007 ATD
AB-12	N/W	5 (1.5)	-0.3 (-0.09)	5/10/2007 ATD
AB-13	AW-6	5 (1.5)	0.2 (0.06)	5/23/2007
AB-14	N/W	7.5 (2.29)	-1.1 (-0.34)	5/11/2007 ATD
AB-15	N/W	6 (1.8)	-0.8 (-0.24)	5/11/2007 ATD
AB-16	AW-9	5 (1.5)	3.1 (0.94)	5/23/2007
AB-17	N/W	6 (1.8)	-0.3 (-0.09)	5/15/2007 ATD
AB-18	N/W	6 (1.8)	1.7 (0.52)	5/16/2007 ATD
AB-19	AW-10	3 (0.9)	0.7 (0.21)	5/24/2007
	AW-1	4.5 (1.37)	-0.1 (-0.03)	5/23/2007
	AW-2*	3.5 (1.07)	2.5 (0.76)	5/23/2007
	AW-4	3 (0.9)	-0.2 (-0.06)	5/24/2007
	AW-5	4.5 (1.37)	0.9 (0.27)	5/24/2007
	AW-7*	4 (1.2)	2 (0.6)	5/23/2007

N/W = no well installed

N/E = not encountered within depth of exploration

ATD = at time of drilling

* = No survey data available, estimated ground surface elevation

4.7 Seismic Conditions

Based on our subsurface explorations and our review of published geologic maps, we interpret the native on-site soil conditions in the upper soil profile to correspond to Seismic Site Class D, as defined by the 2003 International Building Code (IBC). Based on review of IBC maps and more detailed USGS hazard mapping, we recommend using the following parameters:

Use IBC Soil Class D with:

- $S_s = 0.891$
- $S_1 = 0.308$
- $F_a = 1.144$
- $F_v = 1.784$
- $SDS = 0.679$
- $SD_1 = 0.366$
- Peak Ground Acceleration = $0.4(SDS) = 0.27g$

5.0 LIQUEFACTION ANALYSIS

Liquefaction is a sudden increase in porewater pressure and a sudden loss of soil shear strength caused by shear strains, as could result from an earthquake. Research has shown that saturated, loose sands with a fines (silt or clay) content less than about 25 percent are most susceptible to liquefaction. Although other soil types are generally considered to have a low susceptibility, liquefaction may still occur during a strong earthquake. Typically, due to confinement, liquefaction does not extend deeper than about 50 feet below ground surface. Our on-site subsurface explorations revealed saturated (or potentially saturated), loose, clean to silty sand layers or lenses within the upper 50 feet. To evaluate the possibility that the on-site native sands could liquefy during a seismic event, we performed a liquefaction analysis based on these site conditions.

Liquefaction Potential: For purposes of evaluating liquefaction potential, we used the computer program SHAKE2000 to evaluate liquefaction based on the equation for factor of safety against liquefaction. This program evaluates the cyclic resistance ratio (CRR) required to initiate liquefaction based on Standard Penetration Test (SPT) results, as recently reviewed in the Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils (Youd, et al., 2001). We evaluated the potential for liquefaction assuming a magnitude 7.5 earthquake with a peak ground acceleration of 0.27 g. We used this method to determine the relative factor of safety against liquefaction for the loose, silty sand layers underlying the site vicinity. Our analyses revealed that the upper loose layers of sands have a high potential for liquefaction. We find these conditions to be most severe from depths of 5 feet (the water table) to 20 feet (the base of the sandy fill). Loose to medium dense sand layers were encountered within the alluvium to a depth of 50 feet, which we found to have a moderate risk of liquefaction.

Liquefaction Settlements: The combined average thickness of potentially liquefiable loose to medium dense sands is on the order of 15 to 20 feet. We analyzed the liquefaction-induced settlement potential using the method developed by Tokimatsu and Seed (1987). Based on our analysis, we estimate that liquefaction-induced settlements to be on the order of 4 to 8 inches.

In addition to this liquefaction-induced settlement, there are appreciable thicknesses of soft compressible organic soils across the site (soft peat layers) ranging from about 5 to 15 feet in thickness. In our experience, these compressible organic layers also undergo abrupt volume

change (settlement) during earthquake shaking. As a result we estimate that an additional 2 to 6 inches of settlement could occur across the site during earthquake shaking.

Lateral Spreading: Lateral spreading can occur due to earthquake shaking and soil liquefaction. This hazard is greatest for sloping ground or bulkhead retaining walls along the waterfront. At this site, significant lateral spreading is predicted under moderate to strong shaking for untreated waterfront areas, with lateral movement of several feet for the highest bulkheads. Based on the method of Bartlett and Youd (1995), lateral spreading of ground at the top of the waterfront bulkhead wall would be in the range of 1 to 5 feet. At a distance of 50 feet landward, the predicted lateral spreading is in the range of 0 to 1 foot.

Mitigation Methods: Methods for mitigation of liquefaction-induced settlement and lateral spreading typically involve either the use of a deep foundation system that transfers structural loads to non-liquefiable soils at depth, or the densification of the liquefiable soils. We recommend the following mitigation methods be considered at this site:

- **Deep Foundations for Waterfront Bulkheads and Multi-Story Buildings:** Pre-cast concrete piles appear appropriate for structure support. Transferring the load to the medium dense to dense sand and very stiff to hard silt/clay layers at approximately elevation -60 feet to -80 feet would mitigate the risk of liquefaction-induced settlements. We recommend deep foundation support for the waterfront deck and bulkhead structures, and for any multi-story buildings to be located on the property. However, in planning, it should be recognized that in the event of an earthquake, differential settlement between the pile-supported structure and surrounding areas would be expected.
- **Soil Densification- Waterfront Area:** Ground improvement can be accomplished by a variety of methods, including vibroflotation, compaction grouting, and aggregate piers. For this site, we recommend planning on treatment of a zone of soil on the land-side of the waterfront bulkhead, to reduce the risk of liquefaction leading to lateral spreading. For this waterfront area, we recommend planning for treatment of a zone 50 feet wide to a depth of 50 feet, using vibro-replacement stone columns. As an alternative, where space is limited in the vicinity of Pier 9 West, compaction grouting may be considered for ground improvement.
- **Soil Densification- Upland Area:** For the upland portion of the site, the depth of soils most susceptible to liquefaction is on the order of 20 to 25 feet deep. For this application, rammed aggregate piers (impact piers) treatment could be used to improve areas surrounding pile supported structures, and reduce differential settlement. This method could also be considered for densification below concrete slabs on grade, or single story buildings.
- **Partial Overexcavation – At-Grade Facilities:** Treatment of the entire upland area to be developed including plazas, roadways and parking areas would be cost-prohibitive for the purpose of preventing liquefaction-induced settlement. The cost of treatment of all upland areas needs to be balanced against the risk of settlement. Therefore, for these other on-grade facilities, subgrade preparation may be limited to a partial overexcavation and recompaction of the upper soils. We would suggest overexcavation to 2 feet below planned final grade, and construction of a 2-foot thick compacted structural fill. While this is not an equivalent form of mitigation for the risk of settlement, it would stiffen the upper

site soils and reduce differential settlements. With this approach, flexible connections for utilities in and out of buildings would still be needed.

- **Mitigation for Utilities:** Underground utilities will be susceptible to differential settlement as a result of earthquake-induced liquefaction. To mitigate this risk, we recommend: installation of gravity lines on as steep a grade as possible to allow for future differential settlement; plan a minimum 1-foot overexcavation and replacement with bedding beneath all utility lines; avoid sharp bends in major pipe routes; use flexible and/or restrained joints on piping to allow for differential movement; and plan for flexible connections where utilities will enter pile-supported structures. If these mitigation measures are not feasible, pile support of major settlement-sensitive utilities would be required.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Development plans call for waterfront pier repair or replacement along 1.2 miles of San Antonio Channel, from Pier 6 to Navy/Frontier Pier. This involves approximately 80,000 cubic yards of upland excavation, 226,000 cubic yards of offshore dredging, and 130,000 cubic yards of filling. The upland site will be redeveloped with installation of new utilities and roadways, public parks and walkways, and building pads prepared for future development. We offer the following preliminary geotechnical conclusions and recommendations concerning this project.

Feasibility: Based on our field explorations, research, and analyses, the proposed development appears feasible from a geotechnical standpoint, contingent on the recommendations presented herein.

Waterfront Bulkheads: Sheet pile bulkheads appear feasible, using either interlocking steel sheet piles or pre-cast square concrete piles installed as tangent piles. Additional bulkhead lateral support could be provided by a combination of tieback anchors, batter piles, and rock revetments. We have provided lateral earth pressures for design (see Figures 3A through 3G). Seismic surcharge lateral earth pressures are presented for cases of ground improvement and no ground improvement. In areas of low bulkheads, the marginal wharf structure may be sufficiently stable without the need for ground improvement. Depending on the final design criteria and the expected post-earthquake performance, ground improvement may also be deleted for other portions of the bulkhead.

Waterfront Deck Structures: We recommend support of waterfront decks, relieving platforms, and walkways on driven piles. We have provided axial (tension/compression) and lateral capacities for design assuming pre-cast concrete piles (see Tables 6 and 7 below). For Pier 6, the structural engineer has requested that we evaluate the use of larger diameter piles for added lateral resistance. Table 7 also provides lateral capacities for 16-inch by 16-inch square concrete piles, and 24-inch by 24-inch square concrete piles, at Pier 6.

Alternative Pile Types: The project structural engineer has also requested consideration be given to the use of steel pipe piles for deck support. Steel pipe piles would be a suitable alternative from a geotechnical perspective. One advantage to steel pipe piles is that they can be readily spliced. During pile driving, measurements with a pile driving analyzer (PDA) then

analyzed by the proprietary CAPWAP program can be used to field-adjust lengths based on actual driving resistance (once minimum embedment for lateral resistance has been achieved).

Since steel piles would be susceptible to corrosion, especially in this marine environment, we recommend driving closed-end steel pipe piles, backfilling with concrete, and installing steel reinforcement inside. The steel pipe pile then becomes a sacrificial casing. For planning, we would recommend a minimum steel pile wall thickness of 0.375 inches, as thinner steel casing tends to buckle during driving. Thicker steel may be required for structural capacity.

If the steel piles are to be relied on for long-term structural capacity, they would need to be protected from corrosion with epoxy coating, or provided with a cathodic protection system.

Tieback and Deadman anchors: Anchors for tiebacks need to be separated from the back of the wall a sufficient horizontal distance to allow for development of active and passive wedges in the backfill zone. We recommend separation distance include an active wedge rising from the back of the wall at dredge line at 60 degrees horizontal, and a passive wedge rising from the base of the deadman anchor block at 30 degrees from horizontal. We recommend using the pile capacities of Tables 6 and 7 for design of pile-supported deadman anchorage. For shallower anchor blocks, we recommend an allowable passive pressure of 300 pcf. For granular backfill above the water table, an active pressure acting on the anchor block of 30 pcf may be assumed. An allowable base friction coefficient of sliding of 0.35 may be assumed to act along the base of the deadman anchor block. Because many of the upland areas are underlain by variable fill and peat deposits, some long term settlement could occur. For this reason, we recommend installing PVC or corrugated metal sleeves around the tieback tendons to allow for differential settlement without imparting additional shear forces on the tendons. The tieback tendons will also need to be protected against corrosion.

Optional Waterfront Treatments: In some areas, more economical slope treatments may be considered, including sloping rock revetments, narrower walkways, and lower upland elevations.

Seismic Considerations: Design of site facilities will need to consider the potential for liquefaction-induced settlement under moderate to strong earthquake shaking. It is assumed that all multi-story buildings and waterfront structures will be pile-supported to transfer loads beneath the potentially liquefiable soils. However, earthquake-induced lateral spreading along the waterfront areas could also impact the stability of upland development. For mitigation, we recommend planning vibro-replacement stone column densification of an approximately 50-foot wide zone of soils along the landward side of the bulkheads. For areas with limited room or existing structures/piles that need to be protected, such as the existing deck and bulkhead at Pier 9, compaction grouting may be an appropriate alternative. Differential settlement due to liquefaction can be mitigated by treating areas around pile-supported buildings with rammed aggregate piers. Differential settlements can be partially mitigated with flexible and/or restrained joint piping.

At this time, it is not known to what extent ground improvement will be required. The project structural engineer and the owner will need to review the need for ground improvement for protection of waterfront facilities. If the wall and deck structure as designed can withstand the "no ground improvement" lateral earth pressures of Figures 3A to 3G, then no additional ground

improvement would be required in those areas. However, in other areas, there may be additional costs to upgrade the structural design of the wall and deck structure to resist these seismic surcharge pressures. In this case, the upgrade costs will need to be compared to the cost to provide upland ground improvement treatment. As a third option, a lower cost design could be implemented that would tolerate slope movement and structural damage (no collapse), and the need to replace the waterfront bulkhead in the event of earthquake-induced lateral liquefaction and lateral spreading.

Construction Considerations: A construction sequence will need to be developed to manage site development costs. Mobilization of offshore equipment will be a major cost item. Upland demolition and excavation should occur in advance of offshore work involving pier demolition, pile removal, and dredging, followed by pile driving for new bulkhead and pier construction, in turn followed by backfilling. To improve site performance, mechanical compaction of dredge fill should start as soon as filling has progressed above the groundwater table.

Re-use of Materials: To the extent possible, concrete and upland soil should be recycled to reduce transport and disposal costs. Portions of materials to be dredged may be re-used if sufficient lay-down and surface water control can be provided.

Subgrade Protection: Due to the moisture-sensitive nature of the on-site soils, the contractor should install appropriate temporary drainage systems to keep water out of construction areas, and should minimize traffic over any subgrades prepared within these soils.

The preliminary conclusions and recommendations presented in this report are based, in part, on the explorations that we performed for this study. As the specific locations, layouts, and primary structural details of the waterfront bulkheads, roadway alignment, utilities, and associated structure locations have been established, we can provide specific design recommendations.

Table 6 Allowable Axial Load Capacities for Pile Design

12" x 12" Precast Concrete Piles				
Pile Location and Stickup (H) in feet*	Tip Elevation (Pile Embedment) in feet	Compressive Capacity (kips)	Estimated Settlement (in)	Uplift Capacity (kips)
Pier 6				
Top, H=0	-60 (60)	74	0.4	36
Slope, H=30	-60 (30)	51	0.3	20
Toe, H=40	-80 (40)	83	0.3	30
Piers 9 and 10				
Top, H=0'	-60 (60)	35	0.4	50
Slope, H=20'	-60 (40)	50	0.4	36
Toe, H=40'	-80 (40)	79	0.3	34
Piers 11 – 14				
Top, H=0'	-60 (60)	90	0.5	45
Slope, H=20'	-60 (40)	80	0.4	37
Toe, H=40'	-80 (40)	114	0.5	52
Navy/Frontier Pier				
Top, H=0'	-60 (60)	75	0.3	85
Slope, H=10'	-60 (50)	64	0.4	48

*Note: Pile capacities vary depending on location relative to waterfront slope, due to variable subsurface conditions.

"Top" refers to piles installed in upland areas.

"Slope" refers to piles installed through the revetment slope in front of the new bulkhead.

"Toe" refers to piles installed waterward of the revetment slope.

Axial capacities for specific piles will be provided in final design.

Table 7 Lateral Load Capacity for Pile Design

12" x 12" Precast Concrete Piles FIXED-HEAD with 1 inch deflection at ground line			
Pile Stickup (H) in feet	Assumed Tip elevation in feet*	Lateral Capacity (kips)	Depth of Fixity (feet)
Pier 6			
H=0	-60	13	17
H=30	-100	3.5	39
H=40	-120	3.5	49
Piers 9 and 10			
H=0	-60	2.5	30
H=20	-60	6	29
H=40	-120	3	45
Pier 11 – 14			
H=0	-60	13	18
H=20	-60	6	29
H=40	-120	3	45
Navy/Frontier Pier			
H=0	-60	32	13
H=10	-60	12	21
Pier 6, 16" x 16" Precast Concrete Piles			
H=0	-60	25	35
H=30	-90	5.5	60
H=40	-120	4	70
Pier 6, 24" x 24" Precast Concrete Piles			
H=0	-60	65	45
H=30	-90	18	80
H=40	-120	15	85

Note: Software models minimum pile length of 3H. Final pile lengths should be determined based on depth to fixity (plus a safety factor) and required axial capacity.

REFERENCES AND DESIGN CRITERIA

Project Design Criteria: The design recommendations for this report have been developed in general accordance with the International Building Code (2006). Reference documents for design and materials specifications are listed below.

AASHTO, 2004 (with interims). LRFD Bridge Design Specifications, 3rd edition, (with 2005 and 2006 interims), American Association of State Highway and Transportation Officials, Washington, D.C.

American Society of Testing and Materials (ASTM), 2006. Annual Book of ASTM Standards: West Conshohocken, Penn.

Bartlett, S. and Youd, T.L., 1995. "Empirical prediction of liquefaction-induced lateral spread," *Journal of Geotechnical Engineering*, Vol. 121, No. 4, p. 316-329.

International Building Code (IBC), 2006. International Code Council, Falls Church, Virginia.

Tokimatsu, K. and Seed, H.B., 1987. "Evaluation of settlements in sand due to earthquake shaking," *Journal of Geotechnical Engineering*, Vol. 113, No. 8.

Youd, T.L. et al., 2001, "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils", *Journal of Geotechnical and Environmental Engineering*, ASCE, V. 127, No. 10, p. 817-833.

8.0 CLOSURE

The conclusions and recommendations presented in this preliminary report are based, in part, on the explorations that we performed and utilized for this study; therefore, if variations in the subgrade conditions are observed at a later time, we may need to modify this report to reflect those changes. Also, because the future performance and integrity of the project elements depend largely on proper initial site preparation, drainage, and construction procedures, monitoring and testing by experienced geotechnical personnel should be considered an integral part of the construction process. AMEC is available to provide geotechnical monitoring, soils and concrete testing, steel and masonry inspection, and other services throughout construction.

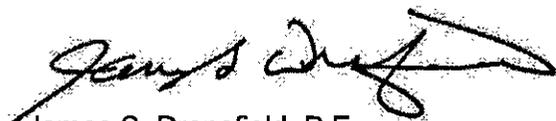
We appreciate the opportunity to be of service on this project. If you have any questions regarding this report or any aspects of the project, please feel free to contact our office.

Sincerely,

AMEC E & E Caribe, LLP

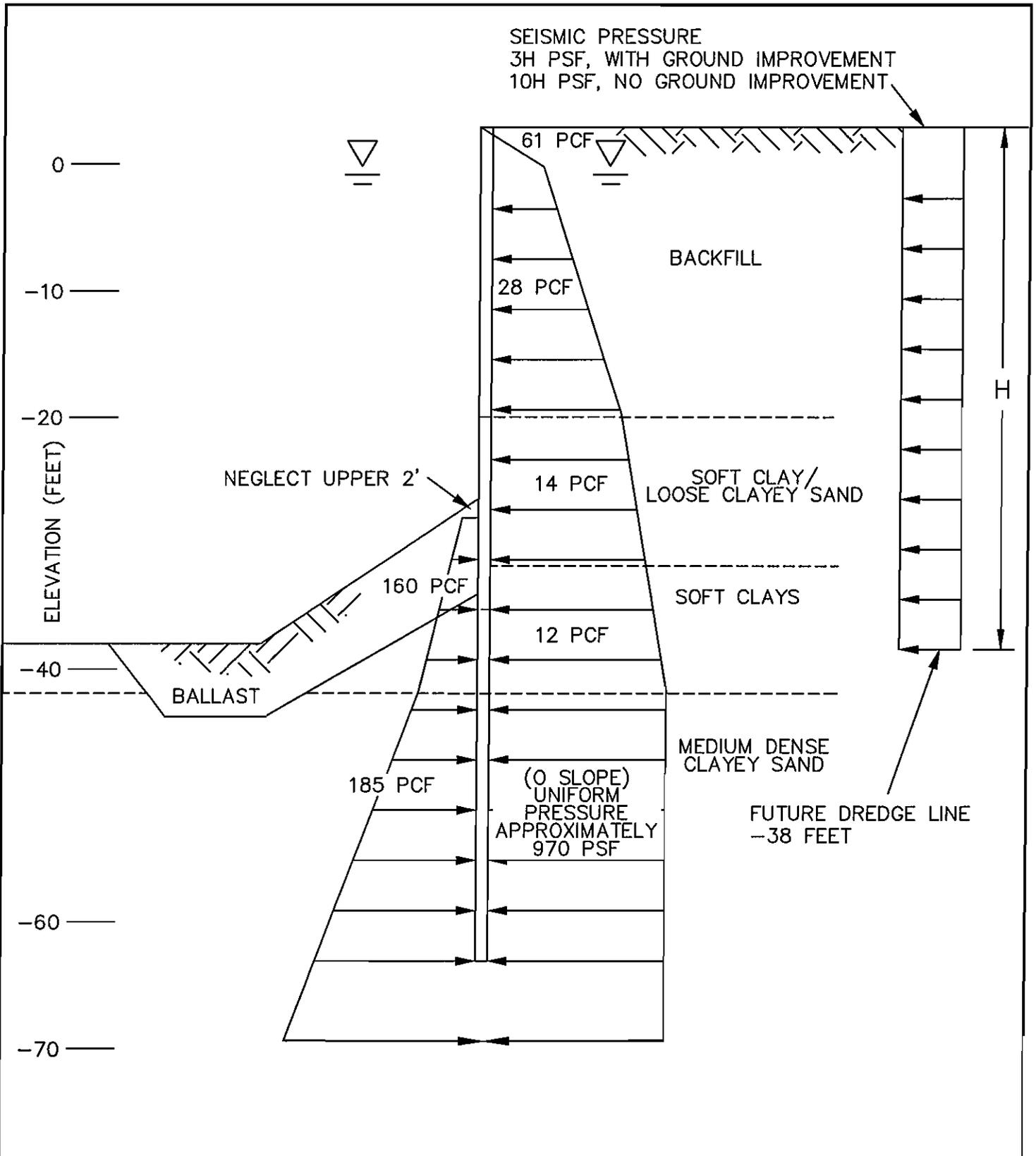


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FIGURES



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DWN BY:
 JRS

CHKD BY:
 JD

TITLE

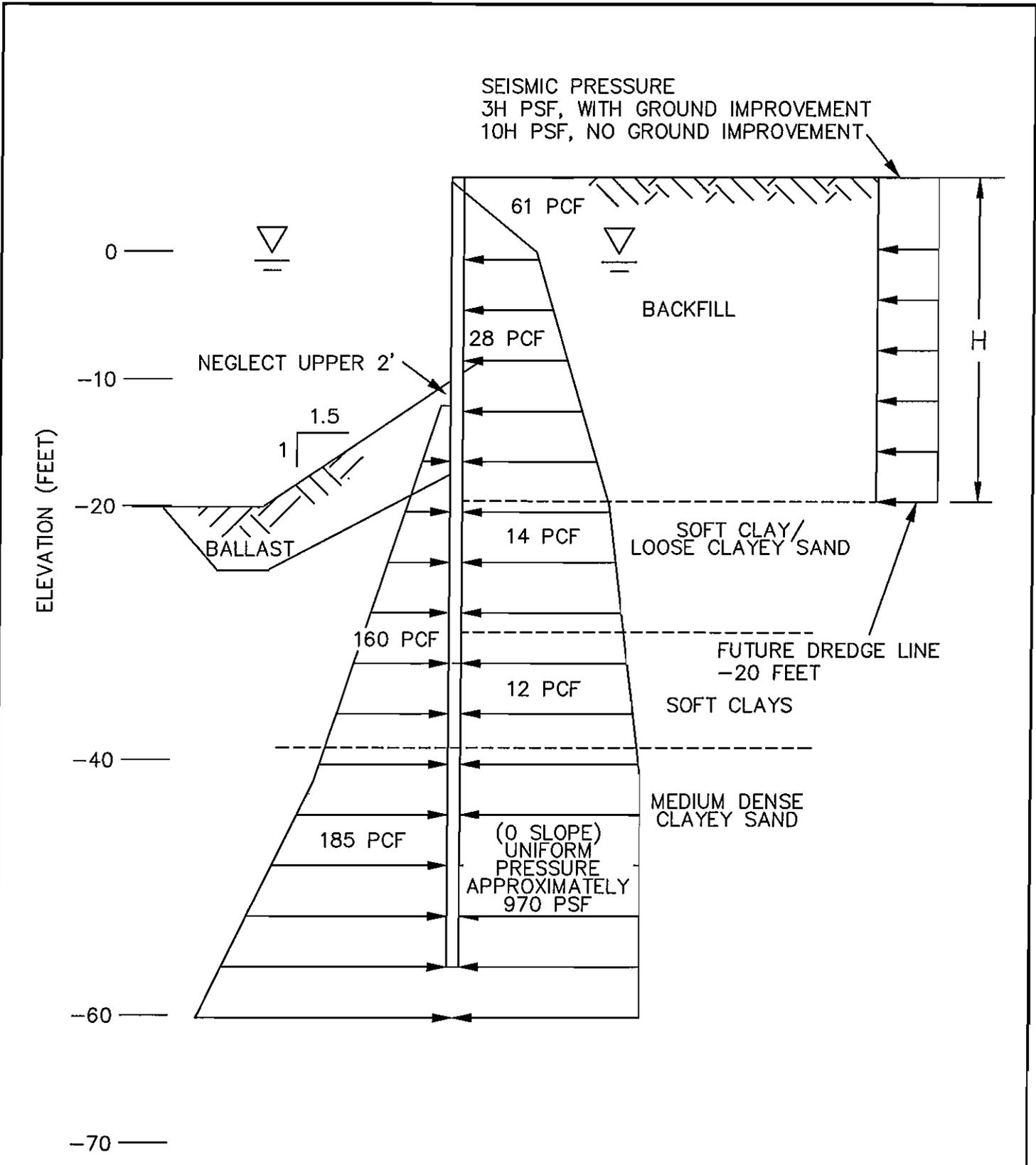
**PRELIMINARY LATERAL EARTH
 PRESSURE AT PIER 6
 SAN JUAN WATERFRONT PROJECT**

DATE:

SEPTEMBER 2007

FIGURE No.

FIGURE 3A



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PRELIMINARY LATERAL EARTH
PRESSURE AT PIER 7
SAN JUAN WATERFRONT PROJECT

DATE:

OCTOBER 2007

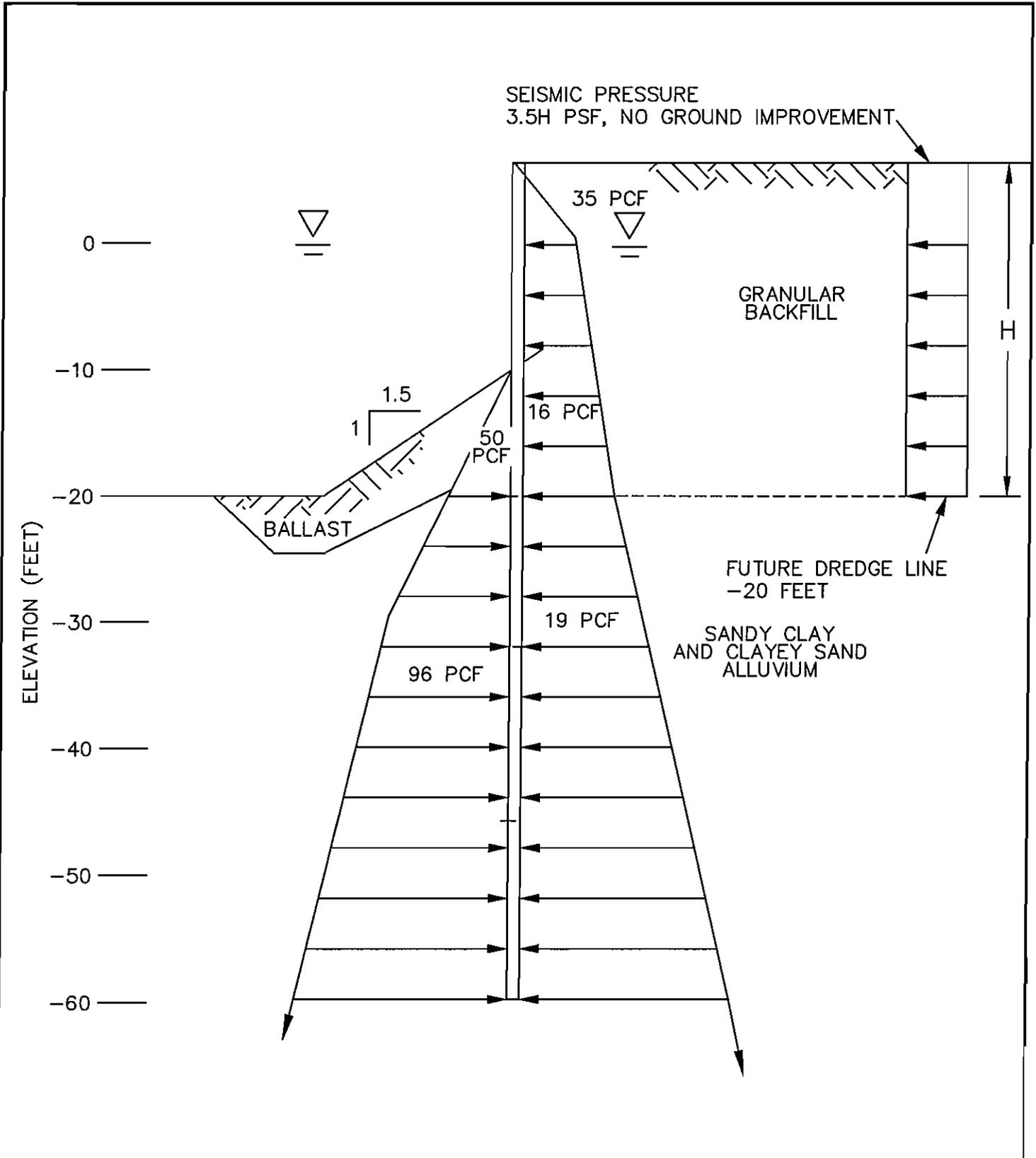
CHKD BY:
JD

FIGURE No.

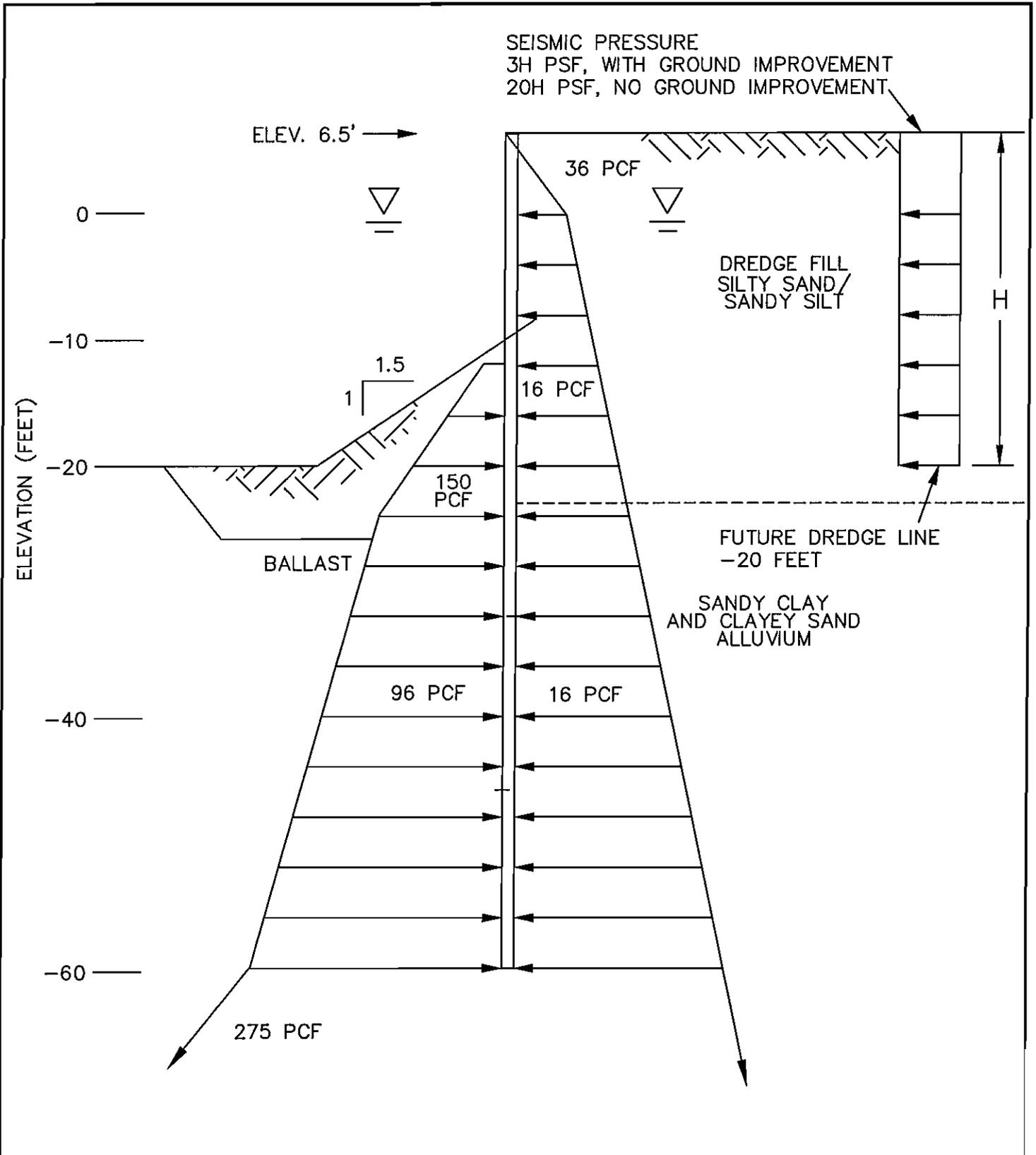
FIGURE 3B



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	CHKD BY: JD		FIGURE No. FIGURE 3C



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TITLE

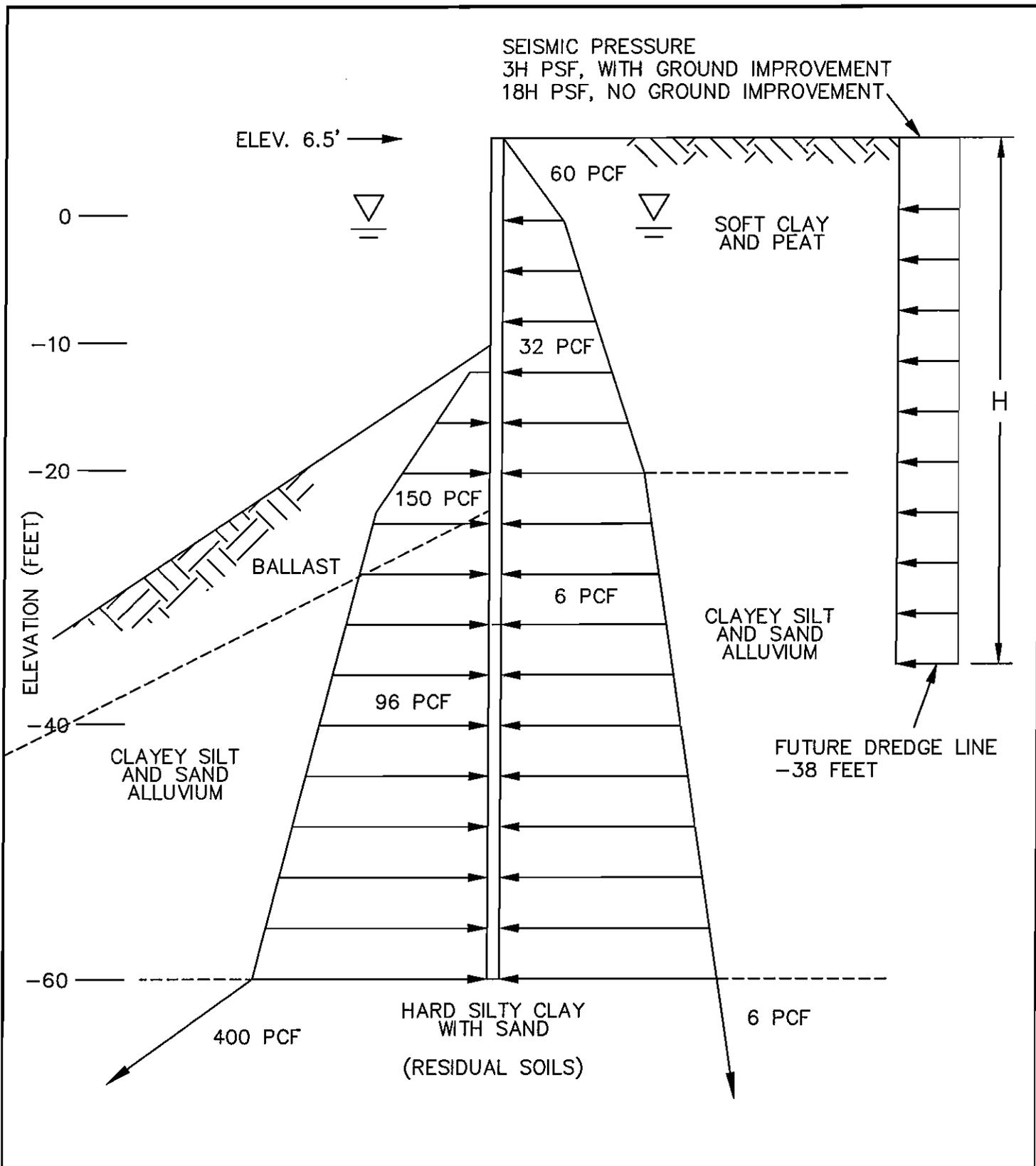
PRELIMINARY LATERAL EARTH
PRESSURE AT PIER 9 WEST SIDE
SAN JUAN WATERFRONT PROJECT

DATE:

SEPTEMBER 2007

FIGURE No.

FIGURE 3D



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TITLE

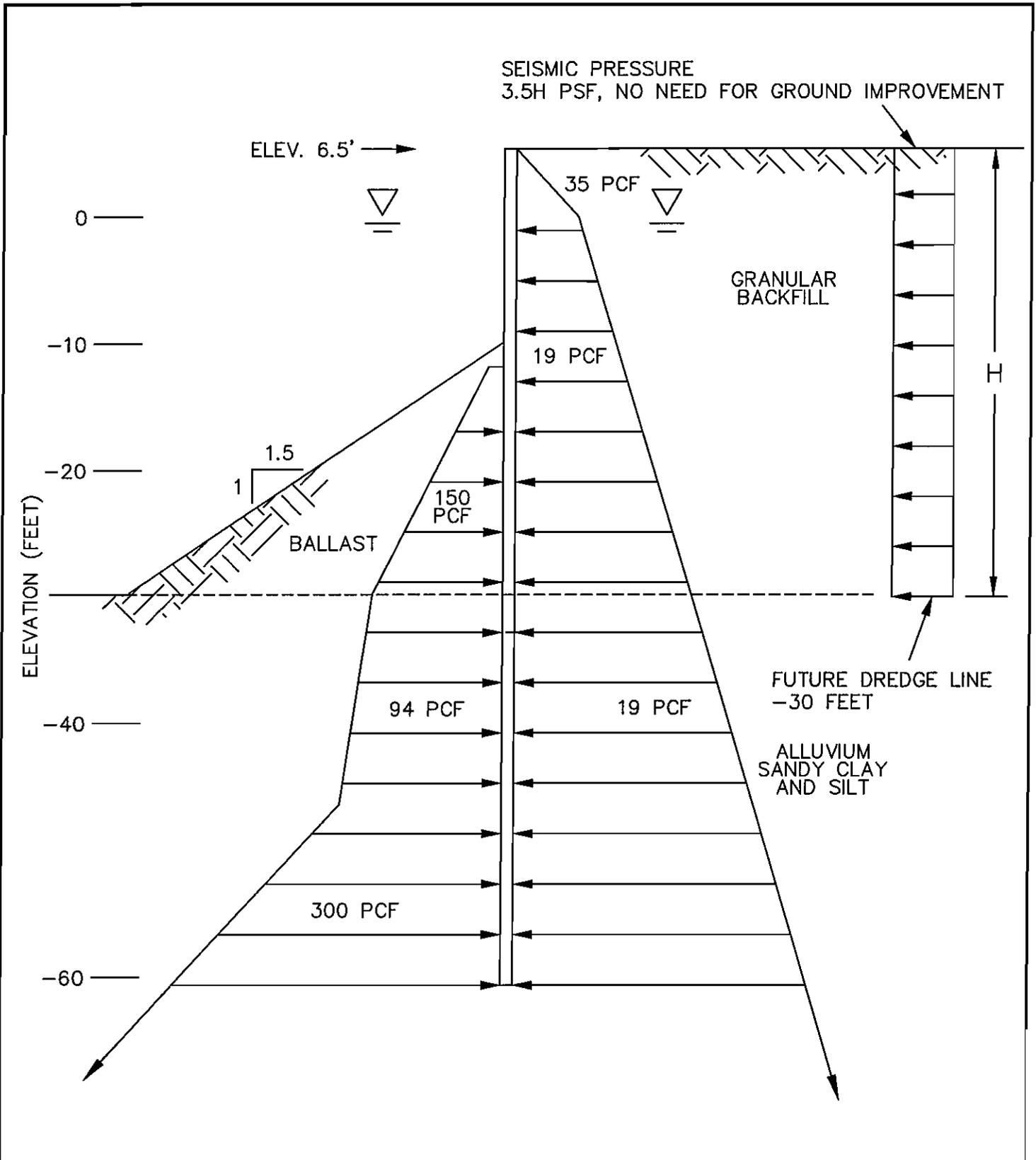
PRELIMINARY LATERAL EARTH
PRESSURE AT PIERS 11 TO 14
SAN JUAN WATERFRONT PROJECT

DATE:

SEPTEMBER 2007

FIGURE No.

FIGURE 3F



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TITLE PRELIMINARY LATERAL EARTH
PRESSURE AT
NAVY/FRONTIER PIER
SAN JUAN WATERFRONT PROJECT

DATE:
SEPTEMBER 2007

FIGURE No.
FIGURE 3G

APPENDIX A

Field Exploration Procedures and Logs

APPENDIX A
FIELD EXPLORATION PROCEDURES AND LOGS
7-660-00004

The following paragraphs describe our procedures associated with the field explorations and field tests that we conducted for this project. Descriptive logs of our explorations are enclosed in this appendix.

Auger Boring Procedures

Our exploratory borings were advanced with a hollow-stem auger, using a truck-mounted drill rig operated by an independent drilling firm working under subcontract to AMEC. A geotechnical specialist from our firm continuously observed the borings, logged the subsurface conditions, and collected representative soil samples. All samples were stored in watertight containers and later transported to our laboratory for further visual examination and testing. After each boring was completed, the borehole was backfilled with soil cuttings, and the surface was patched with concrete (where appropriate).

Throughout the drilling operation, soil samples were obtained at 2½ - or 5-foot depth intervals by means of the Standard Penetration Test (SPT) per ASTM:D-1586. This testing and sampling procedure consists of driving a standard 2-inch-diameter steel split-spoon sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval is counted, and the total number of blows struck during the final 12 inches is recorded as the Standard Penetration Resistance, or "SPT blow count." If a total of 50 blows are struck within any 6-inch interval, the driving is stopped and the blow count is recorded as 50 blows for the actual penetration distance. The resulting Standard Penetration Resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils.

The enclosed *Boring Logs* describe the vertical sequence of soils and materials encountered in each boring, based primarily on our field classifications and supported by our subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, our logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. Our logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these soil samples. If any groundwater was encountered in a borehole, the approximate groundwater depth is depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted.

Well Installation Procedures

Our groundwater observation wells consist of 2-inch-diameter PVC pipe, the lower 10 feet of which is finely slotted. The annular space around the slotted segment was backfilled with clean sand, and the upper portion of annulus was sealed with bentonite chips and concrete. A flush-mounted monument was placed over the top of each wellhead for protection. The as-built configuration of each observation well is illustrated on the respective *Boring Log*. Our logs also show any post-drilling groundwater levels measured in the wells, along with the date of measurement.

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		(LESS THAN 5% FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
		(GREATER THAN 12% FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
		(LESS THAN 5% FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES	
		(GREATER THAN 12% FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
FINE GRAINED SOILS	SILTS AND CLAYS	INORGANIC		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	LIQUID LIMIT LESS THAN 50	ORGANIC		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
			MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	INORGANIC	
		CH				INORGANIC CLAYS OF HIGH PLASTICITY
	LIQUID LIMIT GREATER THAN 50	ORGANIC			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS					PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS
FILL SOILS			FILL (AF)	HUMAN ALTERED SOIL OR MODIFIED LAND		

NOTES:

1. SOIL DESCRIPTIONS ARE BASED ON THE GENERAL APPROACH PRESENTED IN THE STANDARD PRACTICE FOR DESCRIPTION AND IDENTIFICATION OF SOILS (VISUAL-MANUAL PROCEDURE), AS OUTLINED IN ASTM D 2488. WHERE LABORATORY INDEX TESTING HAS BEEN CONDUCTED, SOIL CLASSIFICATIONS ARE BASED ON THE STANDARD TEST METHOD FOR CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES, AS OUTLINED IN ASTM D 2487.

2. SOIL DESCRIPTION TERMINOLOGY IS BASED ON VISUAL ESTIMATES (IN THE ABSENCE OF LABORATORY TEST DATA) OF THE PERCENTAGES OF EACH SOIL TYPE AND IS DEFINED AS DESCRIBED BELOW:

3. DUAL SYMBOLS (E.G. SP-SM, OR GP-GM) ARE USED TO INDICATE A SOIL WITH AN ESTIMATED 5-12% FINES.

PRIMARY CONSTITUENT: >50% - "GRAVEL", "SAND", "SILT", "CLAY", etc.

SECONDARY CONSTITUENTS: >12% and ≤50% - "gravelly", "sandy", "silty", etc.

ADDITIONAL CONSTITUENTS: >5% and ≤12% - "some gravel", "some sand", "some silt", etc.

≤5% - "trace gravel", "trace sand", "trace silt" etc. or not noted.

4. RELATIVE DENSITY OF SOIL IS BASED ON STANDARD TEST METHOD FOR PENETRATION TEST (SPT) AND SPLIT-BARREL SAMPLING OF SOILS ASTM D 1586 OR CORRELATIONS FOR OTHER SIMPLER TYPES AND METHODS FOR SPT SAMPLING, THE FOLLOWING BLOW COUNT CORRELATION APPLIES.

A. RELATIVE DENSITY OF COARSE GRAINED SOILS
 VERY LOOSE: $N \leq 4$ (N = BLOWS/FOOT SPT METHOD)
 LOOSE: $N = >4$ AND ≤ 10
 MEDIUM DENSE: $N = >10$ AND ≤ 30
 DENSE: $N = >30$ AND ≤ 50
 VERY DENSE: $N = >50$

B. RELATIVE CONSISTENCY OF FINE GRAINED SOILS
 VERY SOFT: $N = <2$ (N = BLOWS/FOOT SPT METHOD)
 SOFT: $N = \geq 2$ AND ≤ 4
 MEDIUM STIFF: $N = >4$ AND ≤ 8
 STIFF: $N = >8$ AND ≤ 15
 VERY STIFF: $N = >15$ AND ≤ 30
 HARD: $N = >30$

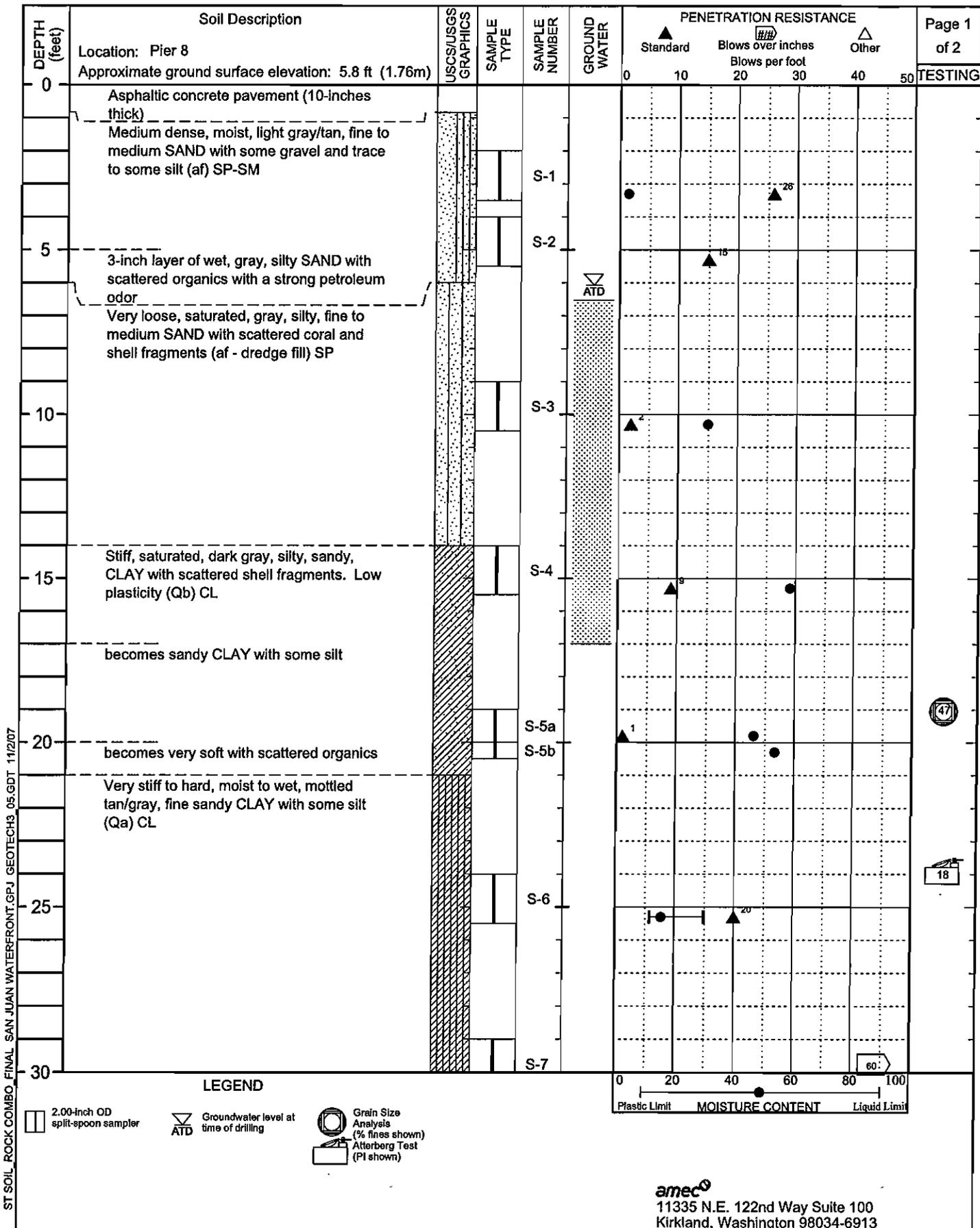
FILE NAME: SOIL CLASS CHART.dwg DWG DATE: 6-21-2006 10:46am



AMEC EARTH & ENVIRONMENTAL, INC.
 11335 N.E. 122nd Way, Suite 100
 Kirkland, WA, U.S.A. 98034-6918

SOIL CLASSIFICATION CHART / KEY

FIGURE
A-1



47

18

ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/20/07

amec
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 Kirkland, Washington 98034-6913

DEPTH (feet)	Soil Description	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE					Page 2 of 2	
						Standard	Blows over inches	Blows per foot		Other		TESTING
30	Location: Pier 8 Approximate ground surface elevation: 5.8 ft (1.76m)					0	10	20	30	40	50	
	fine sandy CLAY as above											
35	becomes reddish tan, silty CLAY with some fine sand			S-8								
	Boring terminated at approximately 35.5 feet below existing ground surface											
40												
45												
50												
55												
60												

ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ_GEOTECH3_05.GDT 11/2/07

LEGEND

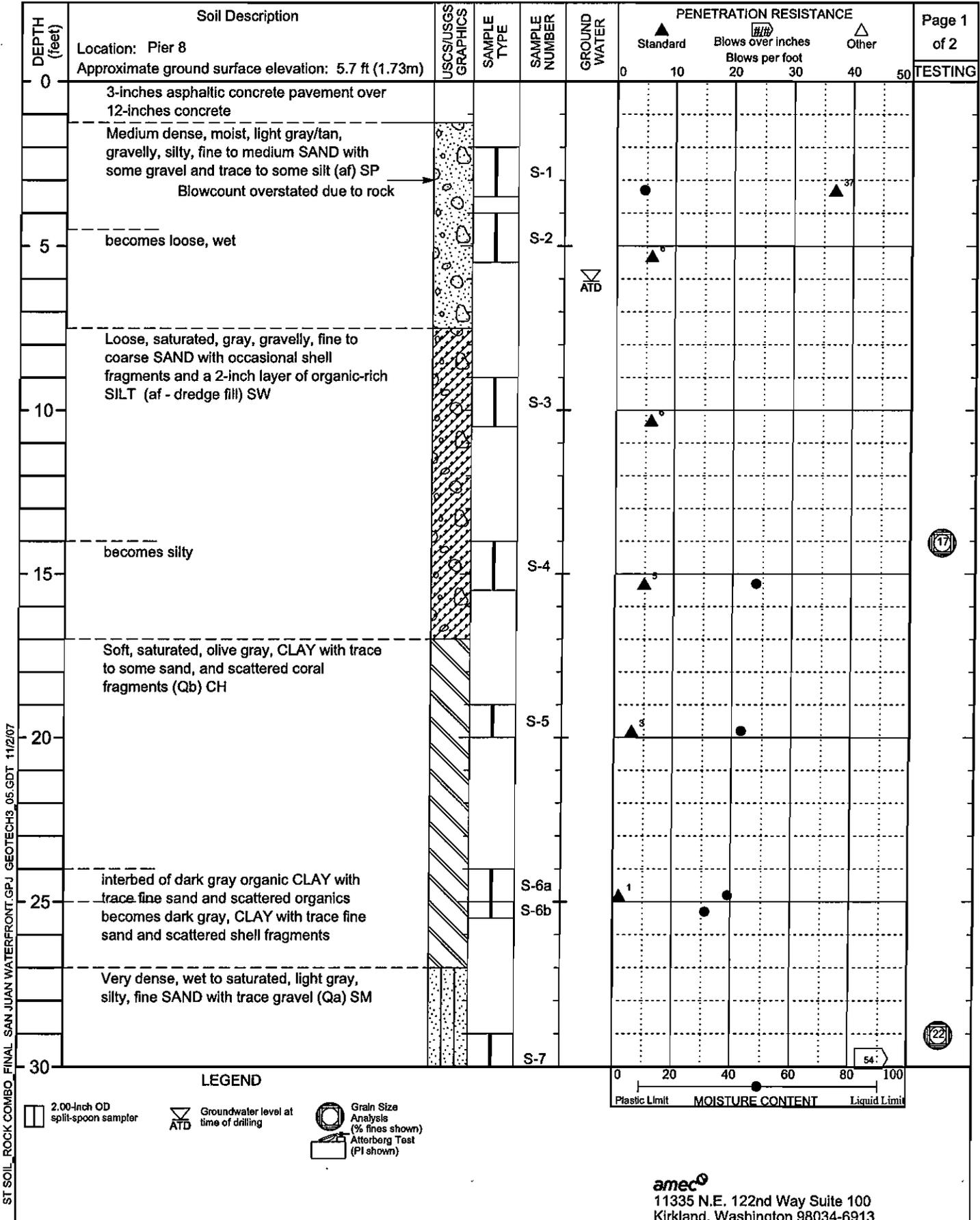
2.00-Inch OD split-spoon sampler

Groundwater level at time of drilling

Grain Size Analysis (% fines shown)
 Atterberg Test (PI shown)



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Kirkland, Washington 98034-6913



amec
 11335 N.E. 122nd Way Suite 100
 Kirkland, Washington 98034-6913

DEPTH (feet)	Soil Description	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE					Page 2 of 2	
						Standard	Blows over inches	Blows per foot	Other	TESTING		
30	Location: Pier 8 Approximate ground surface elevation: 5.7 ft (1.73m)					0	10	20	30	40	50	
	silty fine SAND as above											
	Hard, wet to saturated, light gray, fine sandy SILT (Qa) ML			S-8								Non-Plastic
35												
	Boring terminated at approximately 35.5 feet below existing ground surface											
40												
45												
50												
55												
60												

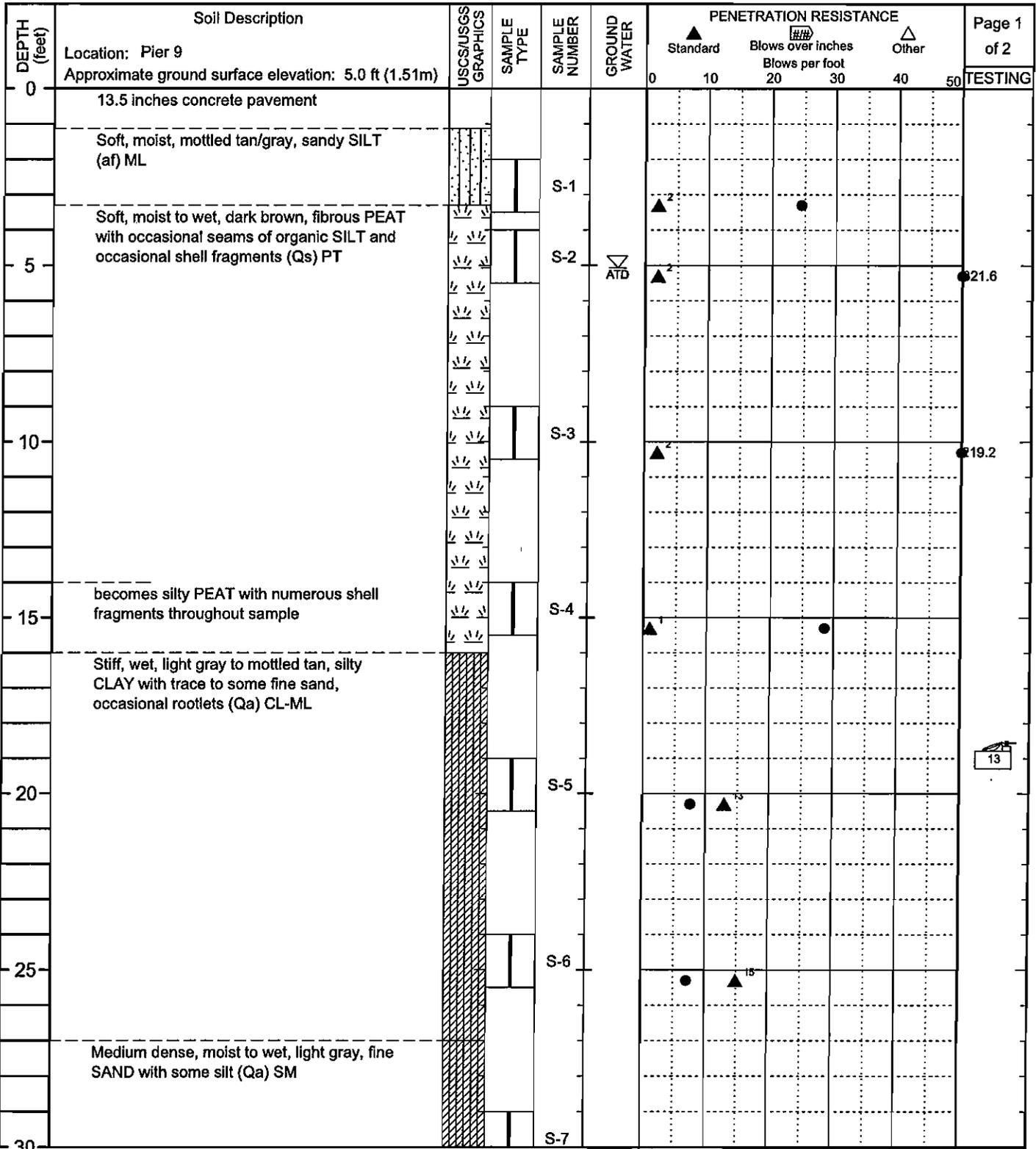
ST SOIL_ROCK_COMBO_FINAL_SAN_JUAN_WATERFRONT.GPJ_GEOTECH3_05.GDT 11/2/07

LEGEND

-  2.00-inch OD split-spoon sampler
-  Groundwater level at time of drilling
-  Grain Size Analysis (% fines shown)
-  Atterberg Test (PI shown)

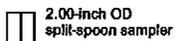
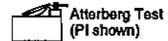


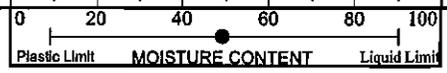
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ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

-  2.00-inch OD split-spoon sampler
-  Groundwater level at time of drilling
-  Atterberg Test (PI shown)

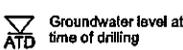


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DEPTH (feet)	Soil Description Location: Pier 9 Approximate ground surface elevation: 5.0 ft (1.51m)	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE					Page 2 of 2
						Standard	Blows over inches	Blows per foot	Other	TESTING	
30	fine SAND as above	[Hatched Pattern]				●		▲ ²⁴			
35	Hard, moist to wet, light gray, silty CLAY with some fine sand (Qa) CL	[Diagonal Hatched Pattern]		S-8		●		▲ ³¹			
35.5	Boring terminated at approximately 35.5 feet below existing ground surface										
40											
45											
50											
55											
60											

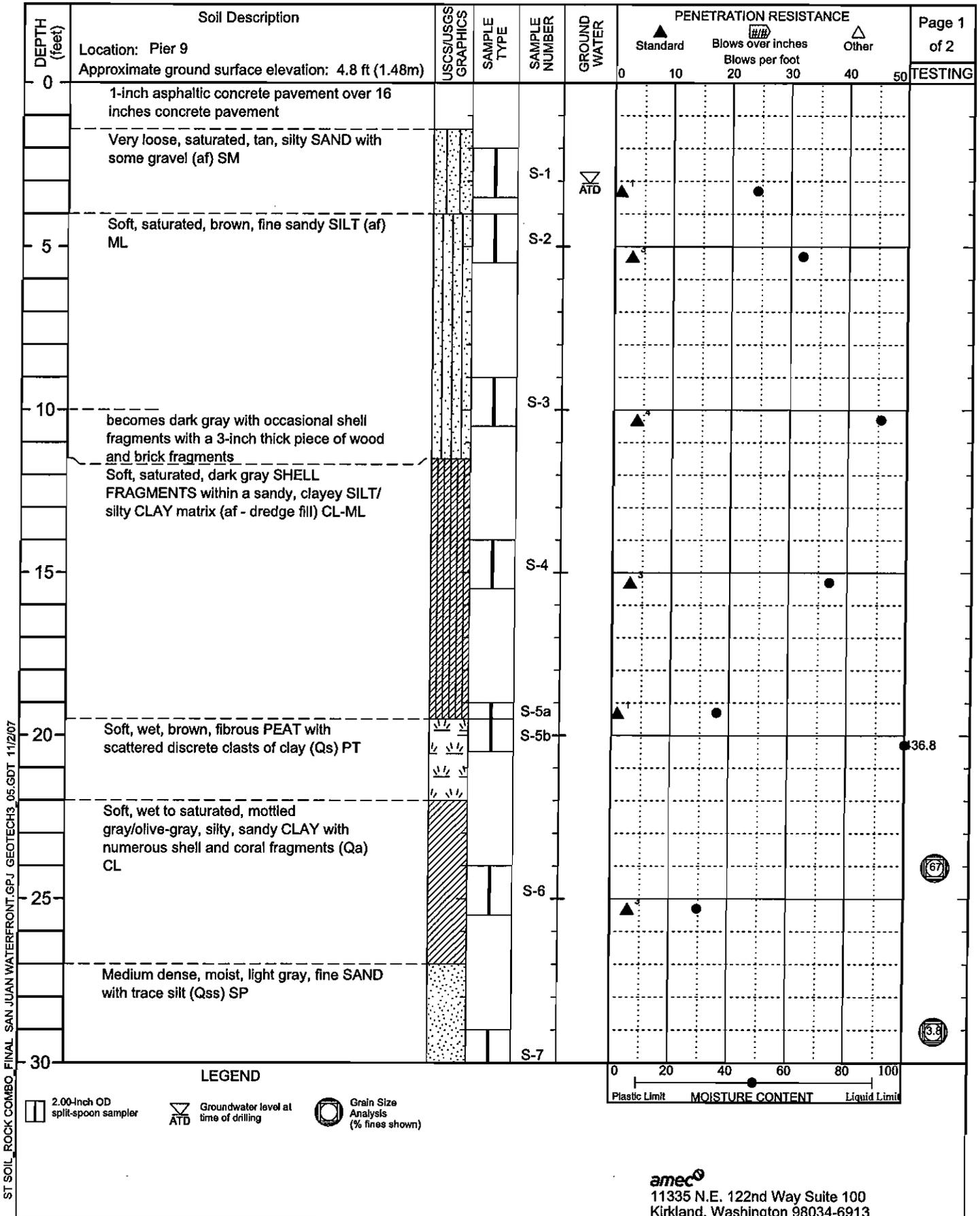
ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

-  2.00-inch OD split-spoon sampler
-  Groundwater level at time of drilling
-  Atterberg Test (PI shown)

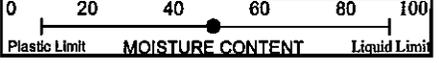


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ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/20/07

DEPTH (feet)	Soil Description	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE					Page 2 of 2	
						Standard	Blows over inches	Blows per foot		Other		TESTING
30	Location: Pier 9 Approximate ground surface elevation: 4.8 ft (1.48m)					0	10	20	30	40	50	
	fine SAND as above	[Stippled pattern]										
35	becomes SAND with some silt	[Stippled pattern]		S-8								
	Boring terminated at approximately 35.5 feet below existing ground surface											
40												
45												
50												
55												
60												

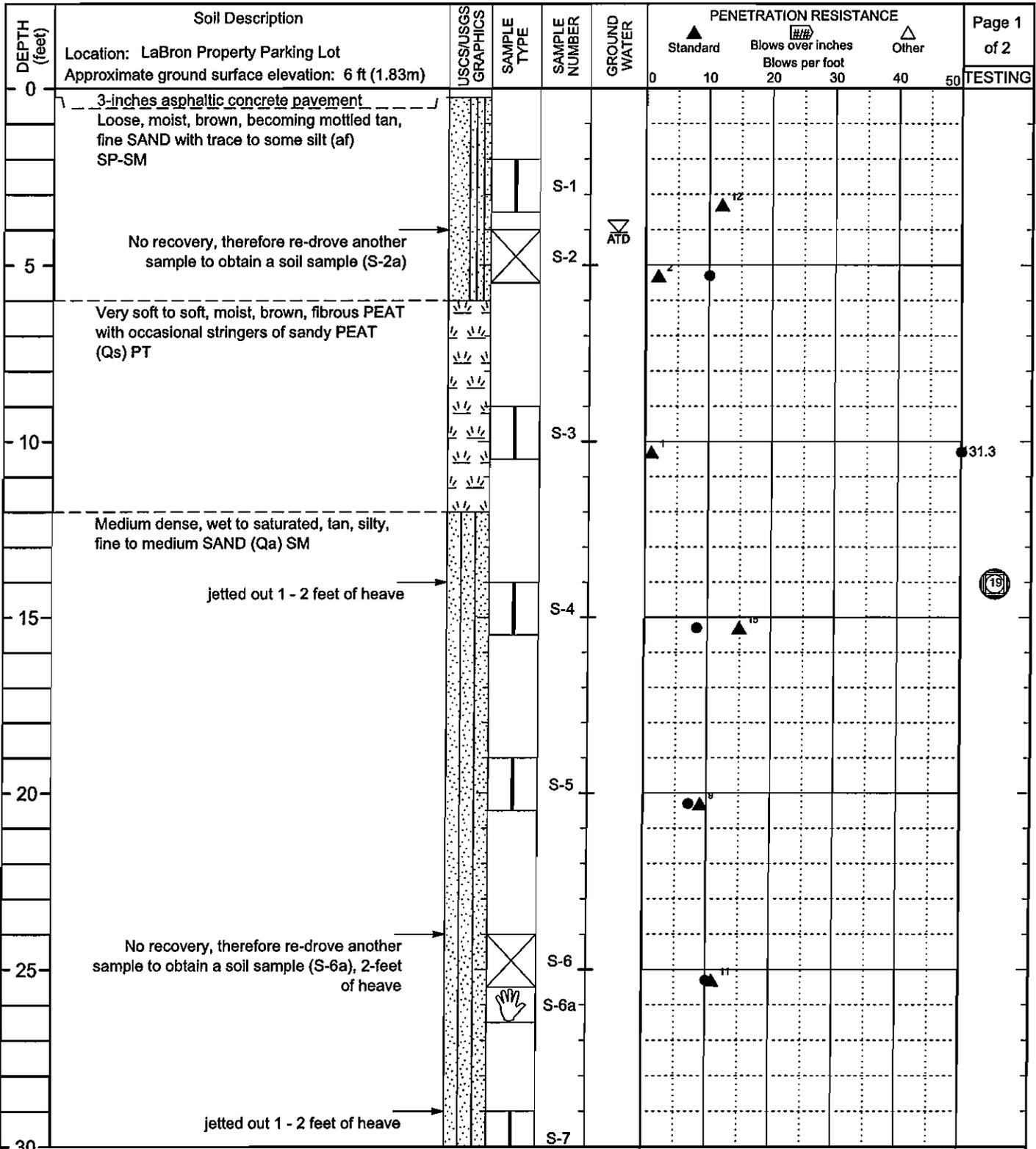


LEGEND

- 2.00-inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)

ST SOIL ROCK COMBO_FINAL_SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

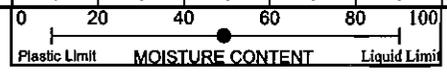
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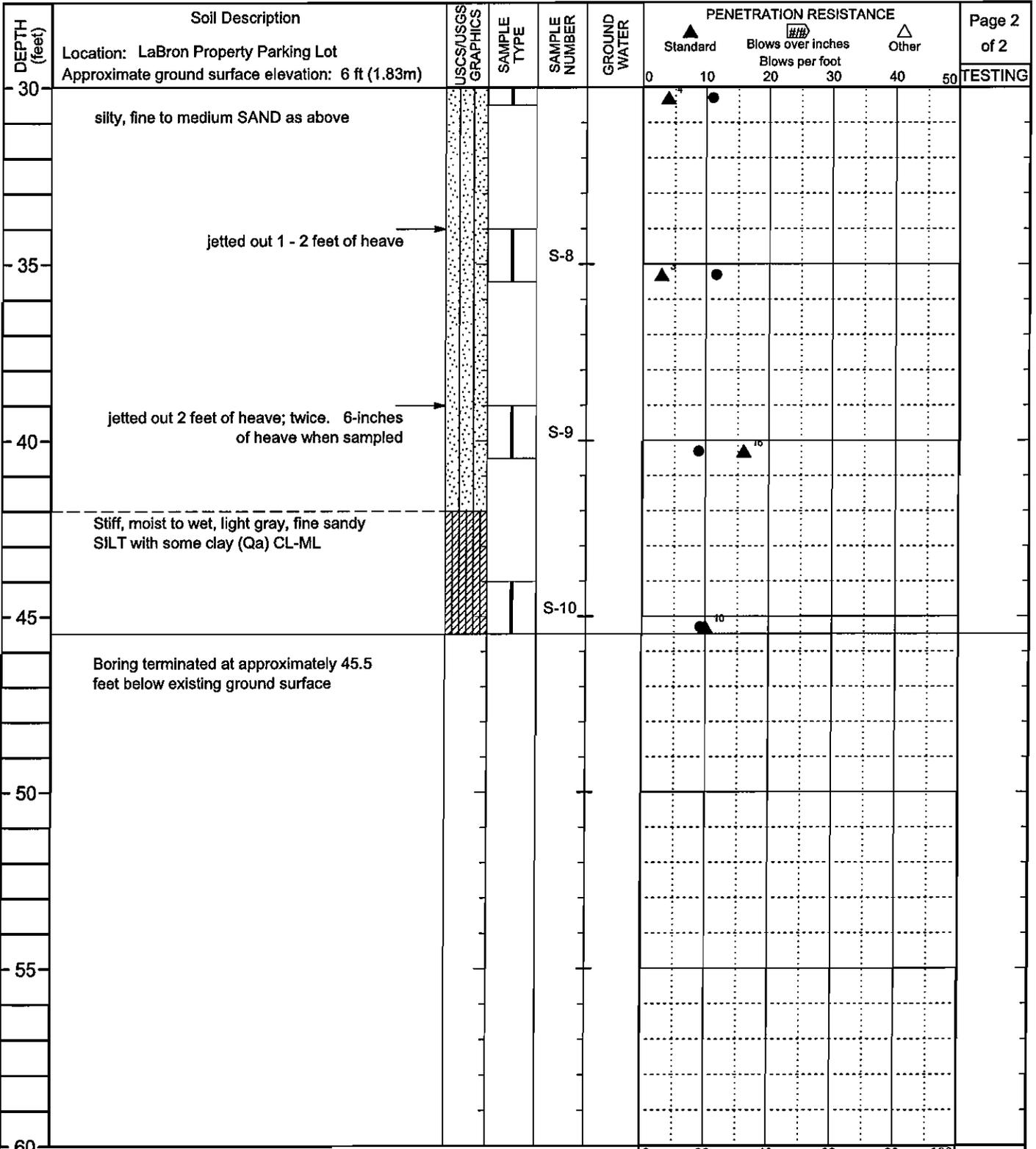
ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- 2.00-Inch OD split-spoon sampler
- No Recovery
- Grab Sample
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)



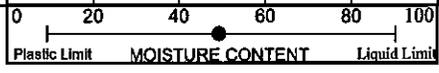
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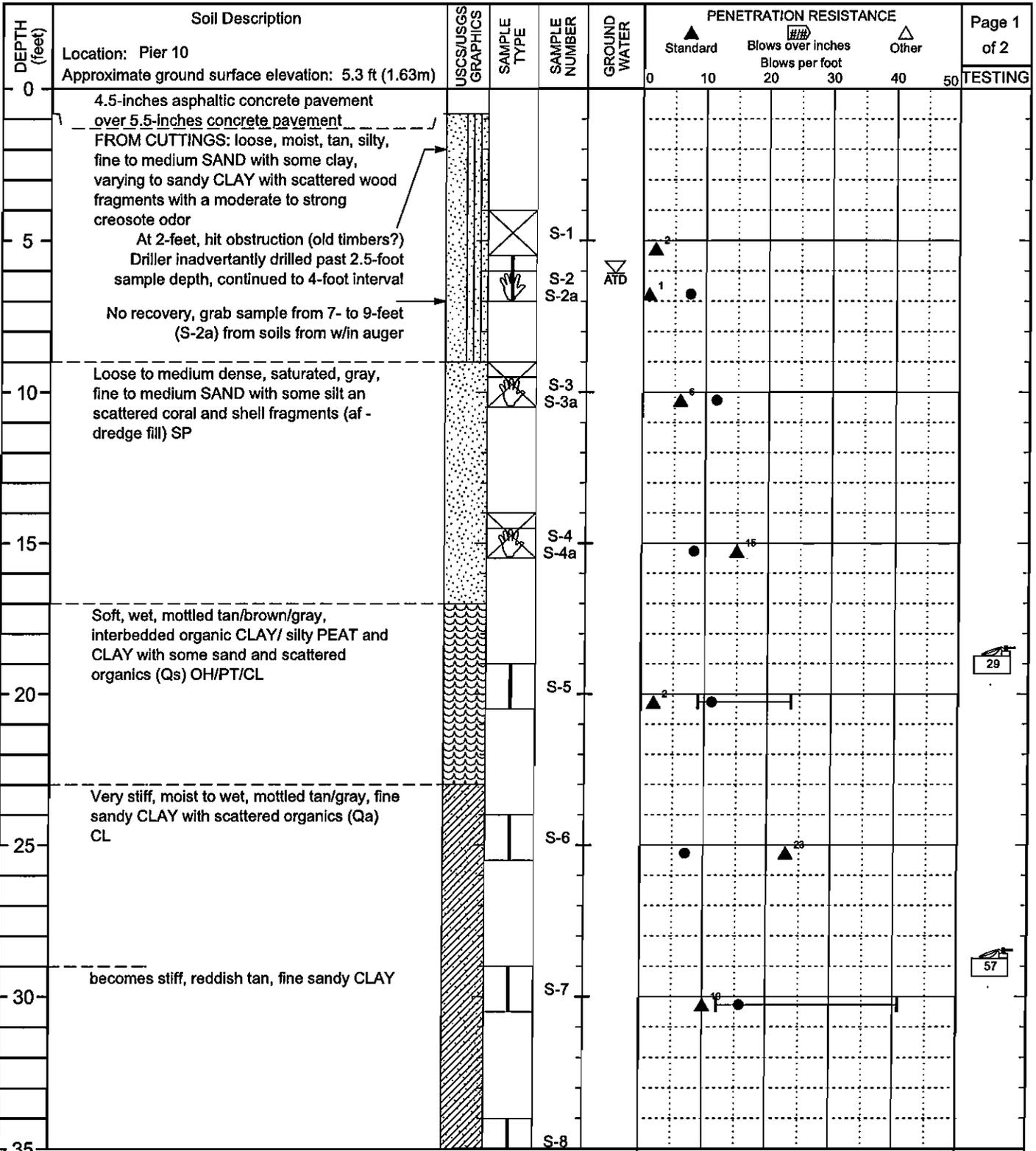
ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- 2.00-inch OD split-spoon sampler
- No Recovery
- Grab Sample
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)



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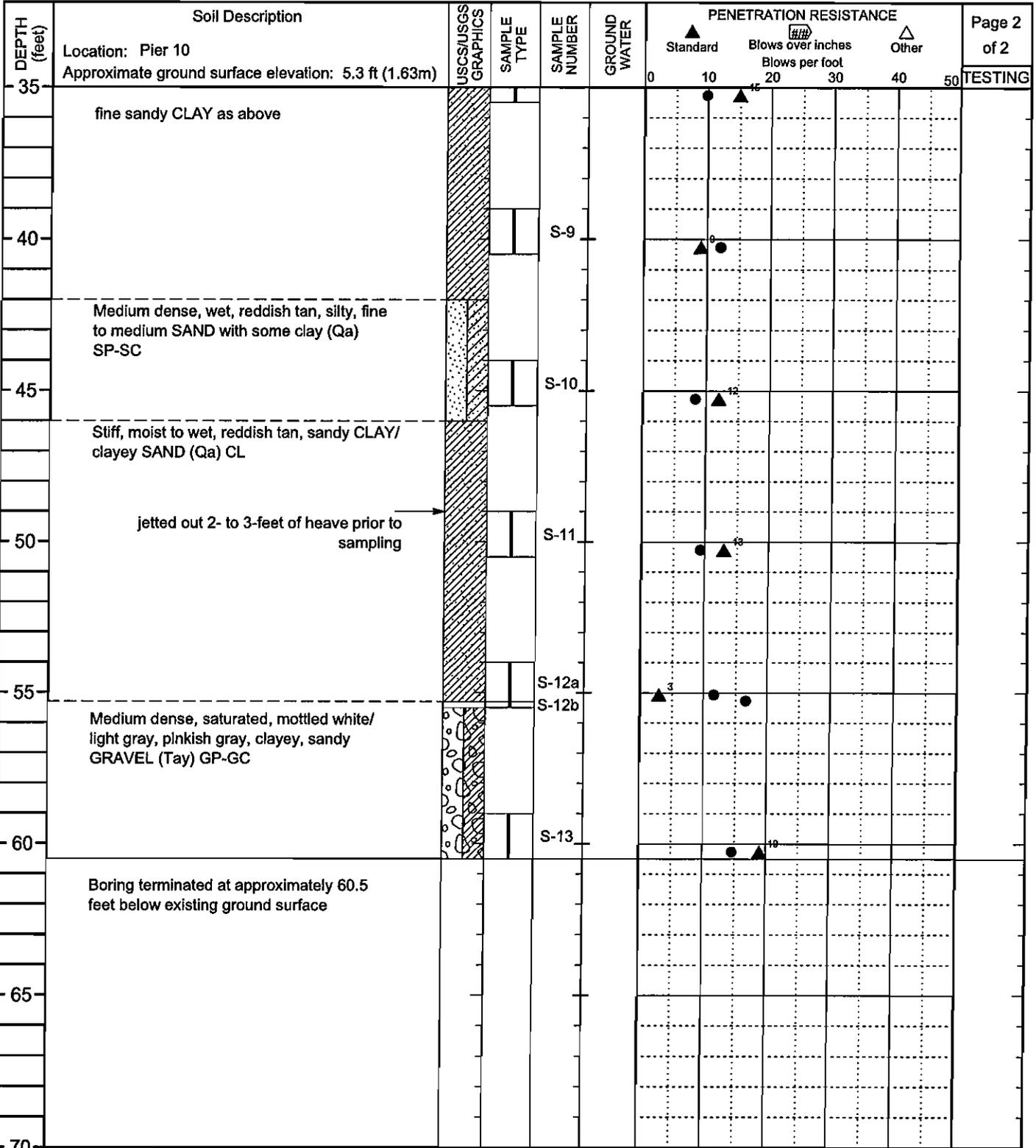
ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- No Recovery
- 2.00-inch OD split-spoon sampler
- Grab Sample
- Groundwater level at time of drilling
- Atterberg Test (PI shown)



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TESTING

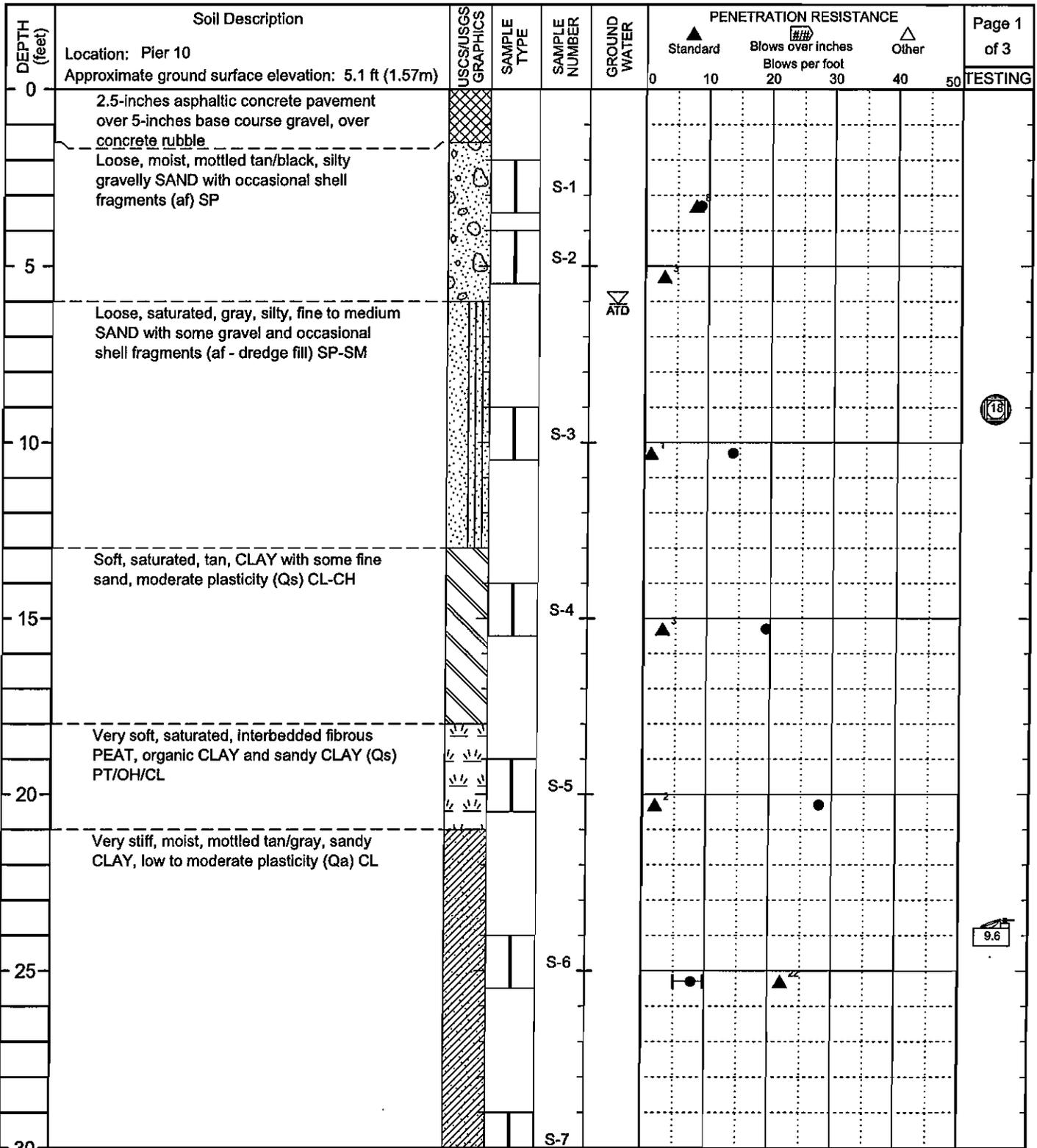
ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- No Recovery
- 2.00-inch OD split-spoon sampler
- Grab Sample
- Groundwater level at time of drilling
- Atterberg Test (PI shown)



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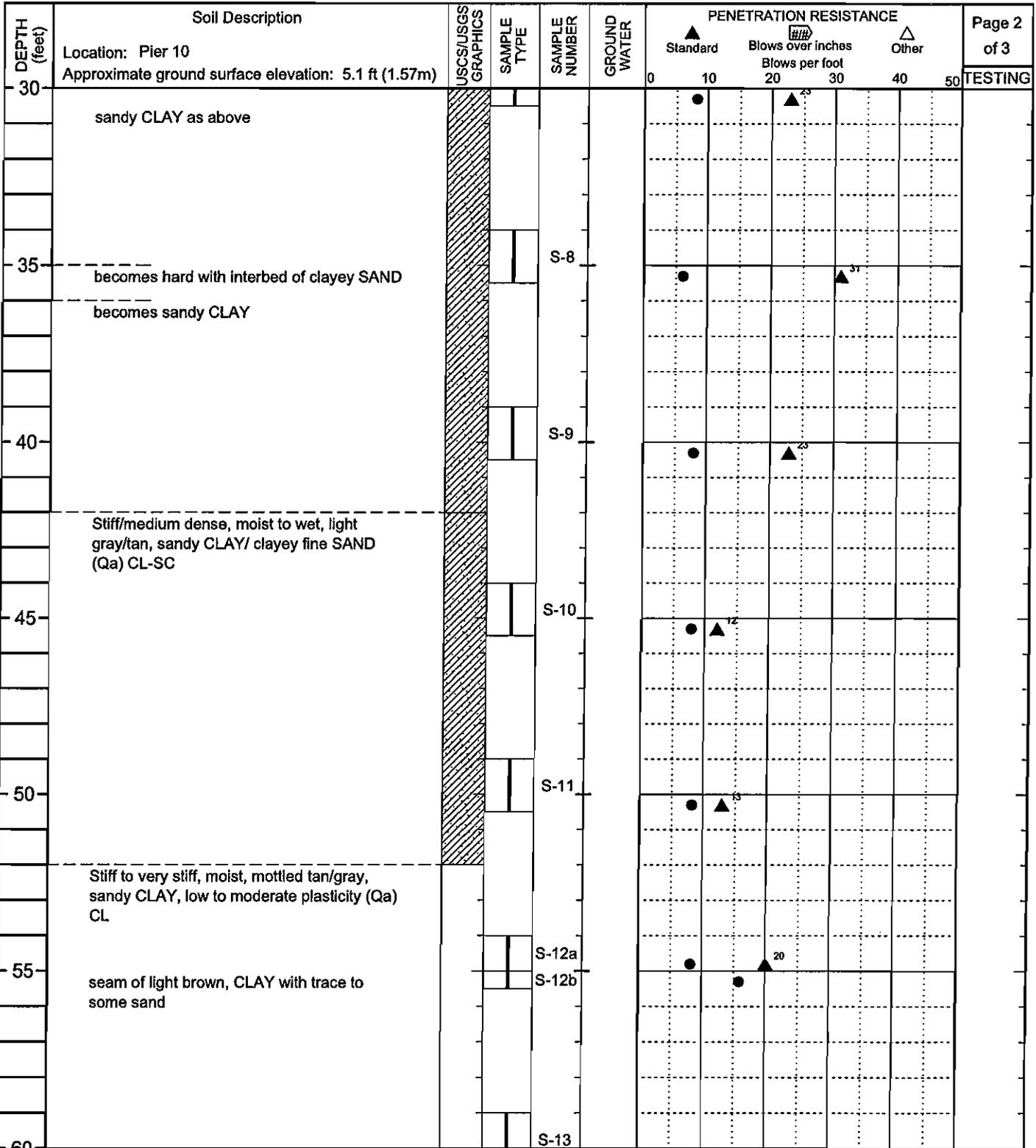
LEGEND

- 2.00-Inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)
- Atterberg Test (PI shown)



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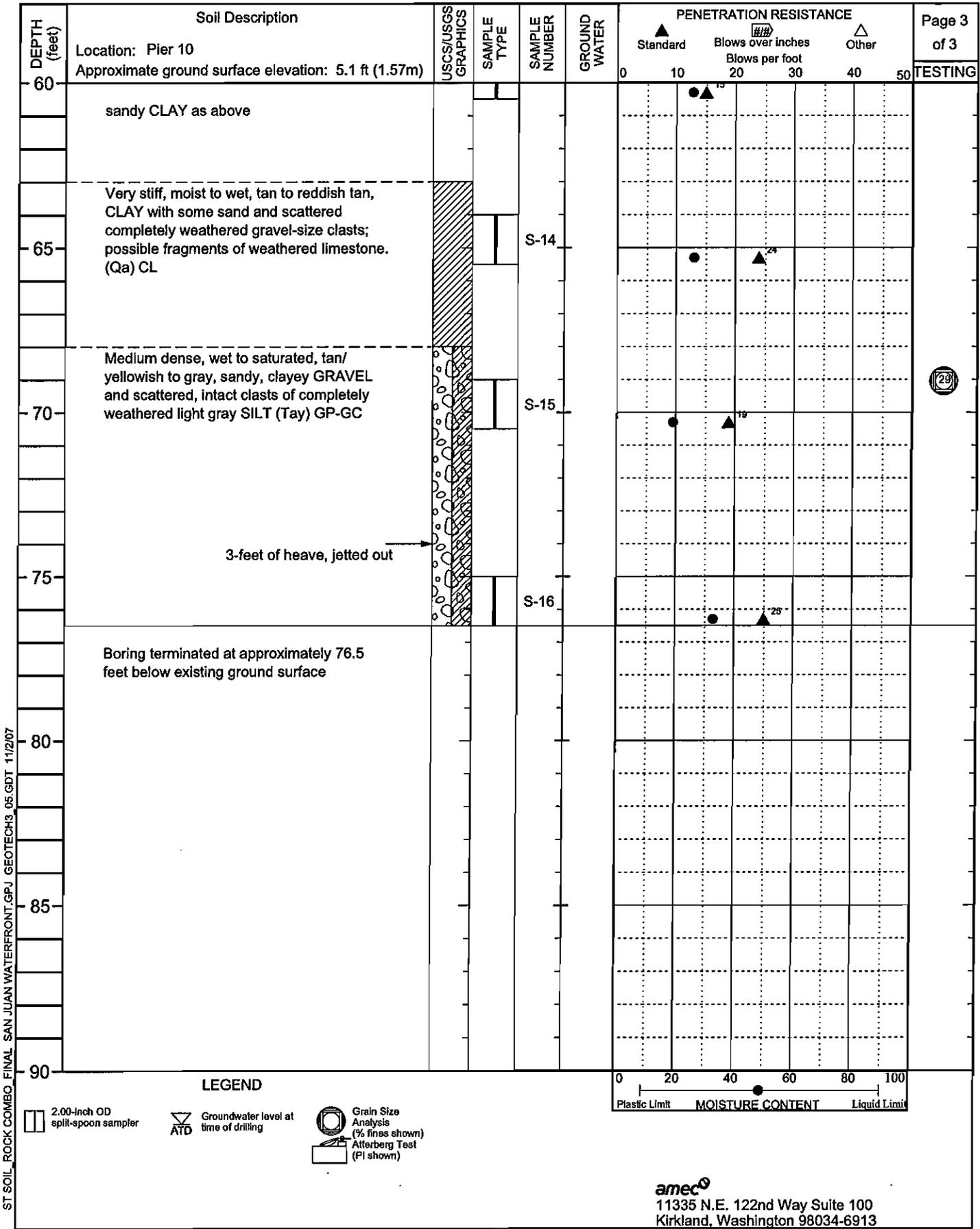
ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- 2.00-inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)
- Atterberg Test (PI shown)



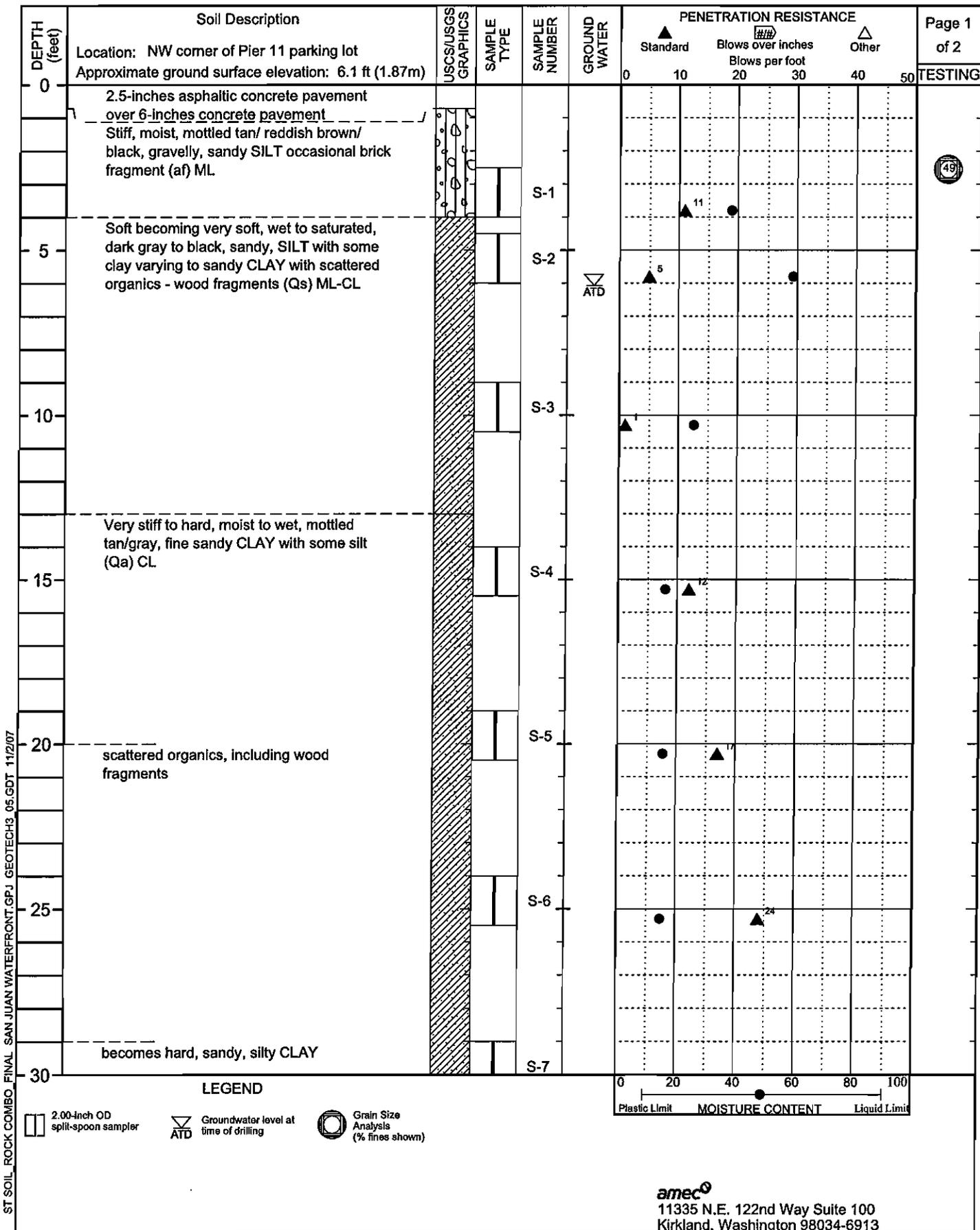
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(28)

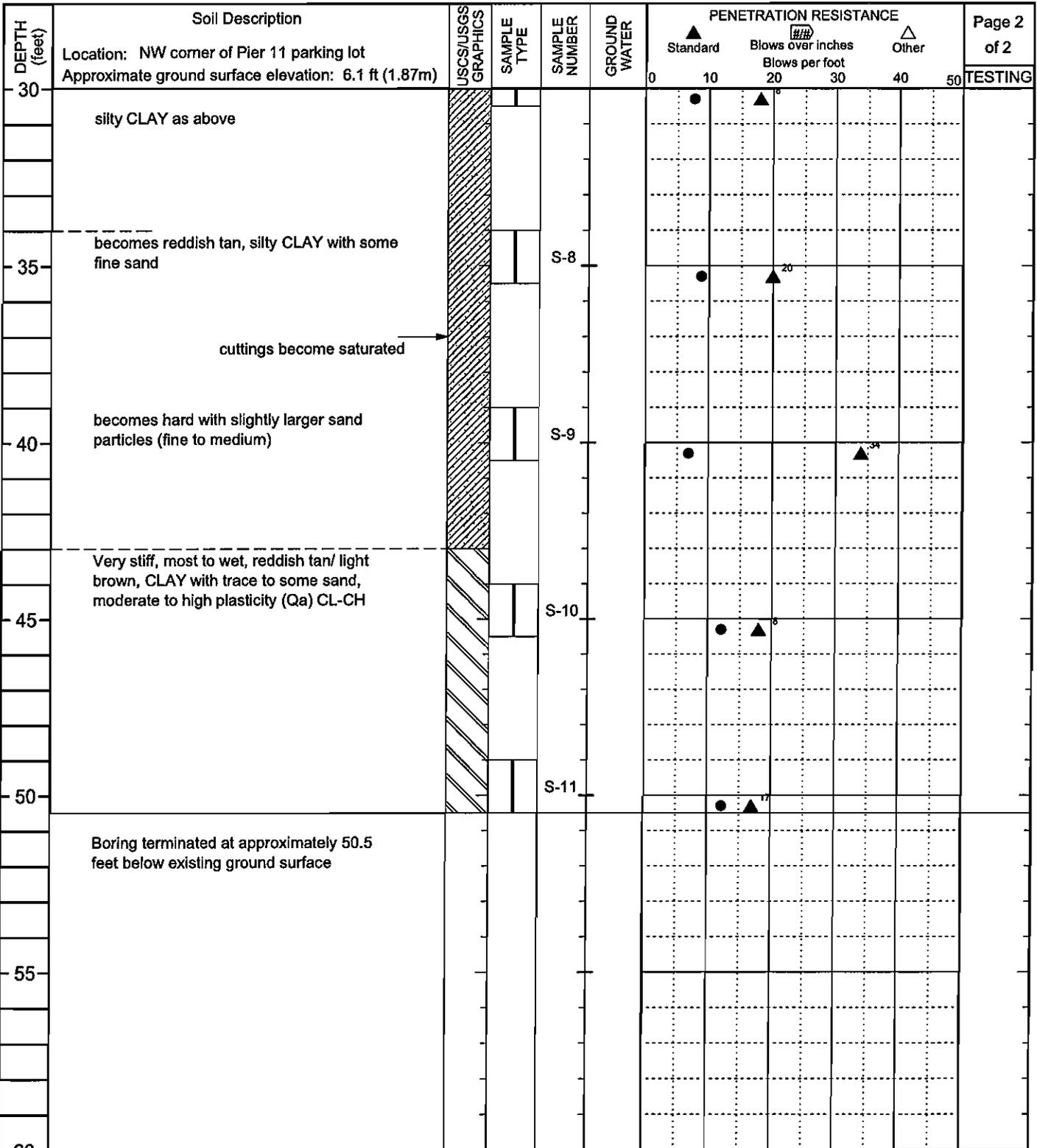
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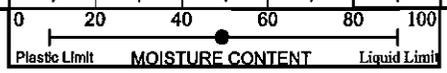
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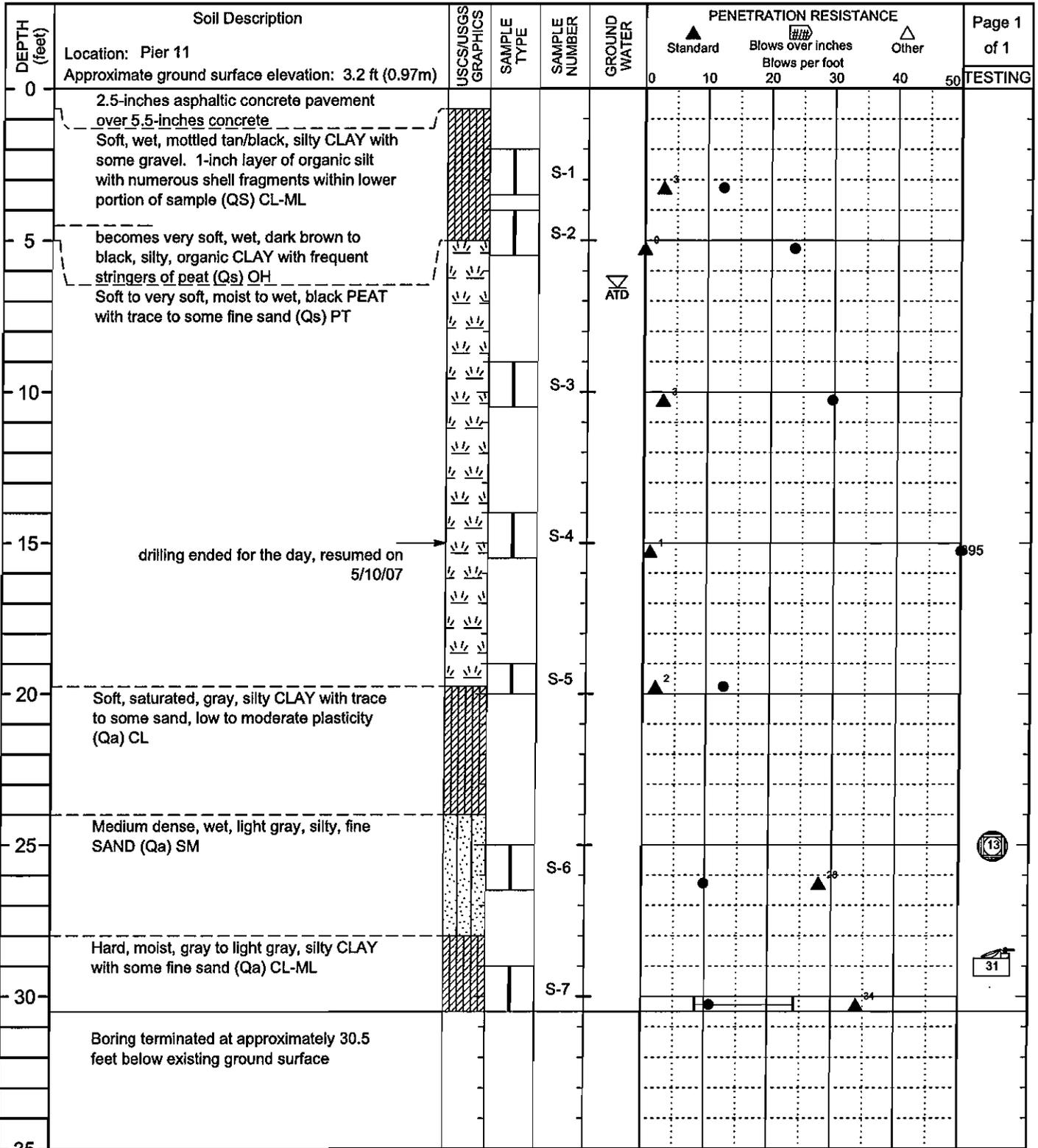
ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- 2.00-Inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)



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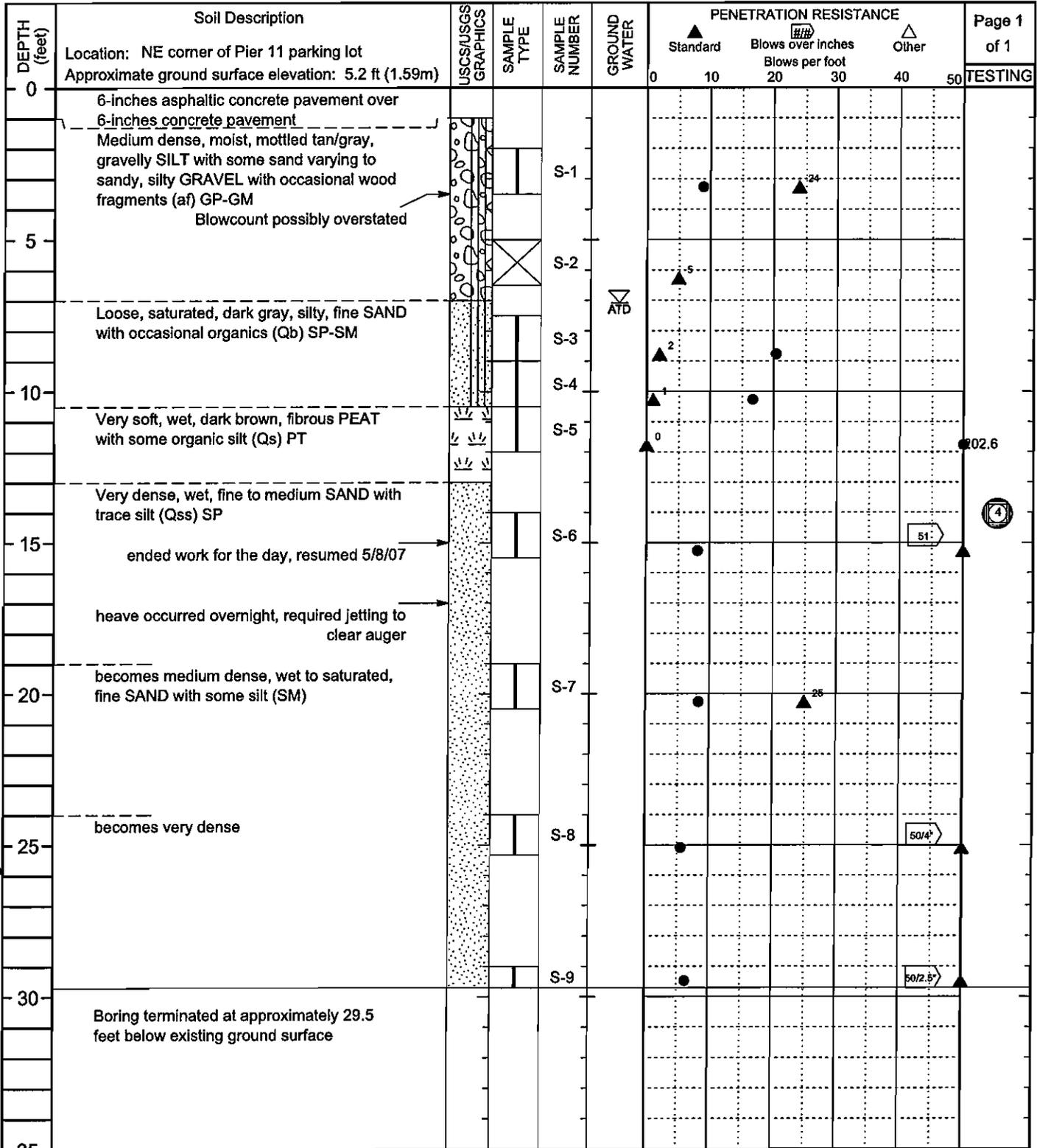
LEGEND

- 2.00-Inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)
- Atterberg Test (PI shown)



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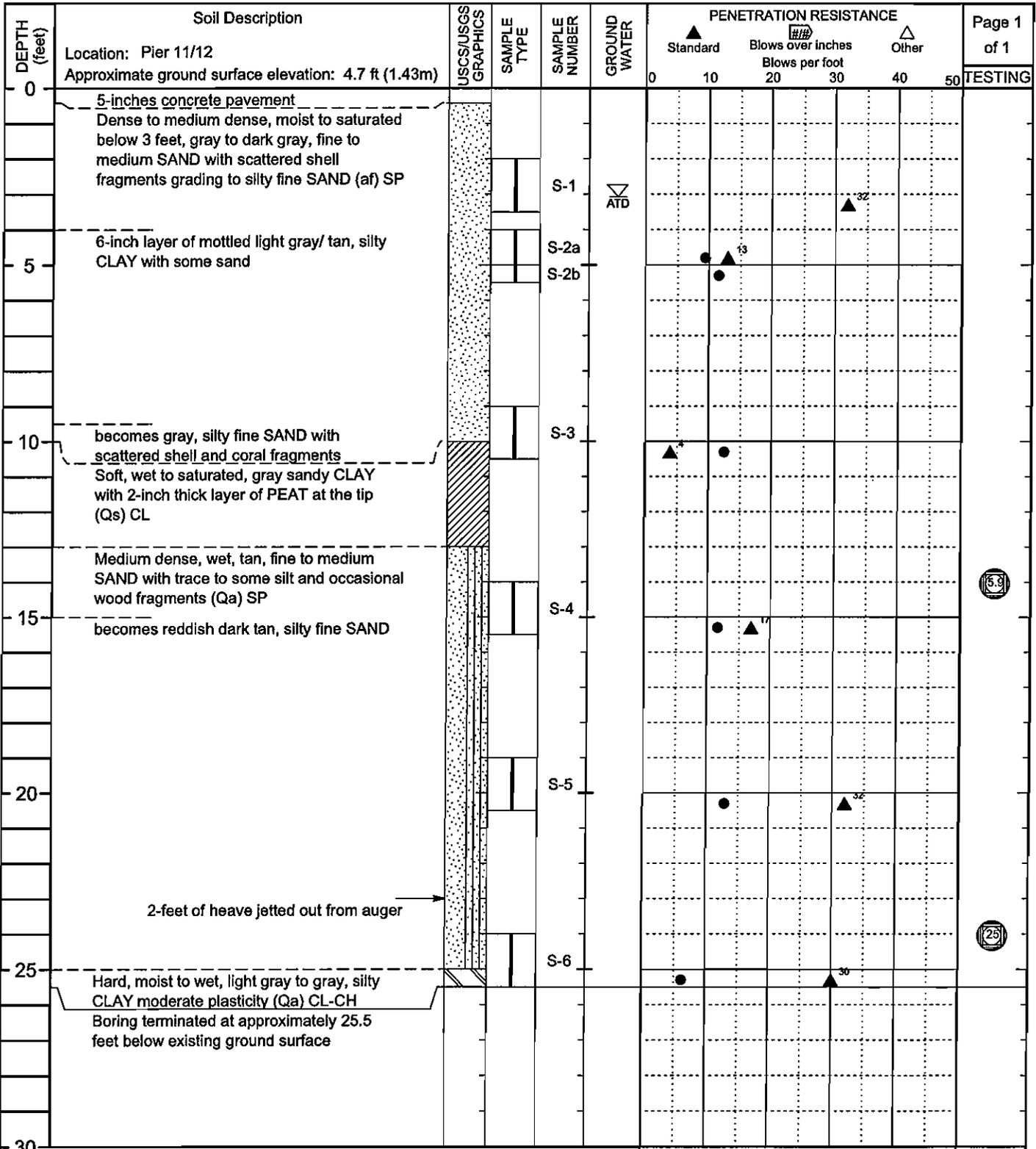
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LEGEND

- 2.00-inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)
- No Recovery



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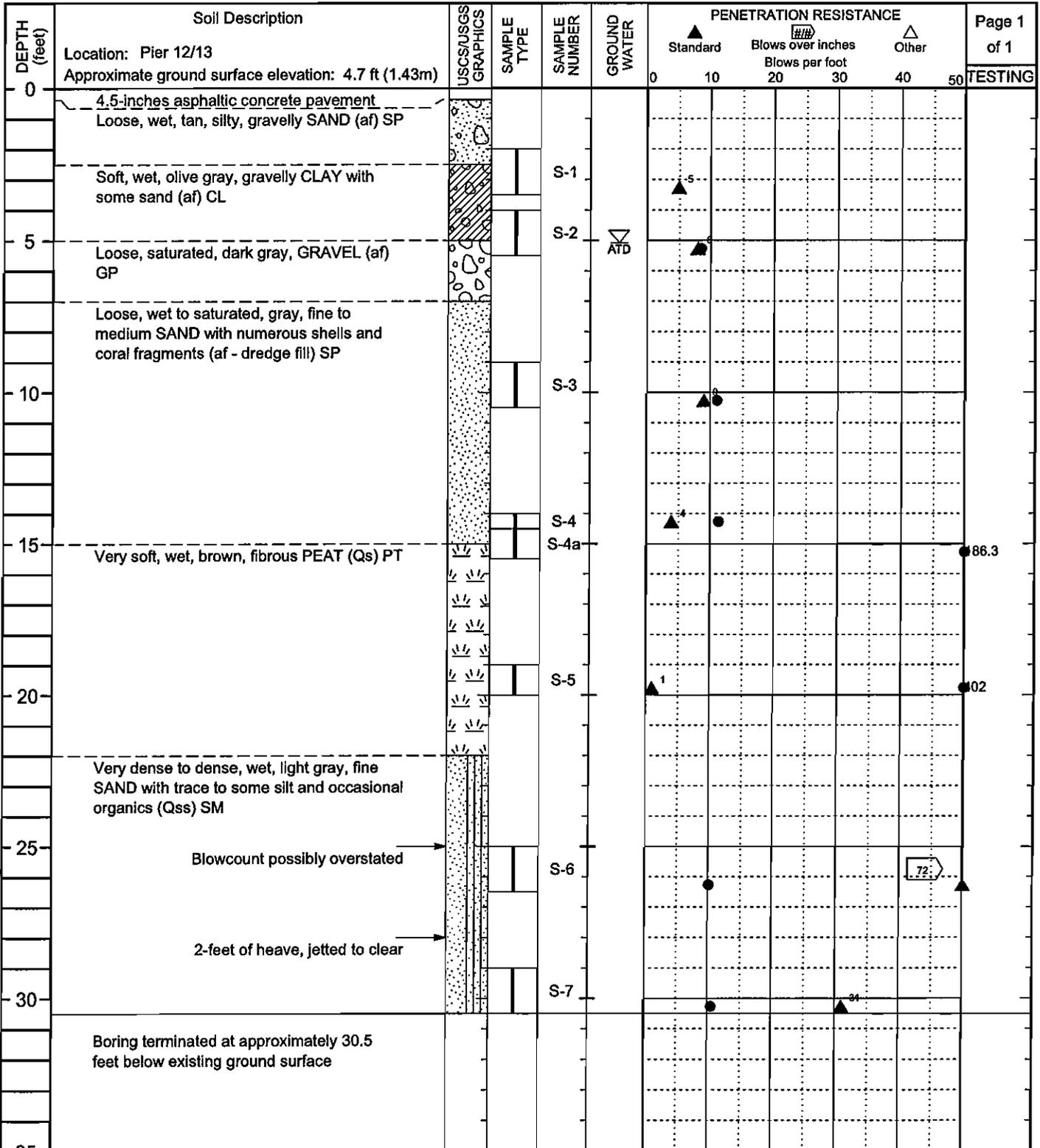
LEGEND

- 2.00-Inch OD split-spoon sampler
- ATD Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)



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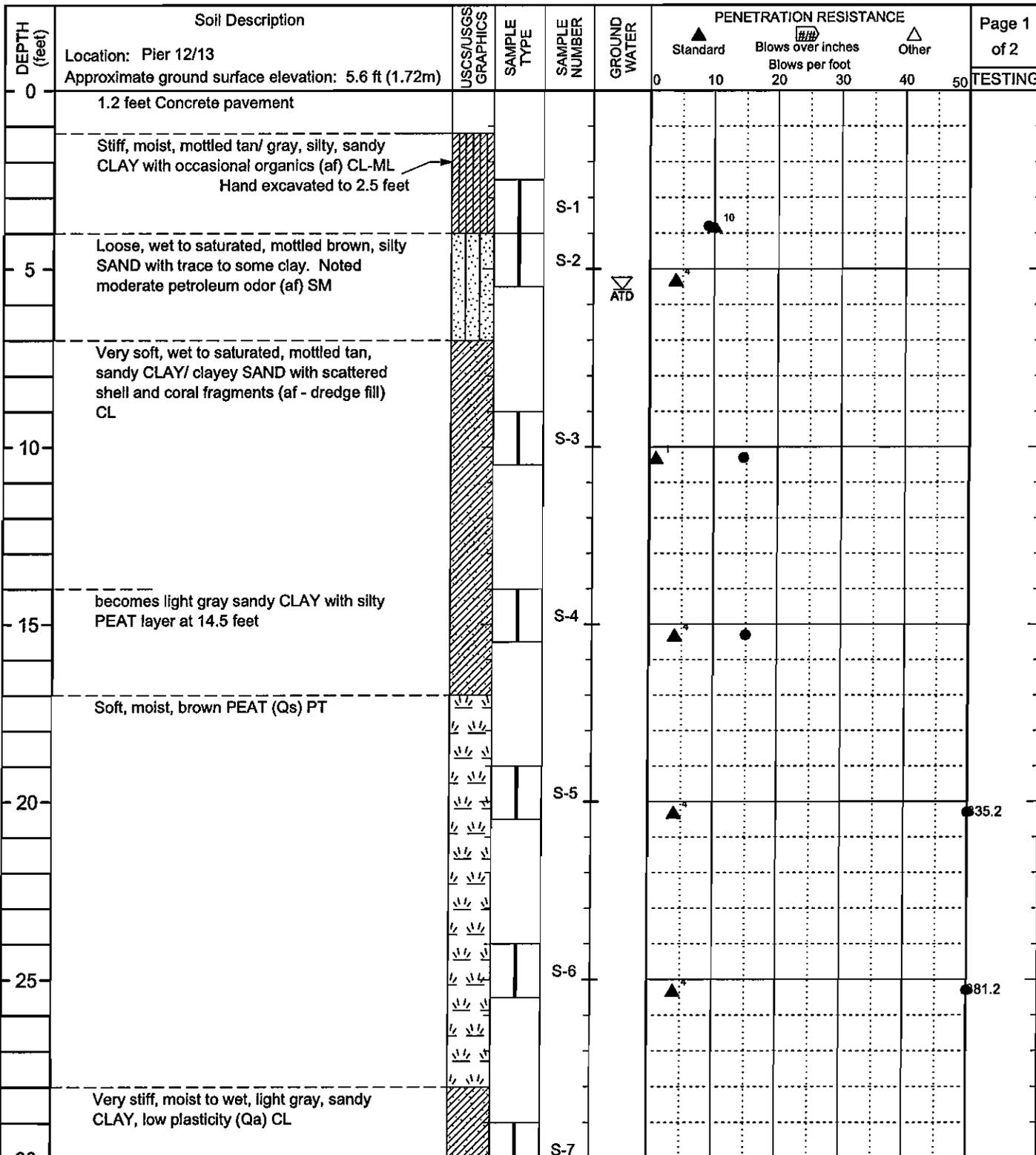
LEGEND

2.00-inch OD split-spoon sampler

Groundwater level at time of drilling

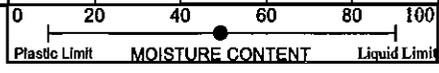


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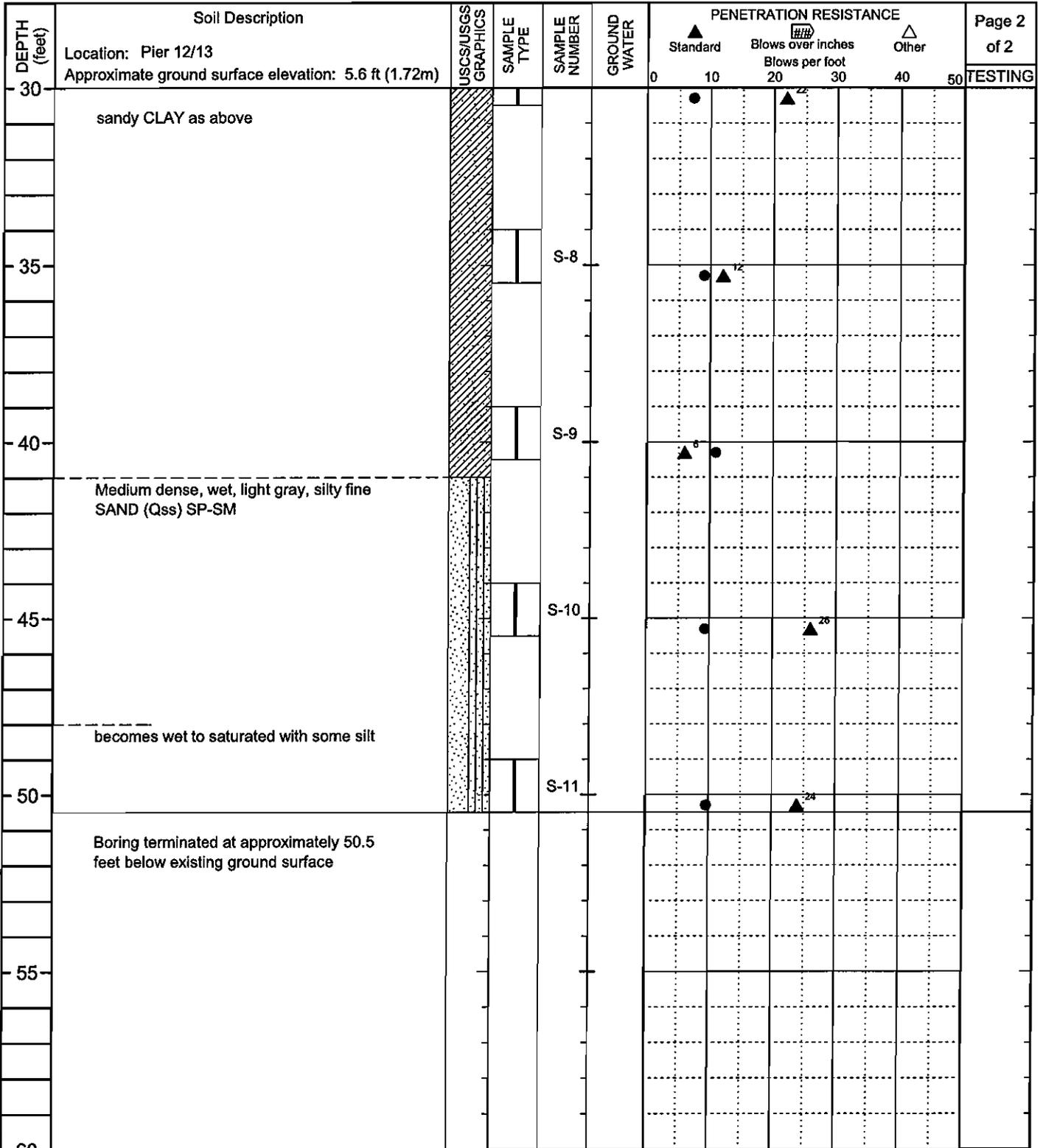
LEGEND

- 2.00-Inch OD split-spoon sampler
- Groundwater level at time of drilling



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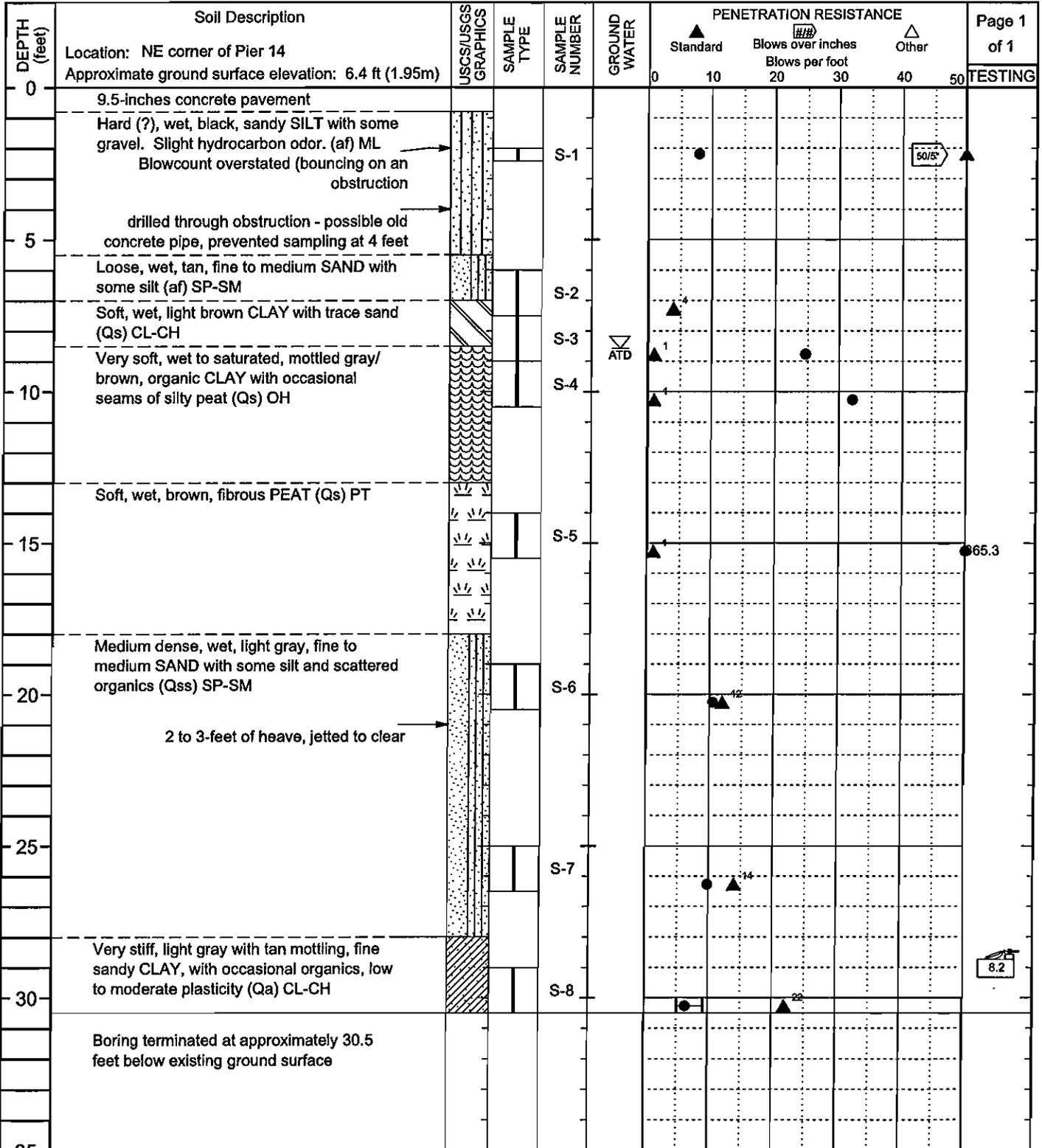
LEGEND

[Symbol] 2.00-Inch OD split-spoon sampler

[Symbol] Groundwater level at time of drilling



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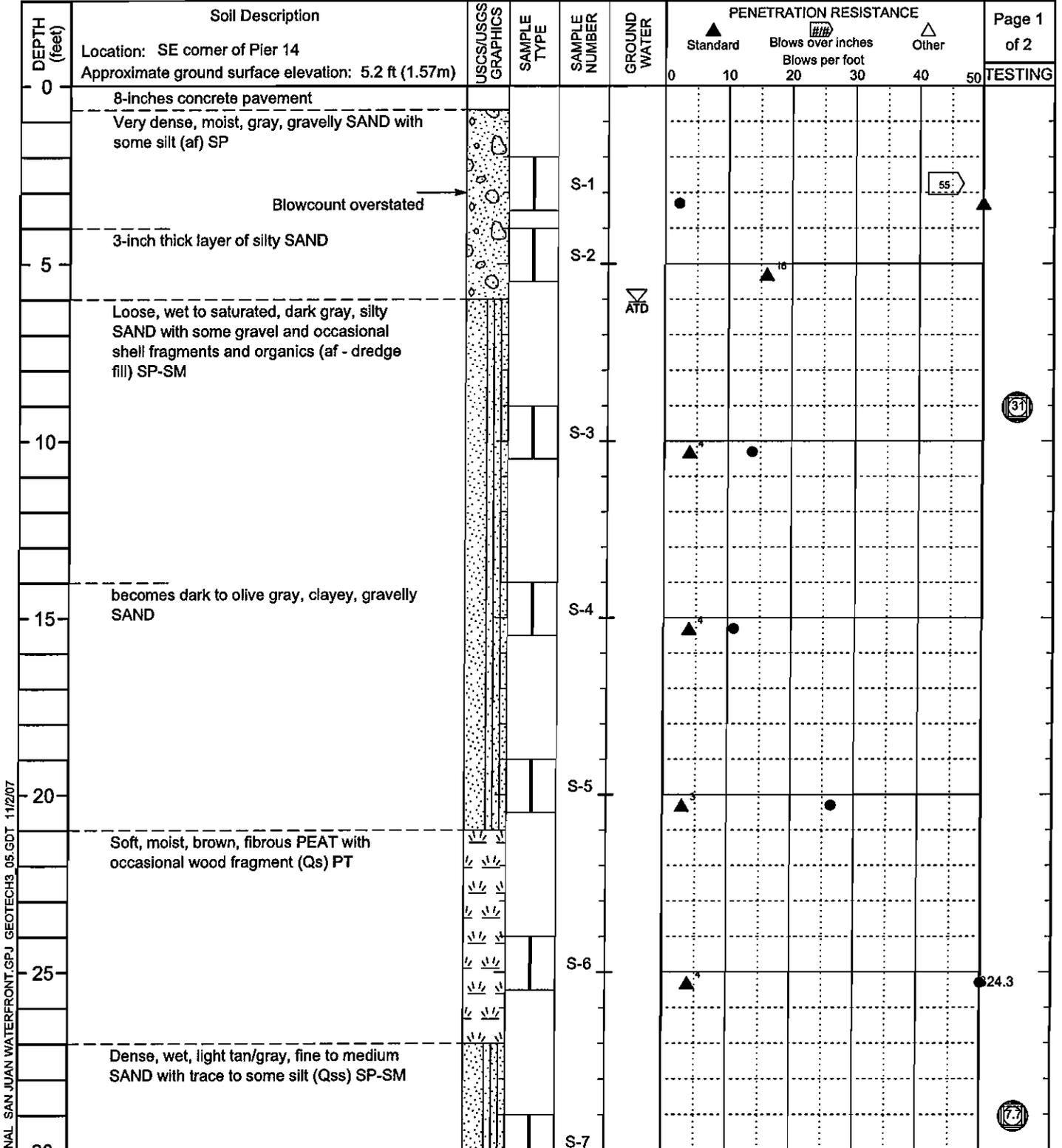
ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- 2.00-inch OD split-spoon sampler
- Groundwater level at time of drilling
- Atterberg Test (PI shown)



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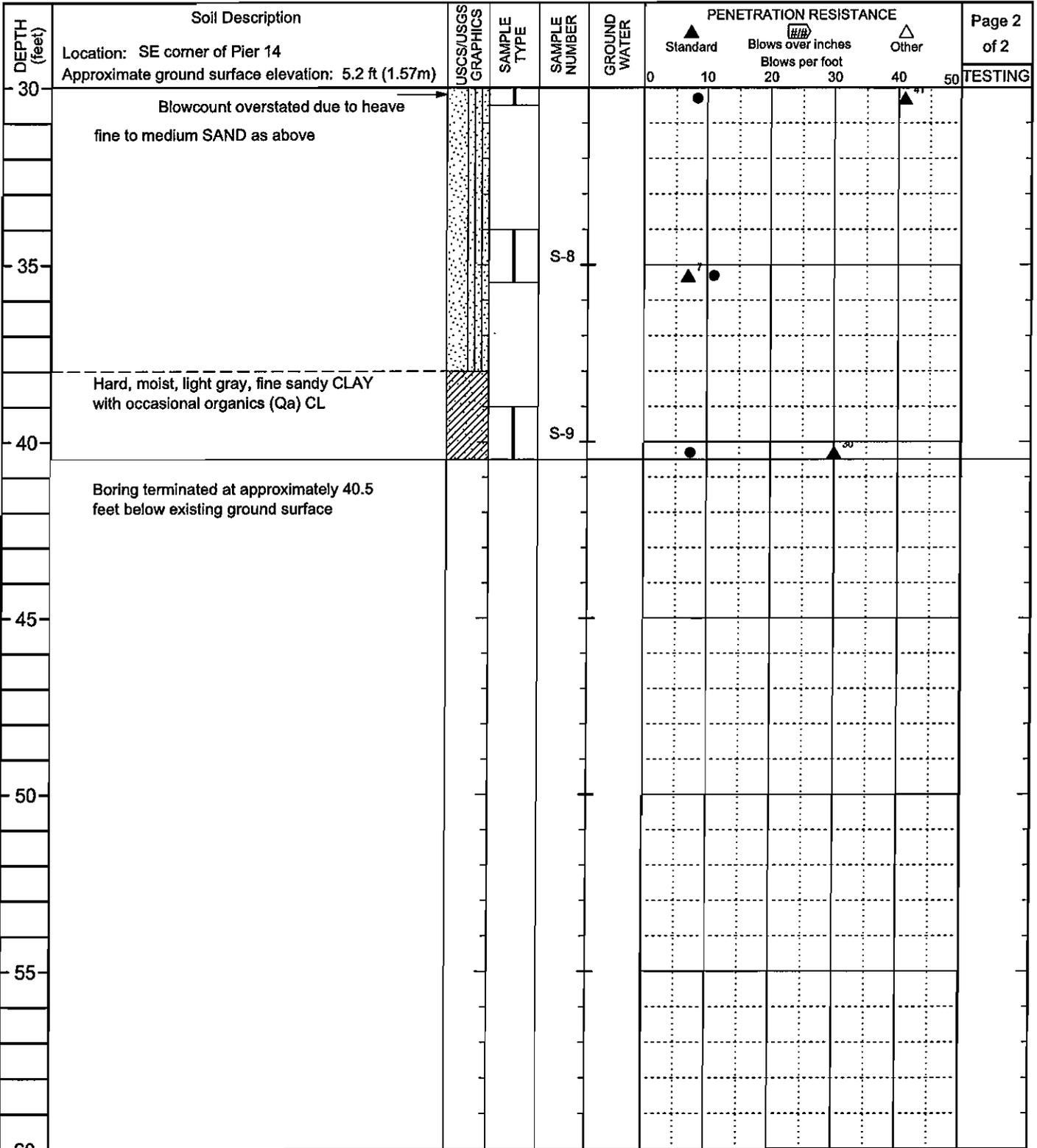
LEGEND

- 2.00-inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)



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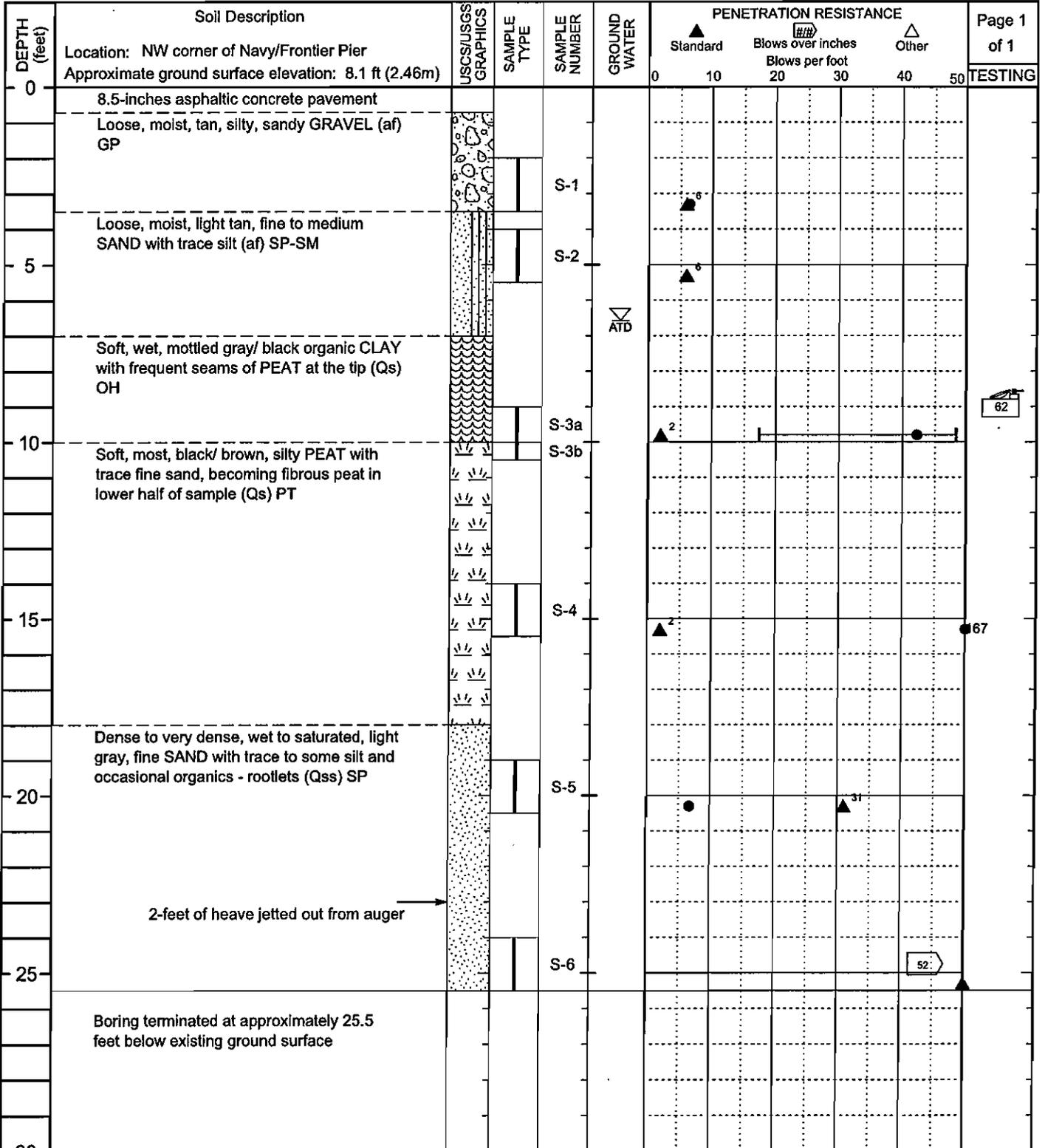
LEGEND

-  2.00-inch OD split-spoon sampler
-  Groundwater level at time of drilling
-  Grain Size Analysis (% fines shown)



ST SOIL ROCK COMBO_FINAL_SAN JUAN WATERFRONT.GPJ GEOTECH3 05.GDT 11/2/07

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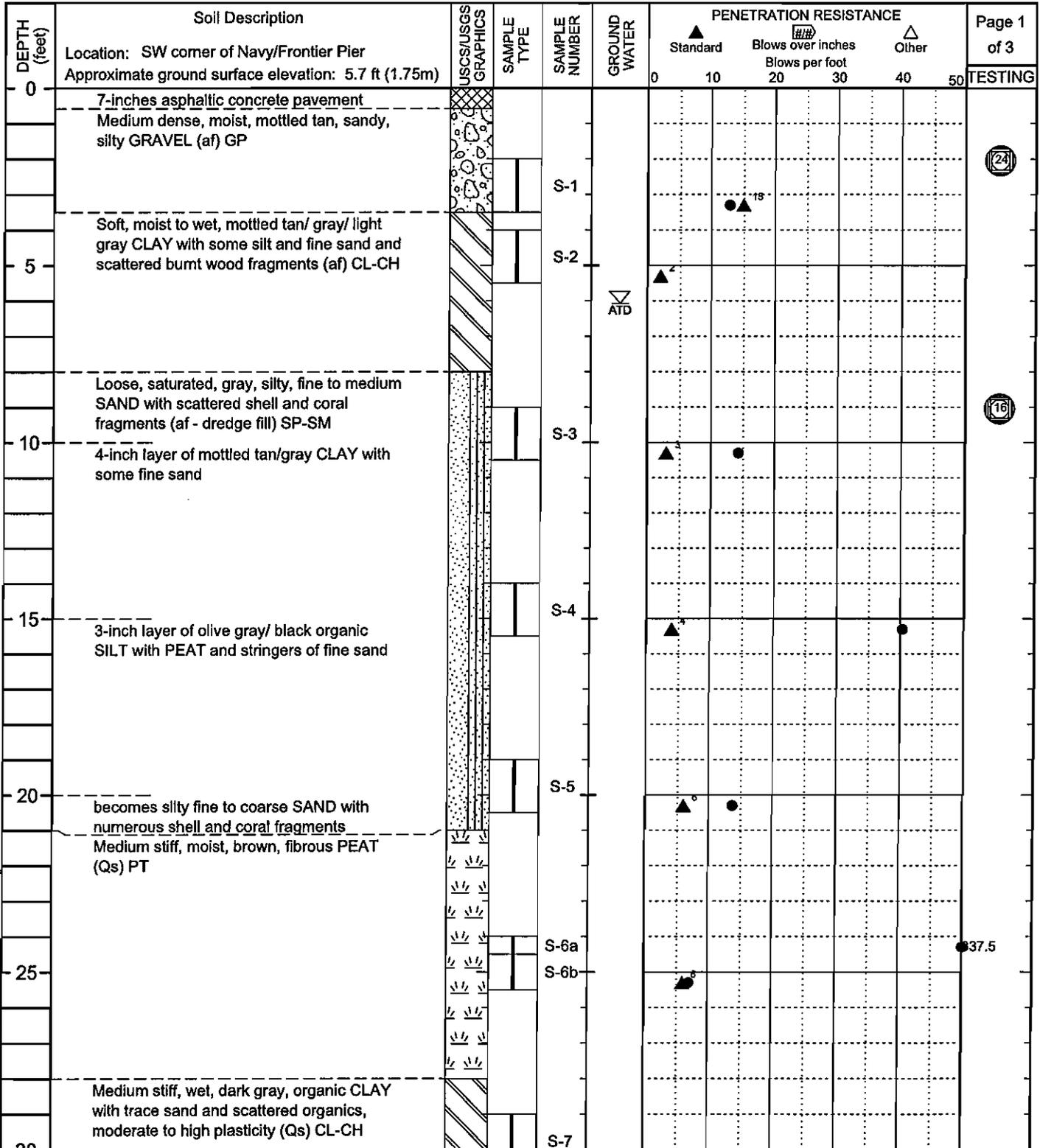
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LEGEND

- 2.00-Inch OD split-spoon sampler
- Groundwater level at time of drilling
- Atterberg Test (PI shown)



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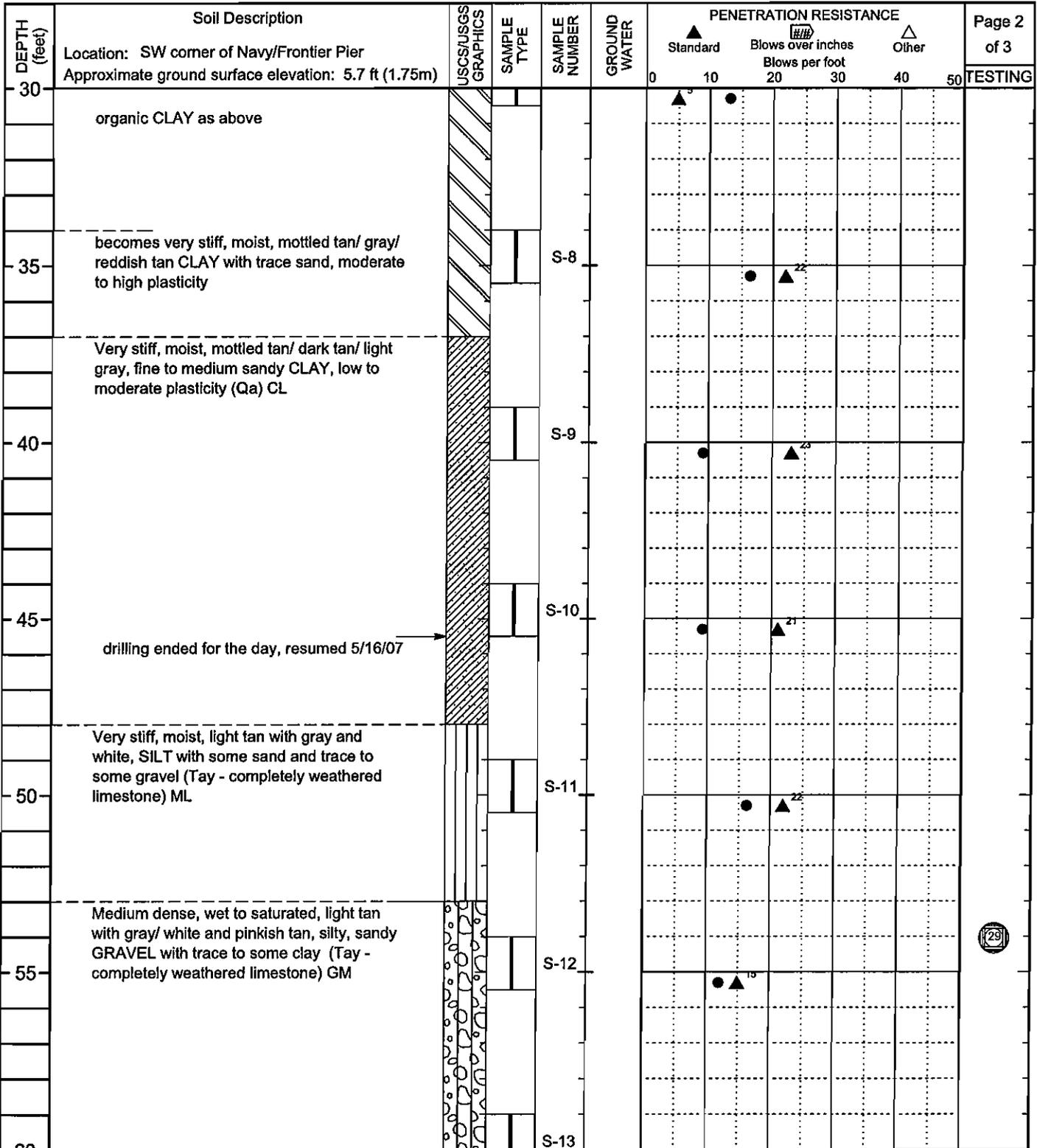
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LEGEND

- 2.00-inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)



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LEGEND

- 2.00-inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)



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DEPTH (feet)	Soil Description Location: SW corner of Navy/Frontier Pier Approximate ground surface elevation: 5.7 ft (1.75m)	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE			Page 3 of 3
						Standard ▲	Blows over inches Blows per foot ■	Other △	
60	becomes dense, moist, fine SAND with some gravel and trace to some silt			S-14		●	▲		TESTING
65	becomes medium dense, silty SAND with some gravel					●	▲		
70	Boring terminated at approximately 65.5 feet below existing ground surface								
75									
80									
85									
90									

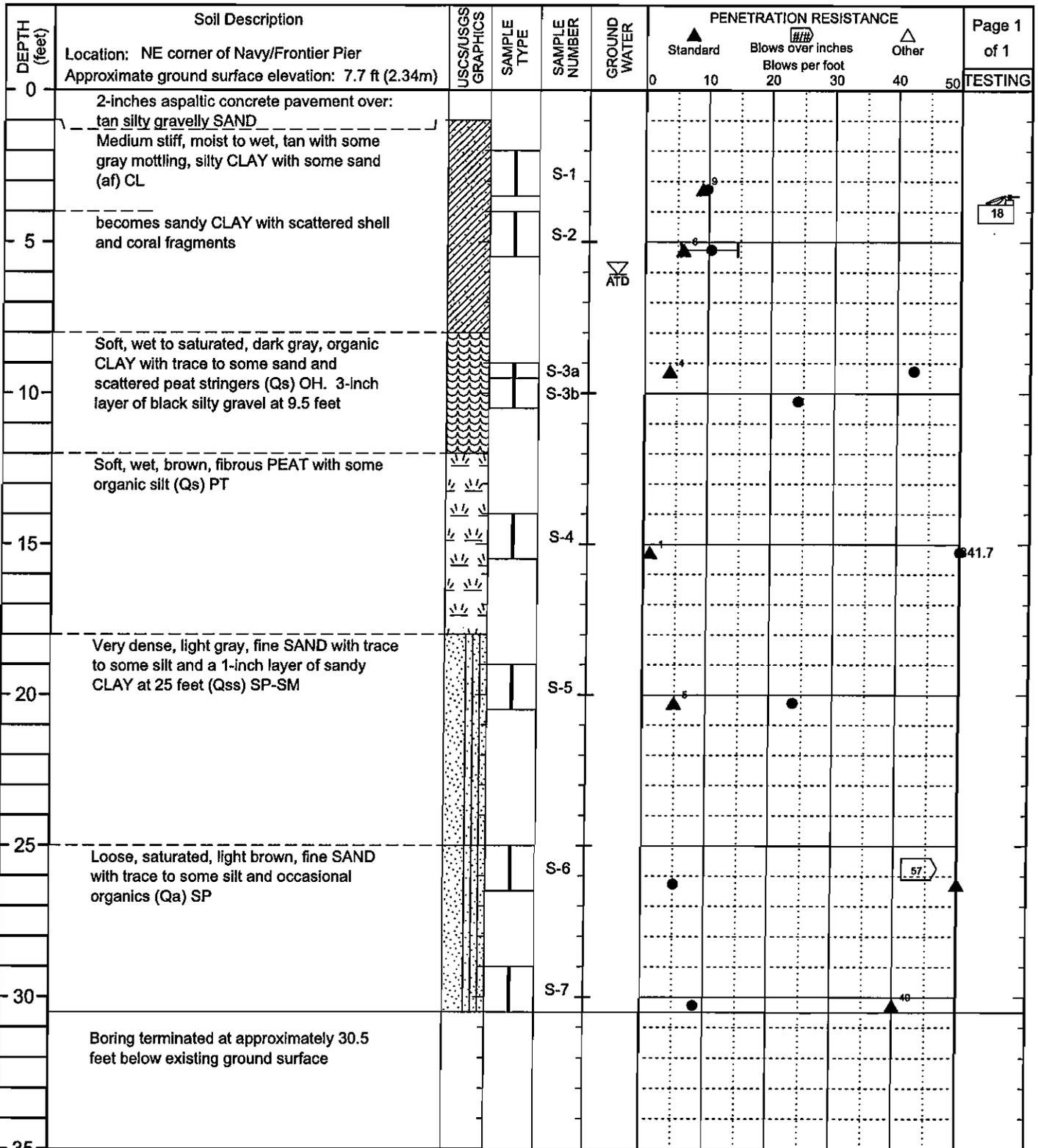
LEGEND

- 2.00-Inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)



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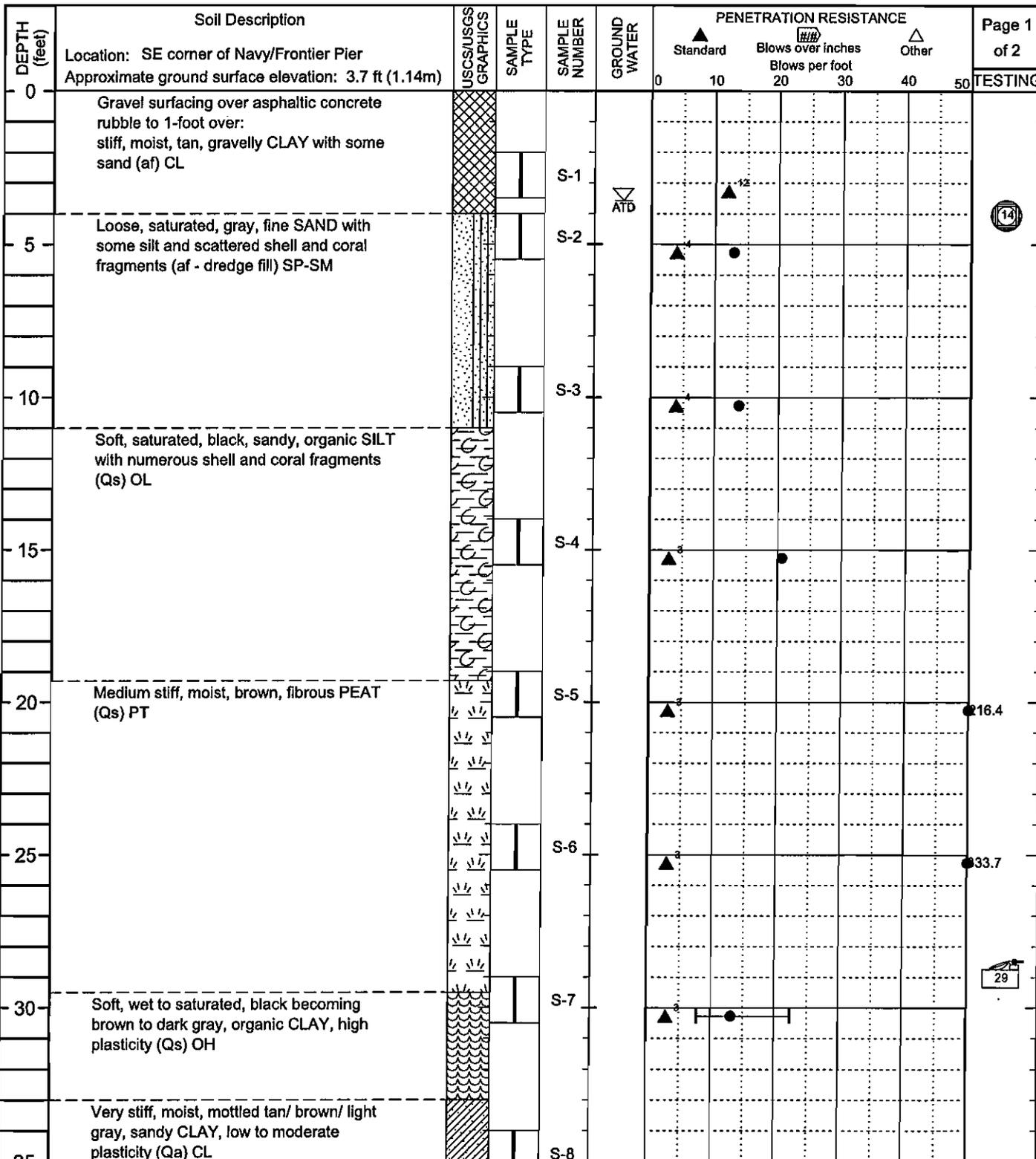
LEGEND

- 2.00-inch OD split-spoon sampler
- Groundwater level at time of drilling
- Atterberg Test (PI shown)



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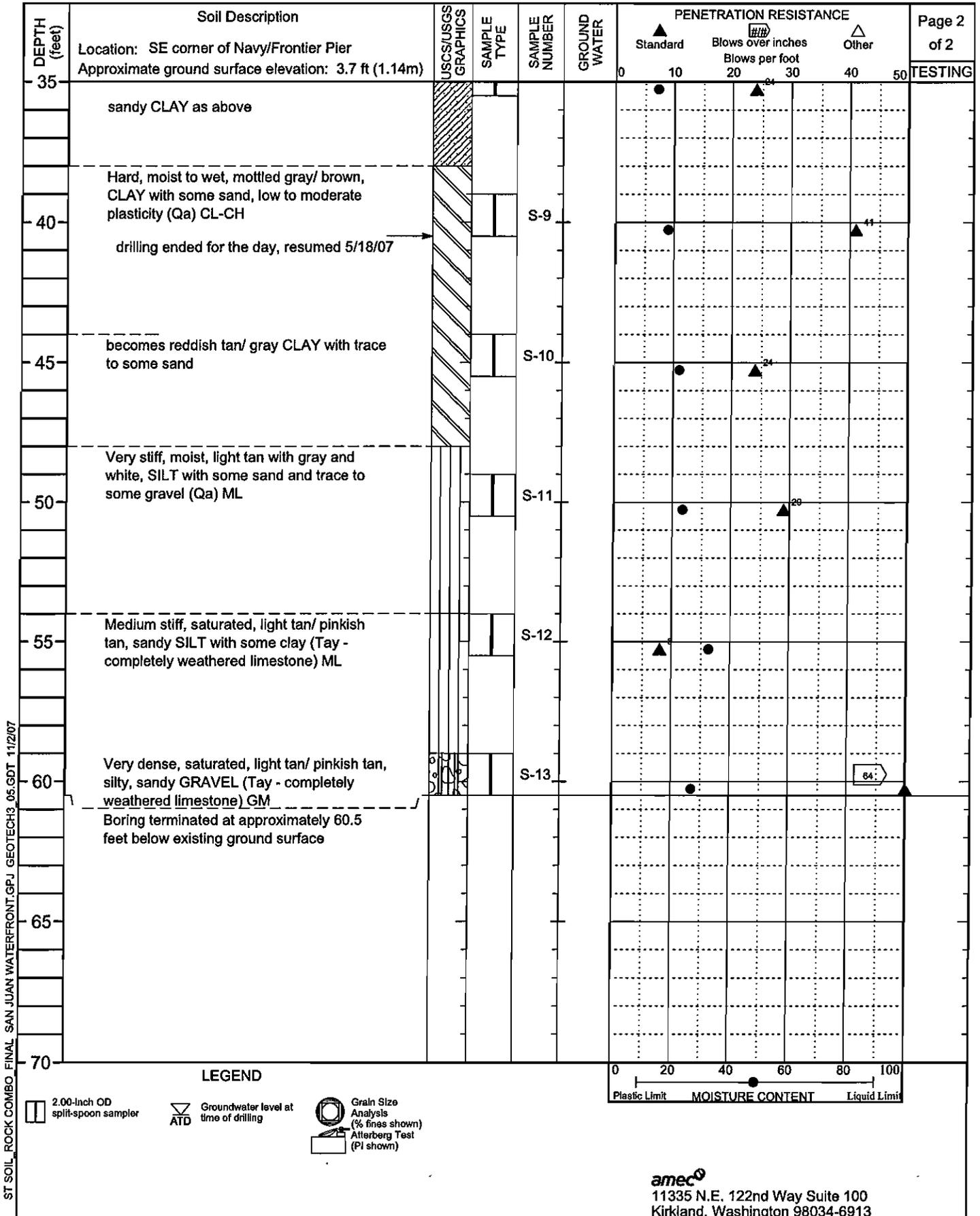
LEGEND

- 2.00-Inch OD split-spoon sampler
- Groundwater level at time of drilling
- Grain Size Analysis (% fines shown)
- Atterberg Test (PI shown)



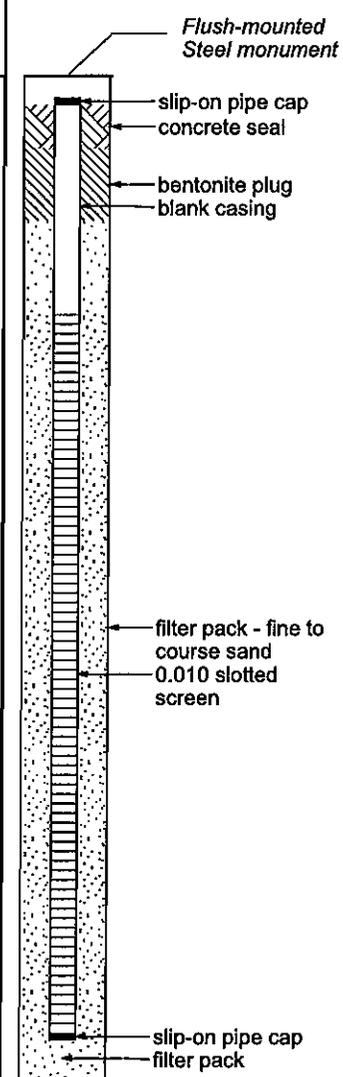
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Elevation reference:		Well completed: May 21, 2007					AS-BUILT DESIGN	
Ground surface elevation:		Casing elevation:						
DEPTH (feet)	SOIL DESCRIPTION	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	QVM READING	GROUND WATER	Page 1 of 1
0	10-inches concrete pavement							TESTING
	Dense (?), moist, tan/brown, clayey GRAVEL with some sand (af) GC - from cuttings							
	Blowcount overstated - bouncing on rock			S-1	36			
	Medium dense, saturated, gray, fine to medium SAND with some silt and numerous shell fragments (af - dredge fill) SP			S-2	11			
5								
	Soft, wet to saturated, brown, fibrous PEAT with trace fine sand (Qs) PT			S-3	3			
10								
15	Boring terminated at approximately 14 feet below existing ground surface							
20								



ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- No Recovery
- Observed groundwater level
- 2.00-inch OD spill-spoon sampler

Observation well:

- Monument
- Bentonite Fill with PVC Pipe
- Groundwater Level
- Sand Fill with Slotted PVC Pipe
- Pipe Cap Slough at Bottom of Hole

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Elevation reference:
Ground surface elevation: 6 Feet

Well completed: May 18, 2007
Casing elevation:

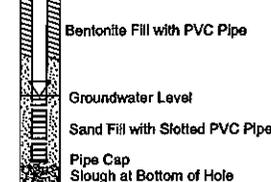
AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	AS-BUILT DESIGN	
								TESTING	Page 1 of 1
0	3-inches asphaltic concrete pavement Medium stiff, moist, mottled tan/reddish tan, clayey SAND/ sandy CLAY (af) CL	[Hatched pattern]						Flush-mounted Steel monument	
				S-1	6			slip-on pipe cap	
								concrete seal	
								blank casing bentonite plug	
5	Soft, wet to saturated, gray/tan, sandy SILT (Qa) ML	[Dotted pattern]		S-2	2				
10	Medium stiff, wet, dark gray, sandy CLAY (Qa) CL	[Diagonal hatched pattern]		S-3	4			filter pack - fine to coarse sand	
								0.010 slotted screen	
15	Boring terminated at approximately 15 feet below existing ground surface							slip-on pipe cap filter pack	
20									

LEGEND

- [Hatched pattern] 2.00-Inch OD split-spoon sampler
- [Dotted pattern] Observed groundwater level

Observation well:
Monument



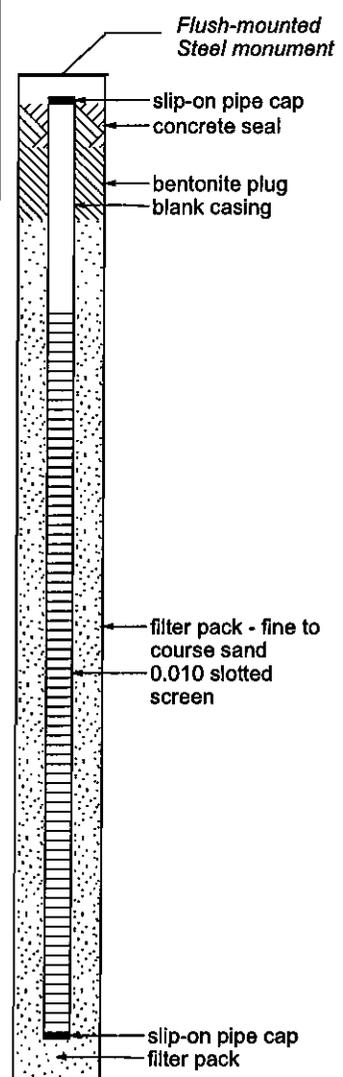
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Elevation reference:
 Well completed: May 21, 2007
 Ground surface elevation:
 Casing elevation:

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER
0	10-inches concrete pavement						
0 - 4	Dense, moist, dark gray to dark brown, fine to coarse SAND, trace clay with scattered coal, brick fragments and organics (af) SP	[Stippled pattern]	[Split spoon sampler]	S-1	42		
4 - 9	Medium dense, moist to wet dark gray, fine to coarse SAND with trace clay and occasional organics (af-dredge fill) SP	[Stippled pattern]	[Split spoon sampler]	S-2	10		
9 - 14	Soft, wet to saturated, brown, fibrous PEAT with trace fine sand (Qs) PT	[Wavy line pattern]	[Split spoon sampler]	S-3	2		
14 - 20	Boring terminated at approximately 14 feet below existing ground surface						



Page 1 of 1
 TESTING

LEGEND

- [Stippled pattern] 2.00-inch OD split-spoon sampler
- [Wavy line pattern] Observed groundwater level

Observation well:

- Monument
- Bentonite Fill with PVC Pipe
- Groundwater Level
- Sand Fill with Slotted PVC Pipe
- Pipe Cap
- Slough at Bottom of Hole

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ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

Elevation reference:		Well completed: May 22, 2007						AS-BUILT DESIGN	
Ground surface elevation:		Casing elevation:							
DEPTH (feet)	SOIL DESCRIPTION	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	QVM READING	GROUND WATER	AS-BUILT DESIGN	
0	2.5-inches asphaltic concrete pavement over 5.5-inches concrete (NOTE: soil description and sample information from AB-9, 3' south) Soft, wet, mottled tan/black, silty CLAY with some gravel. 1-inch layer of organic silt with numerous shell fragments within lower portion of sample (QS) CL-ML	[Hatched pattern]		S-1	3			Flush-mounted Steel monument	Page 1 of 1
5	becomes very soft, wet, dark brown to black, silty, organic CLAY with frequent stringers of peat (Qs) OH Soft to very soft, moist to wet, black PEAT with trace to some fine sand (Qs) PT	[Downward arrow pattern]		S-2	0			slip-on pipe cap	TESTING
10		[Downward arrow pattern]		S-3	3			concrete seal	
15	Boring terminated at approximately 14 feet below existing ground surface							bentonite plug blank casing	
20								filter pack - fine course sand	
								0.010 slotted screen	
								slip-on pipe cap	
								filter pack	
								Well No.	

ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3.05.GDT 11/2/07

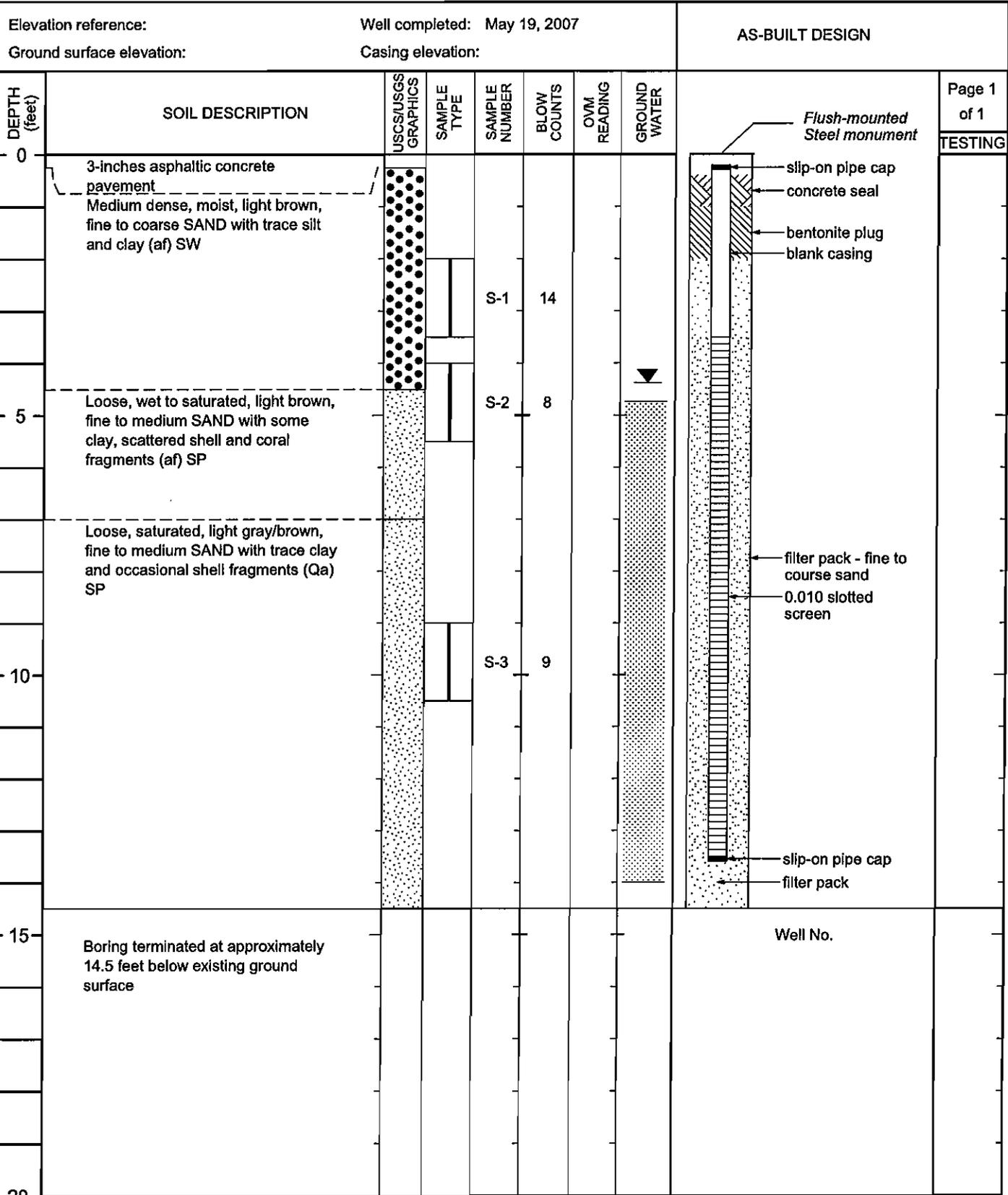
LEGEND

-  2.00-inch OD split-spoon sampler
-  Observed groundwater level

Observation well:

-  Monument
-  Bentonite Fill with PVC Pipe
-  Groundwater Level
-  Sand Fill with Slotted PVC Pipe
-  Pipe Cap
-  Slough at Bottom of Hole

11335 O.E. 122nd Way Suite 100
 Kirkland, Washington 98034-6913



ST SOIL ROCK COMBO FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3 05.GDT 11/2/07

LEGEND

- 2.00-inch OD split-spoon sampler
- Observed groundwater level

- Observation well:**
- Monument
 - Bentonite Fill with PVC Pipe
 - Groundwater Level
 - Sand Fill with Slotted PVC Pipe
 - Pipe Cap
 - Slough at Bottom of Hole

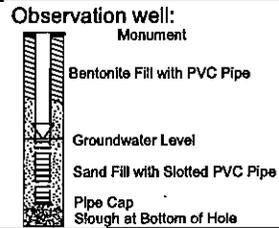
11335 N.E. 122nd Way, Suite 100
 Kirkland, Washington 98034-6913

Elevation reference: Well completed: May 19, 2007
 Ground surface elevation: Casing elevation:

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	QVM READING	GROUND WATER	AS-BUILT DESIGN	Page 1 of 1
0	1.2 feet Concrete pavement (NOTE: soil description and sample information from AB-13)							Flush-mounted Steel monument slip-on pipe cap concrete seal bentonite plug blank casing	TESTING
0 - 2.5	Stiff, moist, mottled tan/ gray, silty, sandy CLAY with occasional organics (af) CL-ML Hand excavated to 2.5 feet			S-1	10				
2.5 - 5	Loose, wet to saturated, mottled brown, silty SAND with trace to some clay. Noted moderate petroleum odor (af) SM			S-2	4				
5 - 10	Very soft, wet to saturated, mottled tan, sandy CLAY/ clayey SAND with scattered shell and coral fragments (af - dredge fill) CL			S-3	1			filter pack - fine to coarse sand 0.010 slotted screen	
10 - 16								slip-on pipe cap	
16 - 20	Well completed within same hole as for AB-13. Formation allowed to collapse (16 feet remained open) then set well. Boring originally terminated at approximately 50.5 feet below existing ground surface							filter pack	

LEGEND



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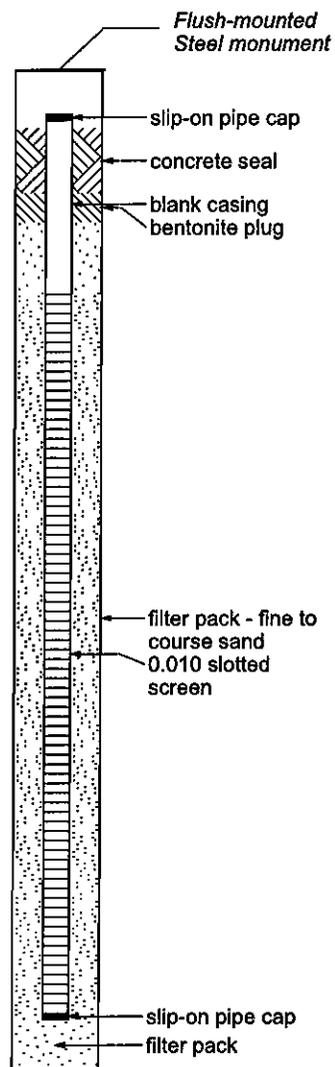
ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3 05.GDT 11/2/07

Elevation reference:
 Ground surface elevation: 6 Feet

Well completed: May 19, 2007
 Casing elevation:

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	9-inches asphaltic concrete pavement							
0 - 4	Loose, moist to wet, light brown, fine to medium SAND with some gravel and scattered brick fragments (af) SP	[Stippled pattern]		S-1	8			
4 - 10	Medium dense, wet to saturated, gray, fine to coarse SAND with some silt (Qa) SW	[Stippled pattern]		S-2	12			
10 - 14				S-3	6			
14 - 15	Boring terminated at approximately 14 feet below existing ground surface							



Page 1 of 1

ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT_11/2/07

LEGEND

- 2.00-inch OD split-spoon sampler
- Observed groundwater level

Observation well: Monument

- Bentonite Fill with PVC Pipe
- Groundwater Level
- Sand Fill with Slotted PVC Pipe
- Pipe Cap
- Slough at Bottom of Hole

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 Kirkland, Washington 98034-6913

Elevation reference: Well completed: May 21, 2007
 Ground surface elevation: Casing elevation: AS-BUILT DESIGN

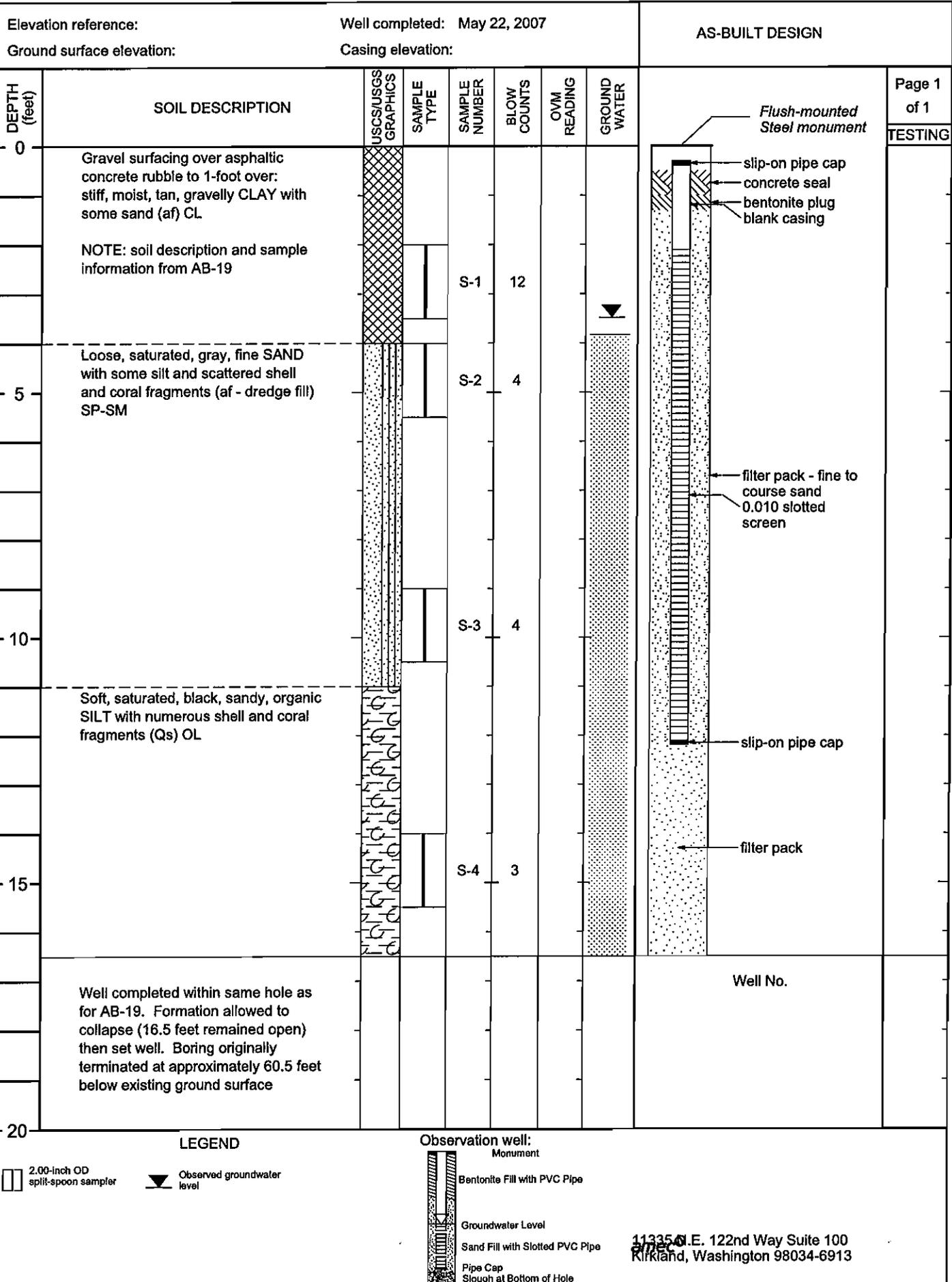
DEPTH (feet)	SOIL DESCRIPTION	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	AS-BUILT DESIGN	Page 1 of 1
0	8.5-inches asphaltic concrete pavement (NOTE: soil description and sample information from AB-16) Loose, moist, tan, silty, sandy GRAVEL (af) GP			S-1	6			Flush-mounted Steel monument slip-on pipe cap concrete seal blank casing bentonite plug	TESTING
5	Loose, moist, light tan, fine to medium SAND with trace silt (af) SP-SM			S-2	6				
10	Soft, wet, mottled gray/ black organic CLAY with frequent seams of PEAT at the tip (Qs) OH			S-3	2			filter pack - fine to coarse sand 0.010 slotted screen	
15	Well completed within same hole as for AB-16. Boring originally terminated at approximately 25.5 feet below existing ground surface							slip-on pipe cap filter pack	Well No.

ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- 2.00-inch OD split-spoon sampler
- Observed groundwater level
- Observation well: Monument
- Bentonite Fill with PVC Pipe
- Groundwater Level
- Sand Fill with Slotted PVC Pipe
- Pipe Cap
- Slough at Bottom of Hole

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 amec



ST SOIL ROCK COMBO_FINAL SAN JUAN WATERFRONT.GPJ GEOTECH3_05.GDT 11/2/07

LEGEND

- 2.00-inch OD split-spoon sampler
- Observed groundwater level

Observation well: Monument

- Bentonite Fill with PVC Pipe
- Groundwater Level
- Sand Fill with Slotted PVC Pipe
- Pipe Cap
- Slough at Bottom of Hole

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Kirkland, Washington 98034-6913

APPENDIX B

Laboratory Testing Procedures and Results

APPENDIX B
LABORATORY TESTING PROCEDURES AND RESULTS
7-660-00004

The following paragraphs describe our procedures associated with the laboratory tests that were conducted for this project. All laboratory testing was performed by a local geotechnical company, under subcontract to AMEC. Graphical results of certain laboratory tests are enclosed in this appendix.

Visual Classification Procedures

Visual soil classifications were conducted on all samples in the field. All soils were classified in general accordance with the United Soil Classification System, which includes color, relative moisture content, primary soil type (based on grain size), and any accessory soil types. The resulting soil classifications are presented on the exploration logs contained in Appendix A.

Moisture Content Determination Procedures

Moisture content determinations were performed on all samples to aid in identification and correlation of soil types. All determinations were made in general accordance with ASTM:D-2216. The results of these tests are shown on the exploration logs contained in Appendix A.

Atterberg Limit Determination Procedures

Atterberg limits are used primarily for classifying and indexing cohesive soils. The liquid and plastic limits, which are defined as the moisture contents of a cohesive soil at arbitrarily established limits for liquid and plastic behavior, respectively, were determined for selected samples in general accordance with ASTM:D-423 and ASTM:D-414. The results of these tests are presented on the enclosed Atterberg limit graphs and on the exploration logs contained in Appendix A.

Grain Size Analysis Procedures

A grain size analysis indicates the range of soil particle diameters included in a particular sample. Grain size analyses were performed on representative samples in general accordance with ASTM:D-422. The results of these tests are presented on the enclosed grain-size distribution graphs and were used in soil classifications shown on the exploration logs contained in Appendix A.

**GEOTECHNICAL DRILLING SERVICES
FOR SAN JUAN WATERFRONT PROJECT
SAN JUAN, PUERTO RICO
JOB NO. 3640-07
JUNE 11, 2007**



LUIS O. GARCIA & ASSOCIATES
GEOTECHNICAL ENGINEERING CONSULTANTS

Partners

Luis Oscar García, MSCE, CE, PE
Carlos García Echevarría, MSCE, PE
James A. Balgés, MSCE, PE

Associate

Alejandro E. Soto, MS, PG

June 11, 2007

Mr. Jim Dransfield, P.E.
AMEC Earth & Environmental, Inc.
11335 NE 122nd Way
Kirkland, WA 98034

**RE: Geotechnical Drilling Services for
San Juan Waterfront Project,
San Juan, P.R.**

Dear Mr. Dransfield:

We have completed the geotechnical testing and laboratory testing program for the project of reference as per your request.

The geotechnical drilling and laboratory testing program consisted of the following:

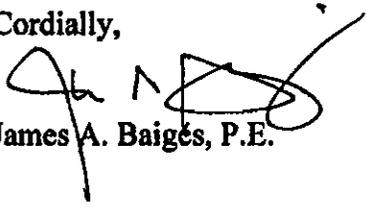
- **Drilling 19 soil borings, AB-1 to AB-19 to depths ranging from 35 to 75 feet as detailed in Table No. 1**
- **Installing, 9 observation wells, AW-1 to AW-7, and AW-9 and AW-10 were also installed to 13 ft depth with a 10-ft screened bottom section as detailed in Table No. 1. Observation Well AW-6 was installed in borehole AB-13. Observation Wells AW-9 and AW-10 were installed adjacent to boring AB-16 and AB-19 as instructed by AMEC field geologist.**
- **Perform water content tests on all samples collected within the borings as presented in Table No. 2**
- **Performing 11 Atterberg Limits tests and 18 Grain-size distribution tests as per required schedule provide by AMEC as summarized in Table No. 3 and in Appendix A**



*Geotechnical Drilling Services for San Juan Waterfront Project,
San Juan, P.R.
June 11, 2007*

We are also submitting our invoice for services rendered. We are available to answer any questions regarding the information and test results herein provided. In addition, we appreciate the opportunity you have given us to assist in this project and looking forward to work again with you in the future.

Cordially,


James A. Baigés, P.E.

Attachments:

Invoice 14629-07

Table 1 - General Boring Information

Table 2 – Results of Water Content Tests

Table 3 – Results of Atterberg Limits and Grain-Size Distribution Tests

Appendix A – Detailed Results of Grain-Size Distribution Tests

**Table 1. Summary of Exploration Schedule for
San Juan Waterfront Project, San Juan, P.R.
Geo Cim Job 3460-07**

Boring No.	Depth (ft)
AB-1	35
AB-2	35
AB-3	35
AB-4	35
AB-5	45
AB-6	60
AB-7	75
AB-8	50
AB-9	30
AB-10	30
AB-11	25
AB-12	30
AB-13	50
AB-14	30
AB-15	40
AB-16	25
AB-17	65
AB-18	30
AB-19	60
Total	785

Obs. Well No.	Depth (ft)
AW-1	13
AW-2	13
AW-3	13
AW-4	13
AW-5	13
AW-6 (see note 1)	13
AW-7	13
AW-9 (see note 2)	13
AW-10 (see note 2)	12

Notes:

1. Observation well AW-6 was installed in borehole AB-13 as instructed by AMEC field representative.

2. Observation wells AW-9 and AW-10 were installed adjacent to boreholes AB-16, and AB-19 as instructed by AMEC field representative.

**Table 2. Summary of Water Content Test Results
San Juan Waterfront Project, San Juan, P.R.
Geo Cim Job 3460-07**

Borehole	Depth	Water Content (%)
AB-01	2	2.8
AB-01	9	30
AB-01	14	58.2
AB-01	19	46.3
AB-01	19.5	53.5
AB-01	24	15.5
AB-01	29	11.3
AB-01	34	13.9
AB-02	2	9.4
AB-02	14	47.9
AB-02	19	43.1
AB-02	24	39
AB-02	24.5	31.3
AB-02	29	12.7
AB-02	34	13.5
AB-03	2	49.1
AB-03	4	321.6
AB-03	9	219.2
AB-03	14	57.1
AB-03	19	15.2
AB-03	24	14.3
AB-03	29	15.4
AB-03	34	12.7
AB-04	2	58.6
AB-04	4	64.1
AB-04	9	91.1
AB-04	14	73.9
AB-04	19	35.9
AB-04	19.5	436.8
AB-04	24	29.7
AB-04	29	21.1
AB-04	34	15.7
AB-05	4	20.1
AB-05	9	131.3
AB-05	14	16.6
AB-05	19	14.3
AB-05	24	20.1
AB-05	29	22
AB-05	34	23.2
AB-05	39	17.8
AB-05	44	18.4
AB-06	7	15
AB-06	9	23.4
AB-06	14	16.5
AB-06	19	22.3
AB-06	24	14.2

Borehole	Depth	Water Content (%)
AB-10	1.5	17.7
AB-10	7	40.8
AB-10	9	33.5
AB-10	10.5	202.6
AB-10	14	16.2
AB-10	19	16.7
AB-10	24	11.3
AB-10	29.5	12.7
AB-11	4	18.8
AB-11	4.5	23.1
AB-11	9	25
AB-11	14	23.3
AB-11	19	25.8
AB-11	24	12.5
AB-12	4	17
AB-12	9	22.1
AB-12	14	22.7
AB-12	14.5	186.3
AB-12	19	402
AB-12	24	20.2
AB-12	29	21.1
AB-13	2.5	18.2
AB-13	9	29.3
AB-13	14	30.1
AB-13	19	335.2
AB-13	24	381.2
AB-13	29	14.6
AB-13	34	18
AB-13	39	21.8
AB-13	44	18.6
AB-13	49	19.2
AB-14	2	15.8
AB-14	7.5	49.5
AB-14	9	64.2
AB-14	14	365.3
AB-14	19	21
AB-14	24	19.6
AB-14	29	12.8
AB-15	2	4.5
AB-15	9	27.5
AB-15	14	21.9
AB-15	19	52.8
AB-15	24	324.3
AB-15	29	16.8
AB-15	34	22.1
AB-15	39	14.8

**Table 2. Summary of Water Content Test Results
San Juan Waterfront Project, San Juan, P.R.
Geo Cim Job 3460-07**

Borehole	Depth	Water Content (%)
AB-06	29	31.6
AB-06	34	19.7
AB-06	39	24.2
AB-06	44	16.6
AB-06	49	18.6
AB-06	54	23.3
AB-06	54.5	33.3
AB-06	59	29.3
AB-07	2	17.5
AB-07	9	28
AB-07	14	38.8
AB-07	19	55.9
AB-07	24	15.7
AB-07	29	16.5
AB-07	34	12.4
AB-07	39	18
AB-07	44	15.8
AB-07	49	16.5
AB-07	54	16.4
AB-07	54.5	31.8
AB-07	59	25.6
AB-07	64	26.1
AB-07	69	19.1
AB-07	74	32.9
AB-08	2.5	37.9
AB-08	4.5	58.6
AB-08	9	25.3
AB-08	14	16
AB-08	19	15.5
AB-08	24	14.8
AB-08	29	15.3
AB-08	34	17.6
AB-08	39	13.7
AB-08	44	24.3
AB-08	44.5	24.8
AB-08	49	24.6
AB-09	2	24.8
AB-09	4	47.3
AB-09	9	59.4
AB-09	14	395
AB-09	19	25.5
AB-09	25	19.6
AB-09	29	21.6

Borehole	Depth	Water Content (%)
AB-16	2	12.8
AB-16	9	79.3
AB-16	9.5	84.5
AB-16	14	167
AB-16	19	13.5
AB-17	2	25.7
AB-17	9	28.7
AB-17	14	80.7
AB-17	19	27.5
AB-17	24	337.5
AB-17	24.5	13.9
AB-17	29	26.4
AB-17	34	32.8
AB-17	39	18.3
AB-17	44	18.4
AB-17	49	32.6
AB-17	54	24.1
AB-17	59	15.4
AB-17	64	28.4
AB-18	2	19.5
AB-18	4	20.8
AB-18	9	85.2
AB-18	9.5	48.5
AB-18	14	341.7
AB-18	19	47.5
AB-18	24	10.3
AB-18	29	16.8
AB-19	4	25.8
AB-19	9	27.6
AB-19	14	41.3
AB-19	19	216.4
AB-19	24	333.7
AB-19	29	26.4
AB-19	34	14.5
AB-19	39	18
AB-19	44	22.1
AB-19	49	23.5
AB-19	54	32.7
AB-19	59	27

**Table 3. Summary of Laboratory Test Results
San Juan Waterfront Project, San Juan, P.R.
Geo Cim Job 3460-07**

BORING	SAMPLE NO.	DEPTH (FT)	DESCRIPTION	ATTERBERG LIMITS		
				LL (%)	PL (%)	PI (%)
AB-1	5A	19-20.5	Clayey Sand, trace gravel, trace shell frags..., dark gray			
AB-1	6	24-25.5	Clay, some peat with shell frags..., dark brown to brown.	29.9	11.6	18.3
AB-2	4	14-15.5	Sand, some gravel, little silt, some shell frags..., dark gray.			
AB-2	7	29-30.5	Sand (surrounded), little silt, light gray.			
AB-2	8	34-35.5	Sand, med.-grained, trace silt, light gray.		Non Plastic	
AB-3	5	19-20.5	Clay, some-little sand (med. Grained), light gray.	24.3	11.3	13.0
AB-4	6	24-25.5	Clay (plastic), some sand, trace gravel, gray.			
AB-4	7	29-30.5	Sand, trace silt, light brown to tan			
AB-5	4	14-15.5	Sand, little silt, tan.			
AB-6	5	19-20.5	Clay, trace sand, trace peat, dark brown.	47.4	18.0	29.4
AB-6	7	29-30.5	Clay, reddish brown	81.5	24.4	57.1
AB-7	3	9-10.5	Sand, little silt and gravel, yellowish brown.			
AB-7	6	24-25.5	Sandy clay to clay some sand, yellowish brown	19.6	10.1	9.6
AB-7	15	69-70.5	Gravel, some silty clay, little sand, brownish yellow.			
AB-8	1	2.5-4	Silt, some sand, little gravel, pale yellow to yellowish brown.			
AB-9	6	25-26.5	Sand, little silt, gray.			
AB-9	7	29-30.5	Clay, olive	48.3	17.0	31.3
AB-10	6	14-15.5	Sand, trace silt, dark brown.			
AB-11	4	14-15.5	Sand, trace silt, dark brown.			
AB-11	6	24-25.5	Sand, little silt, light gray.			
AB-14	8	29-30.5	Clay, little sand, olive brown.	18.5	10.34	8.16
AB-15	3	9-10.5	Sand, some silt, little gravel, brown.			
AB-15	7	29-30.5	Sand, trace silt, brown.			
AB-16	3A	9-10.5	Clay, plastic, trace shell frags..., dark gray.	96.9	34.83	62.07
AB-17	1	2-3.5	Gravel (limestone frags.), little sand and silt, pale yellow - yel. brown.			
AB-17	3	9-10.5	Sand, little silt, trace gravel, gray.			
AB-17	12	54-55.5	Gravel (calcareous), little silty sand, pale yellow.			
AB-18	2	4-5.5	Clay, little to some sand, tan.	29.2	11.13	18.07
AB-19	2	4-5.5	Sand, little silt, trace gravel, brown.			
AB-19	7	29-30.5	Clay, little sand, trace shell frags..., gray.	44.9	15.75	29.15

Legend:

LL (%) = Liquid Limit.

PL (%) = Plastic Limit.

PI (%) = Plastic Index.

**Table 3. Summary of Laboratory Test Results
San Juan Waterfront Project, San Juan, P.R.
Geo Cim Job 3460-07**

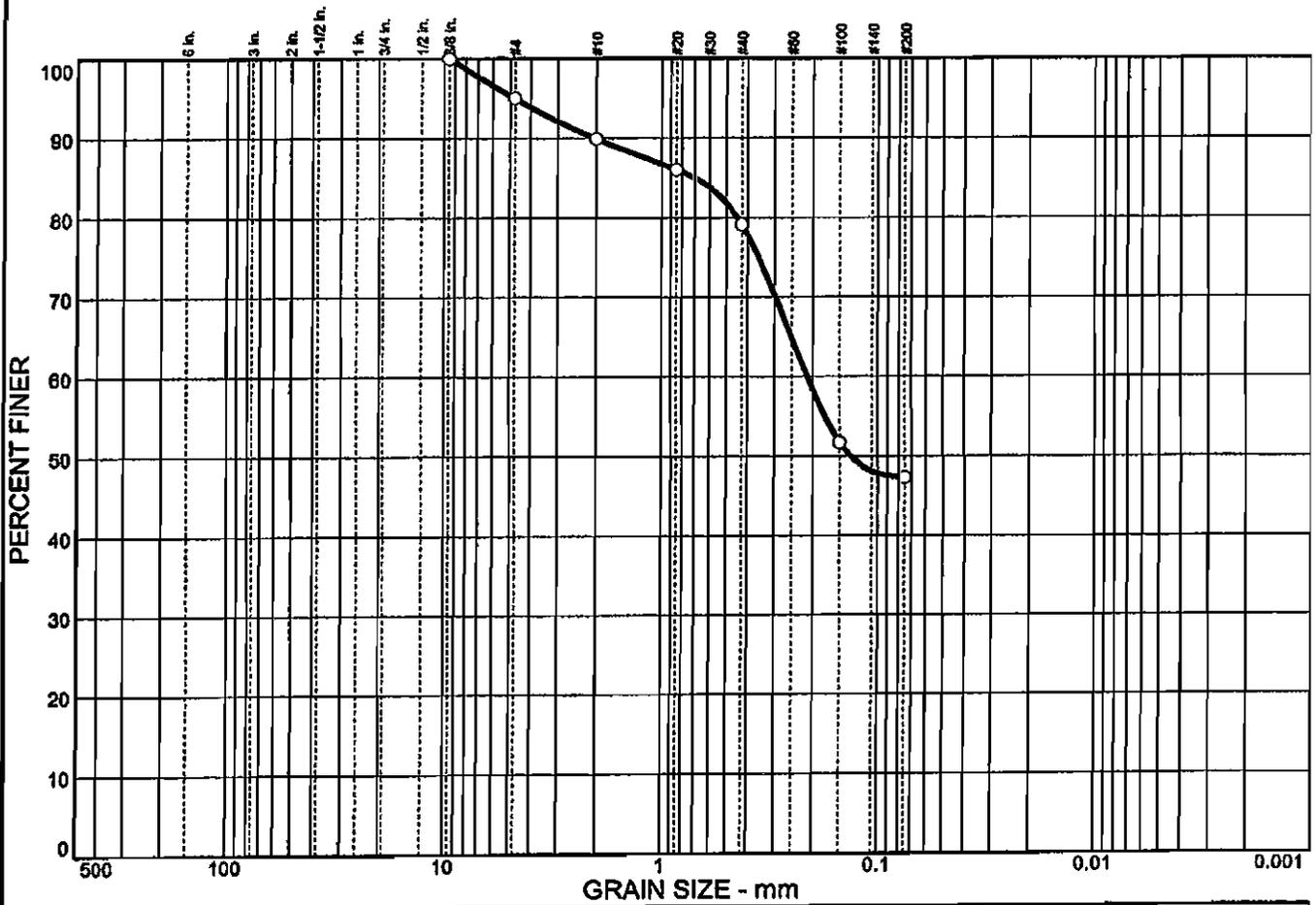
BORING	SAMPLE NO.	DEPTH (FT)	DESCRIPTION	ATTERBERG LIMITS		
				LL (%)	PL (%)	PI (%)
AB-1	5A	19-20.5	Clayey Sand, trace gravel, trace shell frags..., dark gray			
AB-1	6	24-25.5	Clay, some peat with shell frags..., dark brown to brown.	29.9	11.6	18.3
AB-2	4	14-15.5	Sand, some gravel, little silt, some shell frags..., dark gray.			
AB-2	7	29-30.5	Sand (surrounded), little silt, light gray.			
AB-2	8	34-35.5	Sand, med.-grained, trace silt, light gray.		Non Plastic	
AB-3	5	19-20.5	Clay, some-little sand (med. grained), light gray.	24.3	11.3	13.0
AB-4	6	24-25.5	Clay (plastic), some sand, trace gravel, gray.			
AB-4	7	29-30.5	Sand, trace silt, light brown to tan			
AB-5	4	14-15.5	Sand, little silt, tan.			
AB-6	5	19-20.5	Clay, trace sand, trace peat, dark brown.	47.4	18.0	29.4
AB-6	7	29-30.5	Clay, reddish brown	81.5	24.4	57.1
AB-7	3	9-10.5	Sand, little silt and gravel, yellowish brown.			
AB-7	6	24-25.5	Sandy clay to clay some sand, yellowish brown	19.6	10.1	9.6
AB-7	15	69-70.5	Gravel, some silty clay, little sand, brownish yellow.			
AB-8	1	2.5-4	Silt, some sand, little gravel, pale yellow to yellowish brown.			
AB-9	6	25-26.5	Sand, little silt, gray.			
AB-9	7	29-30.5	Clay, olive	48.3	17.0	31.3
AB-10	6	14-15.5	Sand, trace silt, dark brown.			
AB-11	4	14-15.5	Sand, trace silt, dark brown.			
AB-11	6	24-25.5	Sand, little silt, light gray.			
AB-14	8	29-30.5	Clay, little sand, olive brown.	18.5	10.34	8.16
AB-15	3	9-10.5	Sand, some silt, little gravel, brown.			
AB-15	7	29-30.5	Sand, trace silt, brown.			
AB-16	3A	9-10.5	Clay, plastic, trace shell frags..., dark gray.	96.9	34.83	62.07
AB-17	1	2-3.5	Gravel (limestone frags.), little sand and silt, pale yellow - yel. brown.			
AB-17	3	9-10.5	Sand, little silt, trace gravel, gray.			
AB-17	12	54-55.5	Gravel (calcareous), little silty sand, pale yellow.			
AB-18	2	4-5.5	Clay, little to some sand, tan.	29.2	11.13	18.07
AB-19	2	4-5.5	Sand, little silt, trace gravel, brown.			
AB-19	7	29-30.5	Clay, little sand, trace shell frags..., gray.	44.9	15.75	29.15

Legend:

LL (%) = Liquid Limit.
 PL (%) = Plastic Limit.
 PI (%) = Plastic Index.

APPENDIX A
GRAIN-SIZE DISTRIBUTION TESTS

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	5.0	47.7	47.3	47.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	95.0		
#10	89.9		
#20	86.0		
#40	79.1		
#100	51.7		
#200	47.3		

Soil Description

Clayey sand, trace gravel and shell fragments, dark gray.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.702 D₆₀= 0.213 D₅₀= 0.134

D₃₀= D₁₅= D₁₀=

C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

* (no specification provided)

Sample No.: S-5A
Location:

Source of Sample: BORING NO. AB-1

Date: 6/7/2007
Elev./Depth: 19.0'-20.5'

GEO CIM, INC.

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project No: 3640-07
R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-1
Sample No.: S-5A
Elev. or Depth: 19.0' - 20.5' Sample Length (in./cm.):
Location:
Description: Clayey sand, trace gravel and shell fragments, dark gray.
Date: 6/7/2007 PL: LL: PI:
USCS Classification: SM AASHTO Classification:
Testing Remarks:

Mechanical Analysis Data

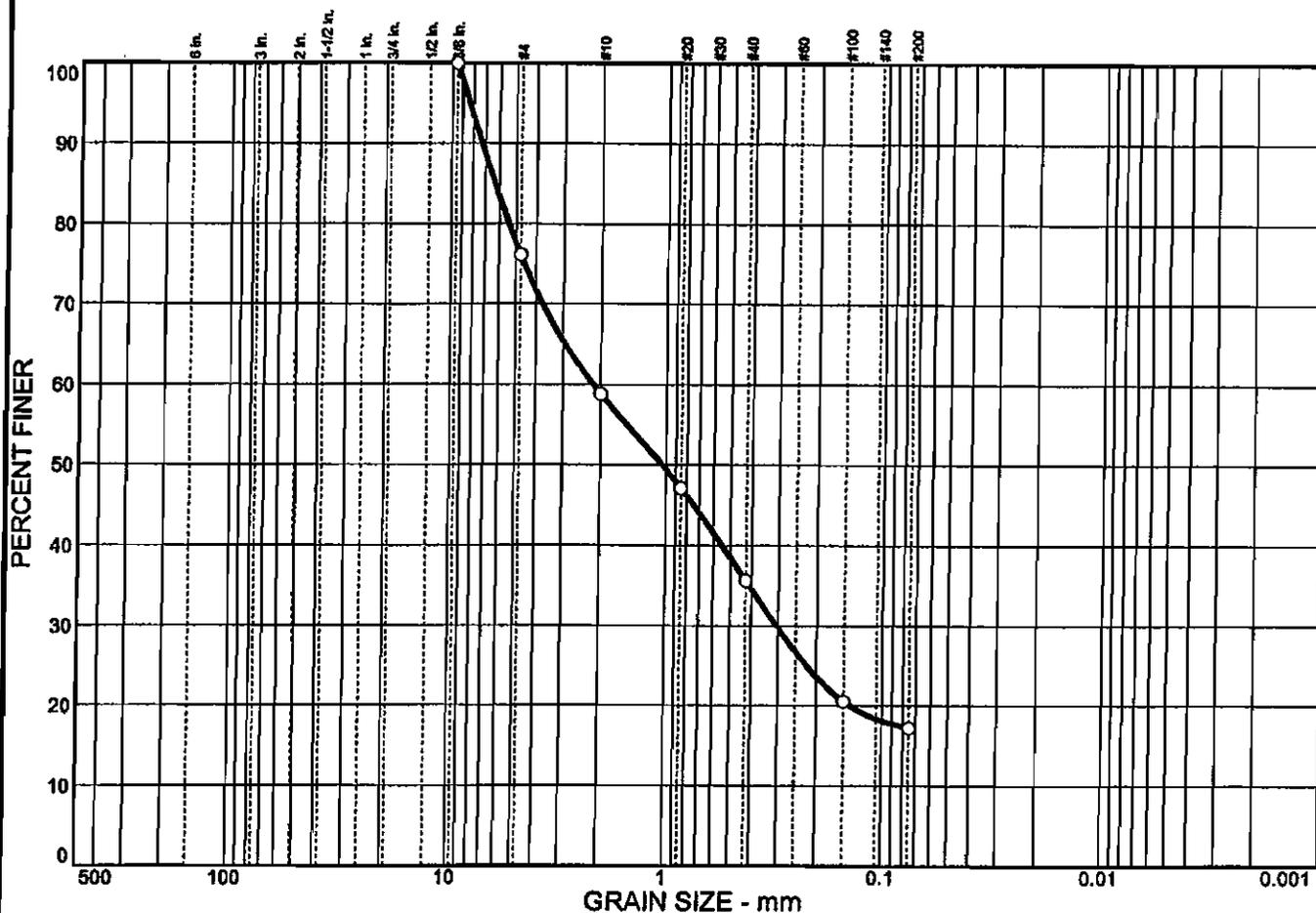
	Initial	After wash	
Dry sample and tare=	94.28	69.59	
Tare =	42.23	42.23	
Dry sample weight =	52.05	27.36	
Minus #200 from wash=	47.4 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
.375 inch	0.00	0.00	100.0
# 4	2.59	0.00	95.0
# 10	2.66	0.00	89.9
# 20	2.05	0.00	86.0
# 40	3.58	0.00	79.1
# 100	14.27	0.00	51.7
# 200	2.28	0.00	47.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 5.0 % SAND = 47.7
% FINES = 47.3

D85= 0.70 D60= 0.21 D50= 0.13

Particle Size Distribution Report



GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-2
Sample No.: 4
Elev. or Depth: 14.0' - 15.5' Sample Length (in./cm.):
Location:
Description: Sand, some gravel and shell fragments, little silt, dark gray.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SM AASHTO Classification: A-1-b
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	128.18	113.12
Tare =	39.38	39.38
Dry sample weight =	88.80	73.74
Minus #200 from wash=	17.0 %	

Sieve	Weight retained	Sieve tare	Percent finer
.375 inch	0.00	0.00	100.0
# 4	21.22	0.00	76.1
# 10	15.40	0.00	58.8
# 20	10.40	0.00	47.1
# 40	10.17	0.00	35.6
# 100	13.42	0.00	20.5
# 200	2.88	0.00	17.2

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 23.9 % SAND = 58.9
% FINES = 17.2

D₈₅ = 6.30 D₆₀ = 2.17 D₅₀ = 1.04
D₃₀ = 0.31

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-2
Sample No.: 7
Elev. or Depth: 29.0' - 30.5' Sample Length (in./cm.):
Location:
Description: Sand (sub rounded), little silt, light gray.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SM AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	140.42	118.69
Tare =	40.17	40.17
Dry sample weight =	100.25	78.52
Minus #200 from wash=	21.7 %	

Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.94	0.00	99.1
# 20	2.55	0.00	96.5
# 40	28.13	0.00	68.5
# 100	41.08	0.00	27.5
# 200	5.61	0.00	21.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 78.1
% FINES = 21.9

D85= 0.63 D60= 0.35 D50= 0.28
D30= 0.17

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-4
Sample No.: 7
Elev. or Depth: 29.0' - 30.5' **Sample Length (in./cm.):**
Location:
Description: Sand, trace silt, light brown to tan.
Date: 06/07/07 **PL:** **LL:** **PI:**
USCS Classification: SP **AASHTO Classification:** A-3
Testing Remarks:

Mechanical Analysis Data

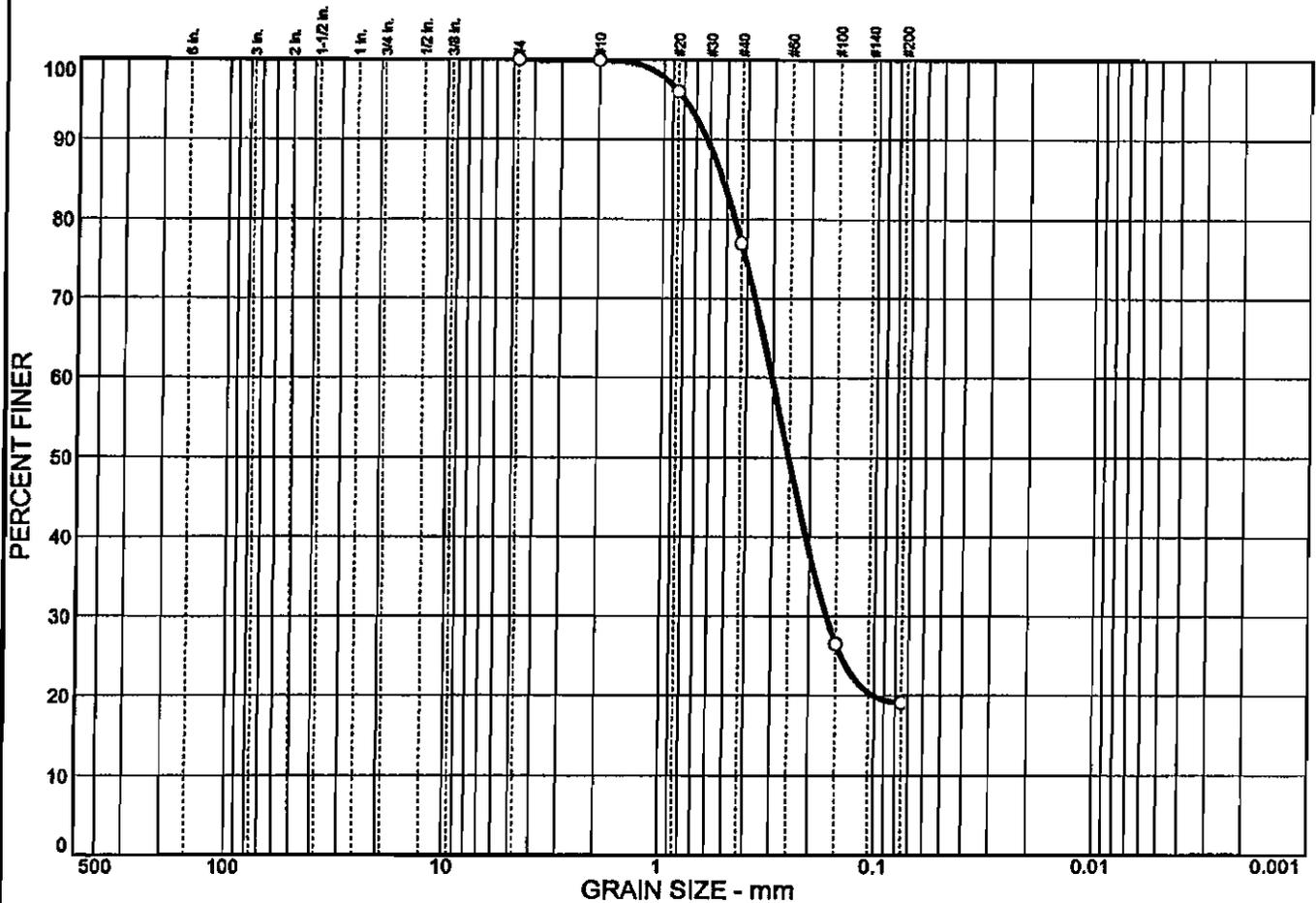
	Initial	After wash	
Dry sample and tare=	179.86	174.88	
Tare =	41.16	41.16	
Dry sample weight =	138.70	133.72	
Minus #200 from wash=	3.6 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.05	0.00	100.0
# 20	1.30	0.00	99.0
# 40	27.95	0.00	78.9
# 100	96.12	0.00	9.6
# 200	8.02	0.00	3.8

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = **% GRAVEL =** **% SAND = 96.2**
% FINES = 3.8

D₈₅ = 0.48 D₆₀ = 0.32 D₅₀ = 0.28
D₃₀ = 0.21 D₁₅ = 0.17 D₁₀ = 0.15
C_c = 0.9493 C_u = 2.0984

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	80.9	19.1	19.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	96.0		
#40	77.0		
#100	26.5		
#200	19.1		

Soil Description

Sand, little silt, tan.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.524 D₆₀= 0.303 D₅₀= 0.253
D₃₀= 0.166 D₁₅= D₁₀=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

* (no specification provided)

Sample No.: 4
Location:

Source of Sample: BORING NO. AB-5

Date: 06/07/07
Elev./Depth: 14.0' - 15.5'

GEO CIM, INC.

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

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GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-5
Sample No.: 4
Elev. or Depth: 14.0' - 15.5' **Sample Length (in./cm.):**
Location:
Description: Sand, little silt, tan.
Date: 06/07/07 **PL:** **LL:** **PI:**
USCS Classification: SM **AASHTO Classification:** A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	179.12	152.70
Tare =	40.44	40.44
Dry sample weight =	138.68	112.26
Minus #200 from wash=	19.1 %	

Sieve tare method

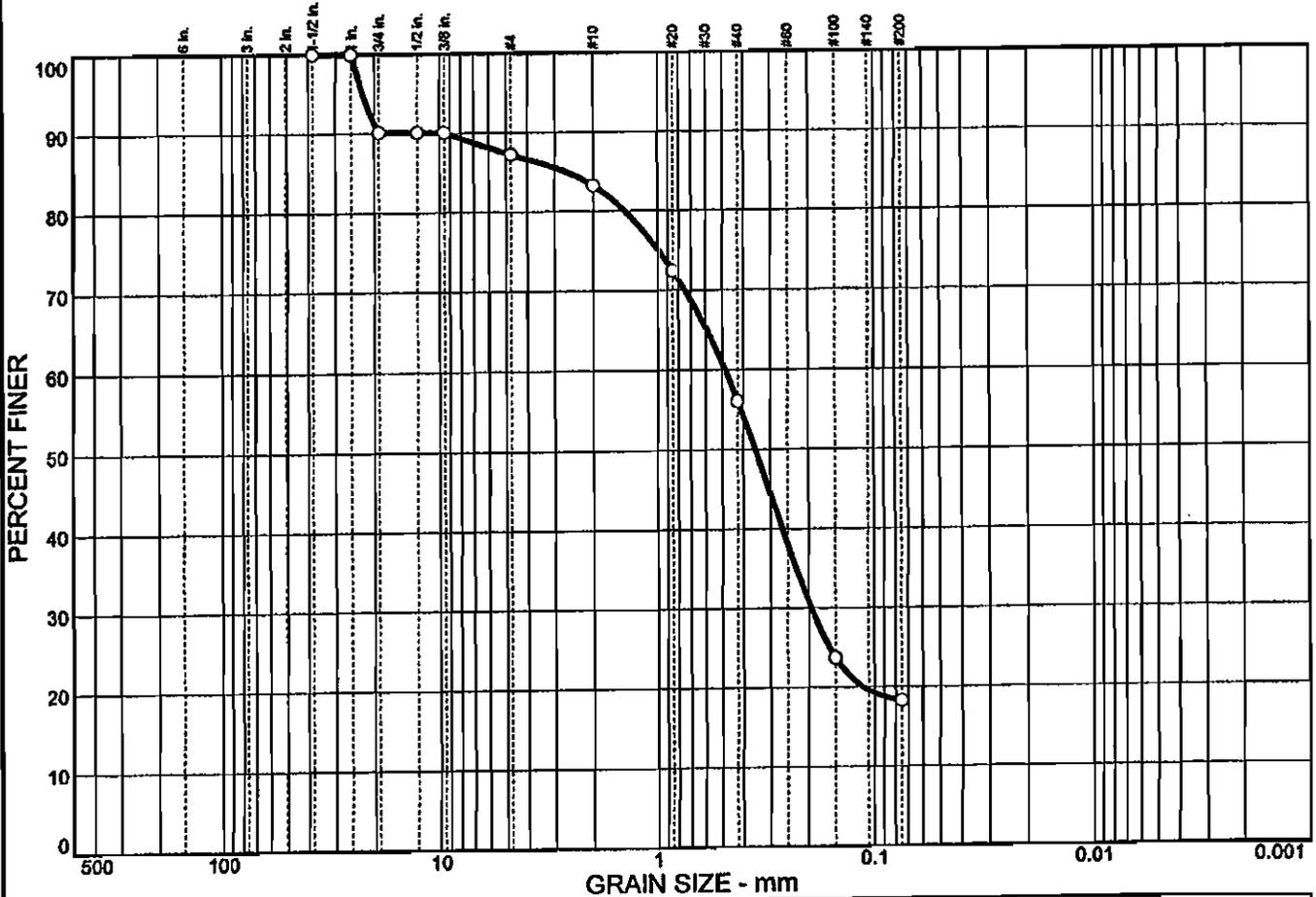
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.08	0.00	99.9
# 20	5.52	0.00	96.0
# 40	26.35	0.00	77.0
# 100	69.92	0.00	26.5
# 200	10.29	0.00	19.1

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 80.9
% FINES = 19.1

D₈₅= 0.52 D₆₀= 0.30 D₅₀= 0.25
D₃₀= 0.17

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	12.8	68.9	18.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	100.0		
.75 in.	90.1		
.5 in.	90.1		
.375 in.	90.1		
#4	87.2		
#10	83.2		
#20	72.4		
#40	56.1		
#100	23.7		
#200	18.3		

Soil Description
Sand, little silt and gravel, yellowish brown.

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 2.68 D₆₀= 0.486 D₅₀= 0.353
 D₃₀= 0.194 D₁₅= D₁₀=
 C_u= C_c=

Classification
 USCS= SM AASHTO= A-2-4(0)

Remarks

* (no specification provided)

Sample No.: 3
Location:

Source of Sample: BORING NO. AB-7

Date: 06/07/07
Elev./Depth: 9.0' - 10.5'

GEO CIM, INC.

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-7
Sample No.: 3
Elev. or Depth: 9.0' - 10.5' Sample Length (in./cm.):
Location:
Description: Sand, little silt and gravel, yellowish brown.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SM AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	142.00	122.71
Tare =	36.26	36.26
Dry sample weight =	105.74	86.45
Minus #200 from wash=	18.2 %	

Sieve tare method

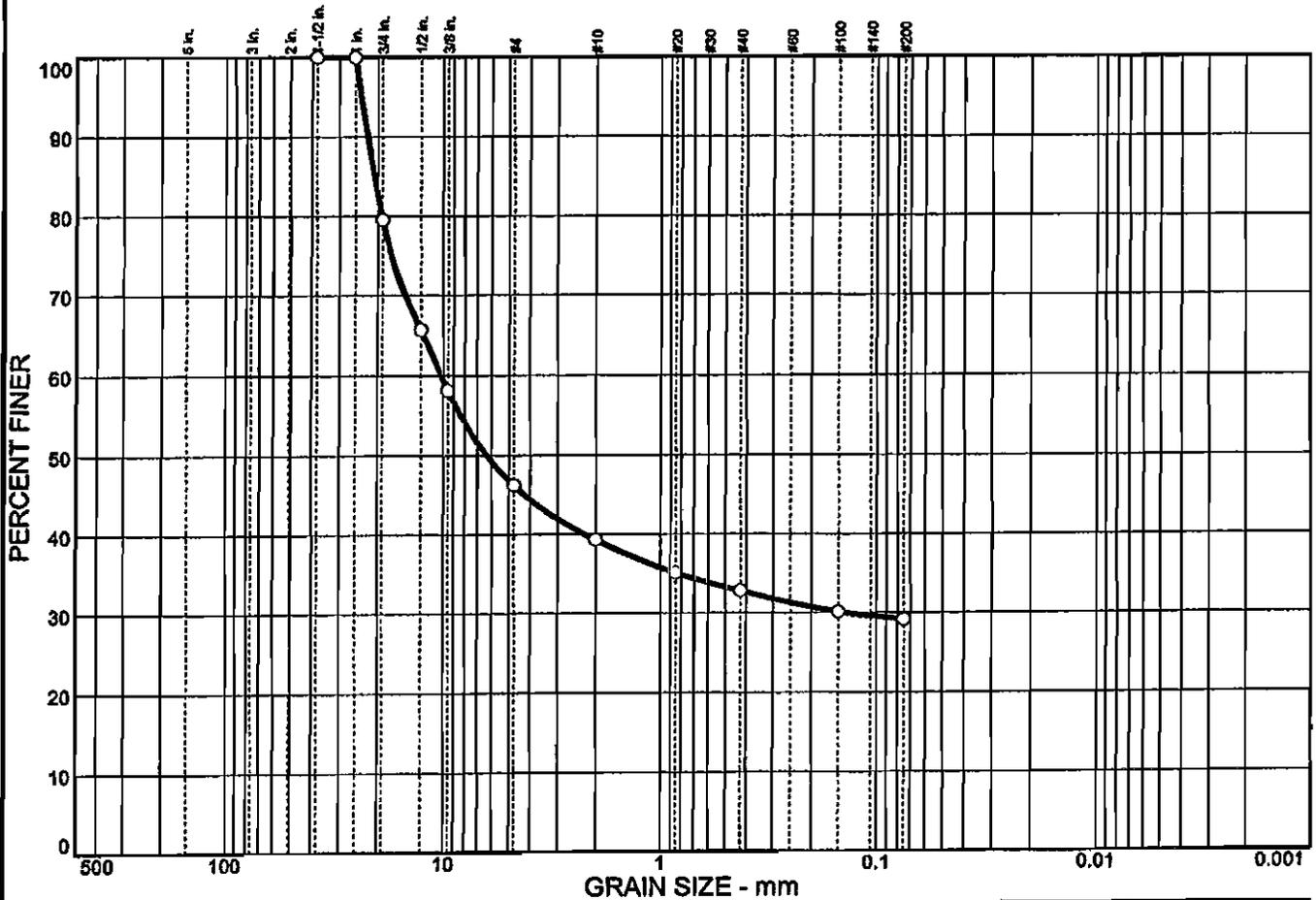
Sieve	Weight retained	Sieve tare	Percent finer
1.5 inch	0.00	0.00	100.0
1 inch	0.00	0.00	100.0
.75 inch	10.48	0.00	90.1
.5 inch	0.00	0.00	90.1
.375 inch	0.00	0.00	90.1
# 4	3.05	0.00	87.2
# 10	4.25	0.00	83.2
# 20	11.43	0.00	72.4
# 40	17.17	0.00	56.1
# 100	34.33	0.00	23.7
# 200	5.65	0.00	18.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 12.8 % SAND = 68.9
% FINES = 18.3

D85= 2.68 D60= 0.49 D50= 0.35
D30= 0.19

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	53.8	17.1	29.1	0.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	100.0		
.75 in.	79.5		
.5 in.	65.7		
.375 in.	58.1		
#4	46.2		
#10	39.3		
#20	35.1		
#40	32.8		
#100	30.1		
#200	29.1		

Soil Description

Gravel, some silty clay, little sand, yellowish brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 20.8 D₆₀= 10.3 D₅₀= 6.33
D₃₀= 0.142 D₁₅= D₁₀=
C_u= C_c=

Classification

USCS= GM AASHTO= A-2-4(0)

Remarks

* (no specification provided)

Sample No.: 15
 Location:

Source of Sample: BORING NO. AB-7

Date: 06/07/07
 Elev./Depth: 69.0'- 70.5'

GEO CIM, INC.

Client: AMEC
 Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-7
Sample No.: 15
Elev. or Depth: 69.0'- 70.5' Sample Length (in./cm.):
Location:
Description: Gravel, some silty clay, little sand, yellowish brown.
Date: 06/07/07 PL: LL: PI:
USCS Classification: GM AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

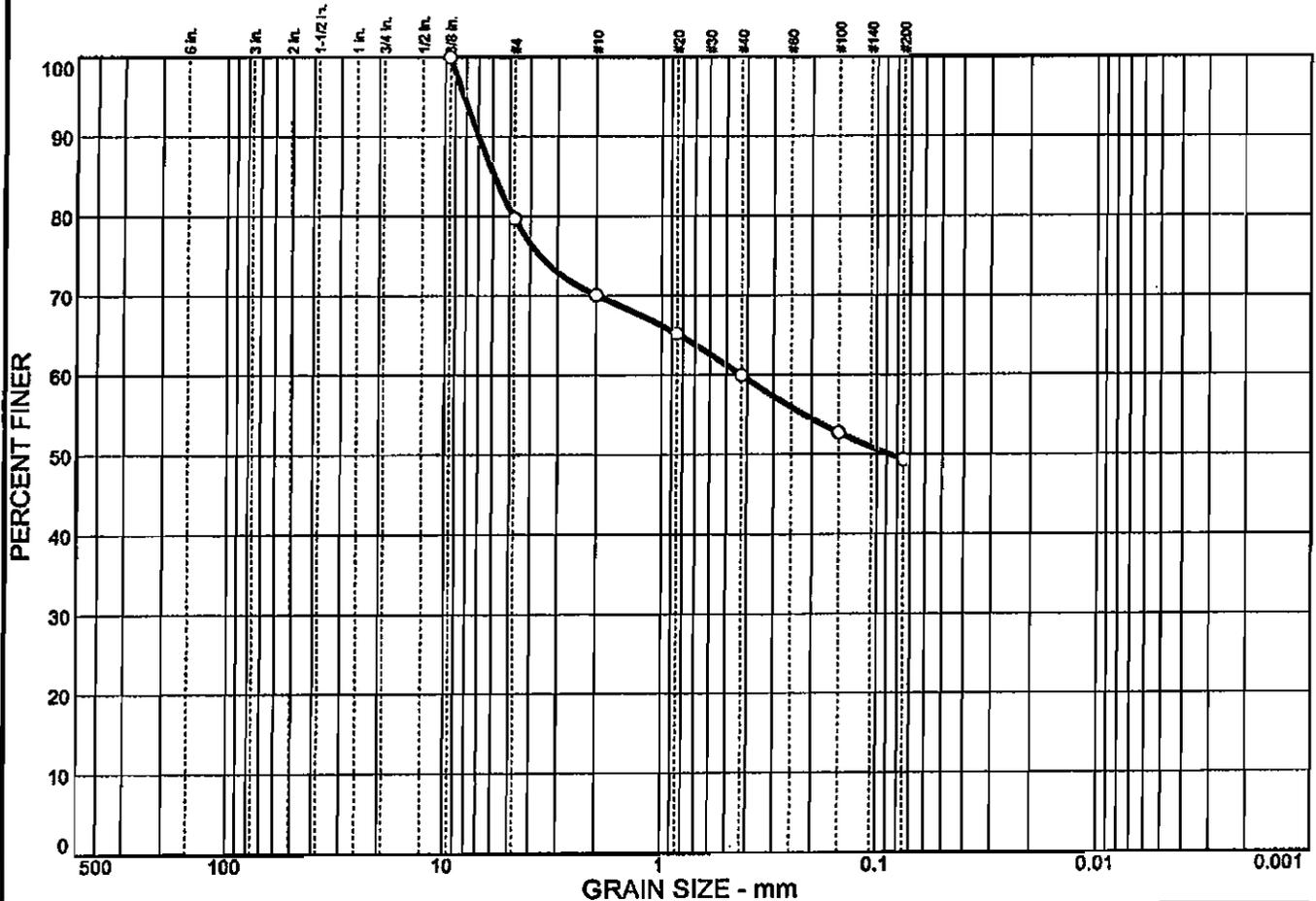
	Initial	After wash	
Dry sample and tare=	152.43	117.62	
Tare =	32.97	32.97	
Dry sample weight =	119.46	84.65	
Minus #200 from wash=	29.1 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
1.5 inch	0.00	0.00	100.0
1 inch	0.00	0.00	100.0
.75 inch	24.51	0.00	79.5
.5 inch	16.44	0.00	65.7
.375 inch	9.14	0.00	58.1
# 4	14.20	0.00	46.2
# 10	8.28	0.00	39.3
# 20	4.94	0.00	35.1
# 40	2.83	0.00	32.8
# 100	3.15	0.00	30.1
# 200	1.23	0.00	29.1

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 53.8 % SAND = 17.1
% FINES = 29.1

D85= 20.82 D60= 10.26 D50= 6.33
D30= 0.14

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	20.3	30.4	49.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	79.7		
#10	70.1		
#20	65.2		
#40	59.9		
#100	52.7		
#200	49.3		

Soil Description

Silt, some sand, little gravel, pale yellow to yellowish brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 5.89 D₆₀= 0.430 D₅₀= 0.0874

D₃₀= D₁₅= D₁₀=

C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

* (no specification provided)

Sample No.: 1
Location:

Source of Sample: BORING NO. AB-8

Date: 06/07/07
Elev./Depth: 2.5' - 4.0'

GEO CIM, INC.

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-8
Sample No.: 1
Elev. or Depth: 2.5' - 4.0' Sample Length (in./cm.):
Location:
Description: Silt, some sand, little gravel, pale yellow to yellowish brown.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SM AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

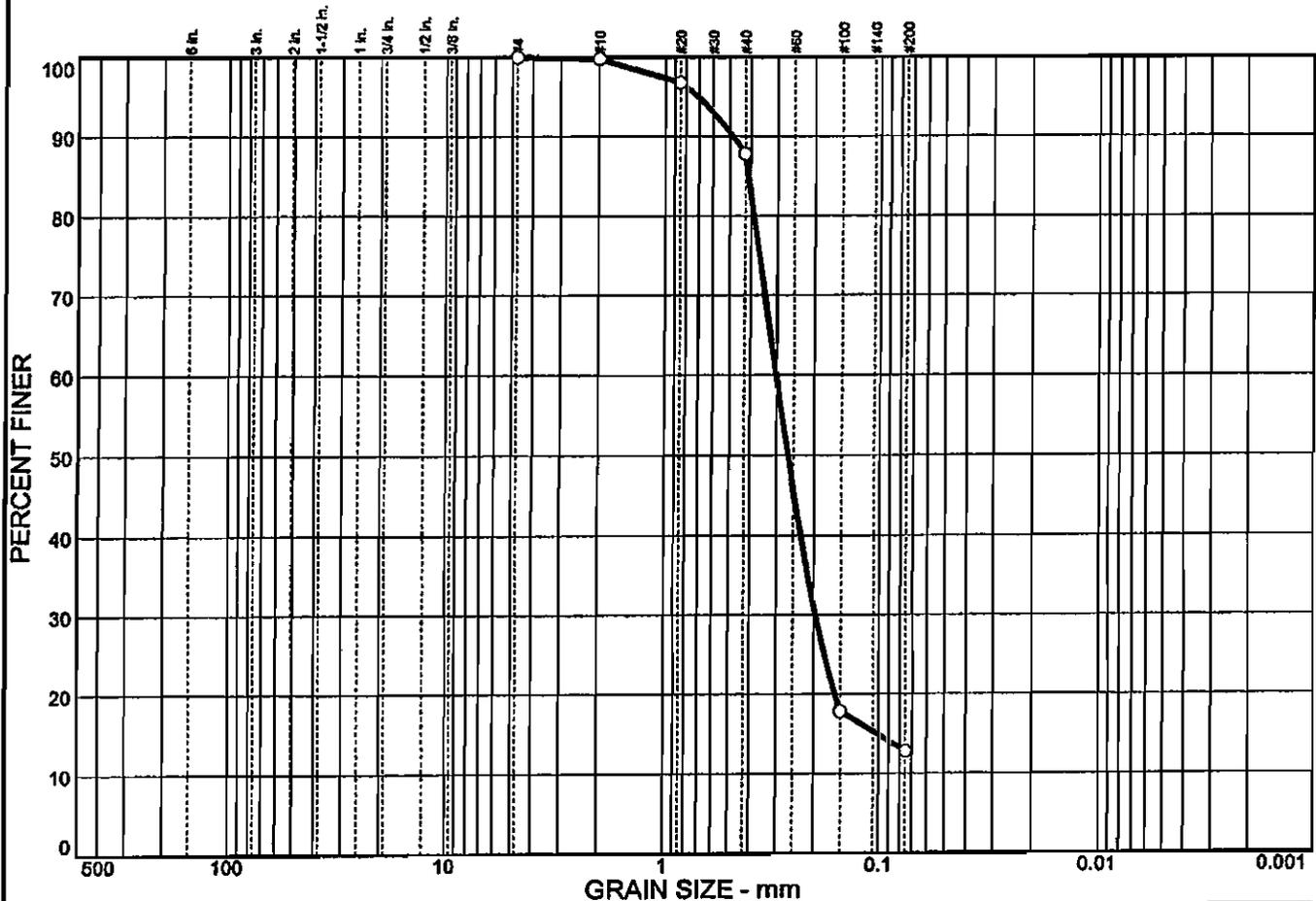
	Initial	After wash	
Dry sample and tare=	69.14	55.38	
Tare =	41.25	41.25	
Dry sample weight =	27.89	14.13	
Minus #200 from wash=	49.3 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
.375 inch	0.00	0.00	100.0
# 4	5.65	0.00	79.7
# 10	2.68	0.00	70.1
# 20	1.39	0.00	65.2
# 40	1.47	0.00	59.9
# 100	2.01	0.00	52.7
# 200	0.94	0.00	49.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 20.3 % SAND = 30.4
% FINES = 49.3

D85= 5.89 D60= 0.43 D50= 0.09

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	87.2	12.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	96.8		
#40	87.8		
#100	17.8		
#200	12.8		

Soil Description

Sand, little silt, gray.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.411 D₆₀= 0.302 D₅₀= 0.265
D₃₀= 0.197 D₁₅= 0.102 D₁₀=
C_u=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

* (no specification provided)

Sample No.: 6
Location:

Source of Sample: BORING NO. AB-9

Date: 06/07/07
Elev./Depth: 25.0' - 26.5'

GEO CIM, INC.

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-9
Sample No.: 6
Elev. or Depth: 25.0 ' - 26.5' Sample Length (in./cm.):
Location:
Description: Sand, little silt, gray.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SM AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	190.01	170.96
Tare =	39.33	39.33
Dry sample weight =	150.68	131.63
Minus #200 from wash=	12.6 %	

Sieve tare method

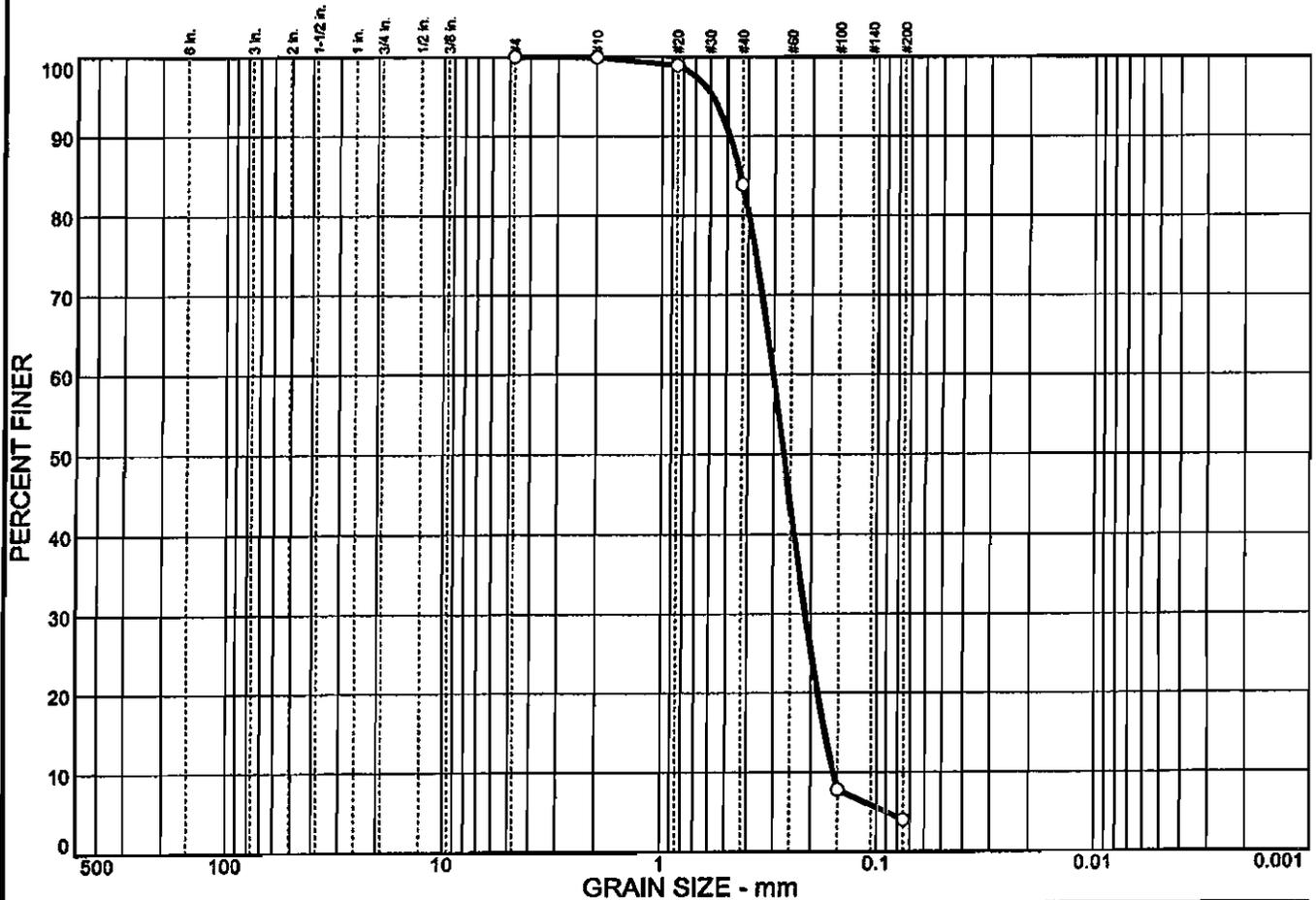
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.28	0.00	99.8
# 20	4.58	0.00	96.8
# 40	13.57	0.00	87.8
# 100	105.48	0.00	17.8
# 200	7.56	0.00	12.8

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 87.2
% FINES = 12.8

D₈₅= 0.41 D₆₀= 0.30 D₅₀= 0.27
D₃₀= 0.20 D₁₅= 0.10

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	96.0	4.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	98.9		
#40	83.9		
#100	7.8		
#200	4.0		

Soil Description

Sand, trace silt, dark brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.434 D₈₀= 0.303 D₅₀= 0.270
D₃₀= 0.213 D₁₅= 0.172 D₁₀= 0.157
C_u= 1.93 C_c= 0.95

Classification

USCS= SP AASHTO= A-3

Remarks

* (no specification provided)

Sample No.: 6
 Location:

Source of Sample: BORING NO. AB-10

Date: 06/07/07
 Elev./Depth: 14.0' 15.5'

GEO CIM, INC.

Client: AMEC
 Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-10
Sample No.: 6
Elev. or Depth: 14.0' 15.5' Sample Length (in./cm.):
Location:
Description: Sand, trace silt, dark brown.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SP AASHTO Classification: A-3
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	134.05	130.28
Tare =	31.81	31.81
Dry sample weight =	102.24	98.47
Minus #200 from wash=	3.7 %	

Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.09	0.00	99.9
# 20	1.03	0.00	98.9
# 40	15.32	0.00	83.9
# 100	77.78	0.00	7.8
# 200	3.96	0.00	4.0

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 96.0
% FINES = 4.0

D85= 0.43 D60= 0.30 D50= 0.27
D30= 0.21 D15= 0.17 D10= 0.16
Cc= 0.9462 Cu= 1.9263

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-11
Sample No.: 4
Elev. or Depth: 14.0' 15.5' Sample Length (in./cm.):
Location:
Description: Sand, trace silt, dark brown.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SP-SM AASHTO Classification: A-3
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	198.32	189.88
Tare =	42.59	42.59
Dry sample weight =	155.73	147.29
Minus #200 from wash=	5.4 %	

Sieve tare method

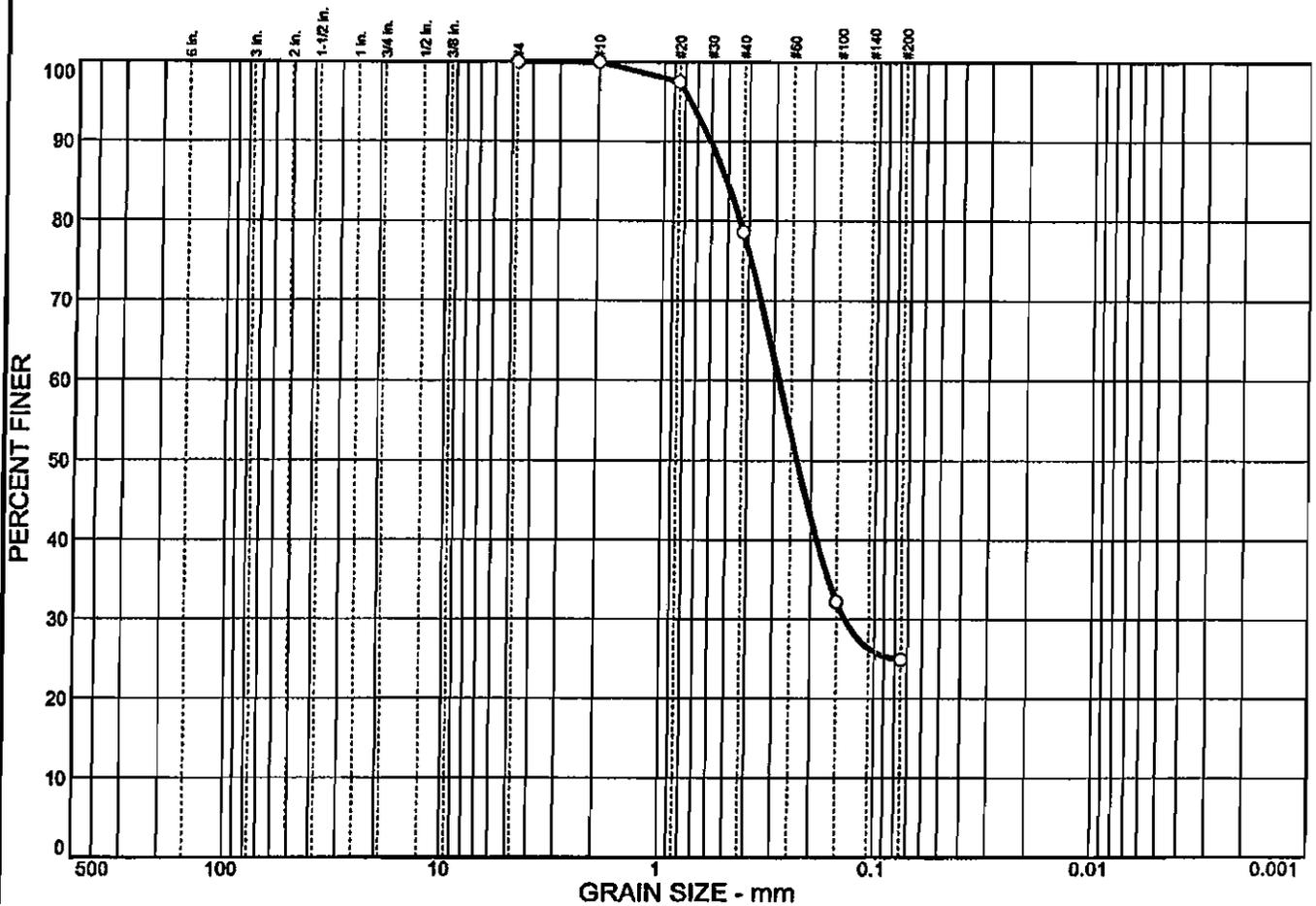
Sieve	Weight retained	Sieve tare	Percent finer
.375 inch	0.00	0.00	100.0
# 4	0.23	0.00	99.9
# 20	0.05	0.00	99.8
# 40	24.17	0.00	84.3
# 100	115.99	0.00	9.8
# 200	6.11	0.00	5.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 0.1 % SAND = 94.0
% FINES = 5.9

D₈₅= 0.43 D₆₀= 0.30 D₅₀= 0.27
D₃₀= 0.21 D₁₅= 0.17 D₁₀= 0.15
C_c= 0.9604 C_u= 1.9919

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	75.1	24.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	97.5		
#40	78.6		
#100	32.2		
#200	24.9		

Soil Description

Sand, little silt, light gray.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.510 D₆₀= 0.285 D₅₀= 0.233
D₃₀= 0.137 D₁₅= D₁₀=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

* (no specification provided)

Sample No.: 6
 Location:

Source of Sample: BORING NO. AB-11

Date: 06/07/07
 Elev./Depth: 24.0' - 25.5'

GEO CIM, INC.

Client: AMBC
 Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-11
Sample No.: 6
Elev. or Depth: 24.0' - 25.5' Sample Length (in./cm.):
Location:
Description: Sand, little silt, light gray.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SM AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

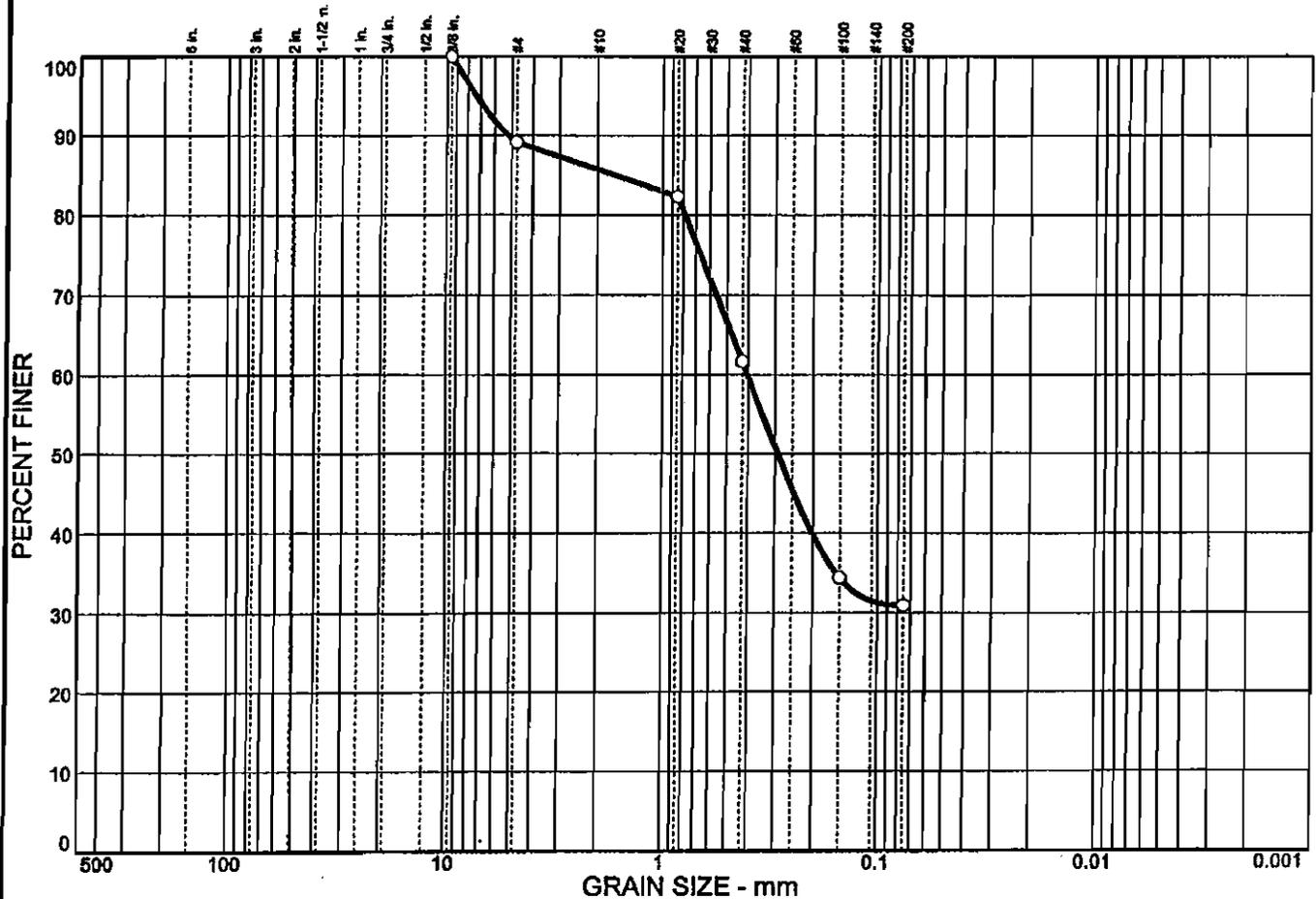
	Initial	After wash	
Dry sample and tare=	159.81	130.18	
Tare =	40.29	40.29	
Dry sample weight =	119.52	89.89	
Minus #200 from wash=	24.8 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.00	0.00	100.0
# 20	2.96	0.00	97.5
# 40	22.68	0.00	78.6
# 100	55.36	0.00	32.2
# 200	8.74	0.00	24.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 75.1
% FINES = 24.9

D85= 0.51 D60= 0.29 D50= 0.23
D30= 0.14

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	10.9	58.2	30.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	89.1		
#20	82.3		
#40	61.7		
#100	34.4		
#200	30.9		

* (no specification provided)

Soil Description

Sand, some silt, little gravel, brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 1.68 D₆₀= 0.402 D₅₀= 0.291

D₃₀= D₁₅= D₁₀=

C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: 3
Location:

Source of Sample: BORING NO. AB-15

Date: 06/07/07
Elev./Depth: 9.0' - 10.5'

GEO CIM, INC.

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davilla - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-15
Sample No.: 3
Elev. or Depth: 9.0' - 10.5' Sample Length (in./cm.):
Location:
Description: Sand, some silt, little gravel, brown.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SM AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	114.98	98.56
Tare =	31.97	31.97
Dry sample weight =	83.01	66.59
Minus #200 from wash=	19.8 %	

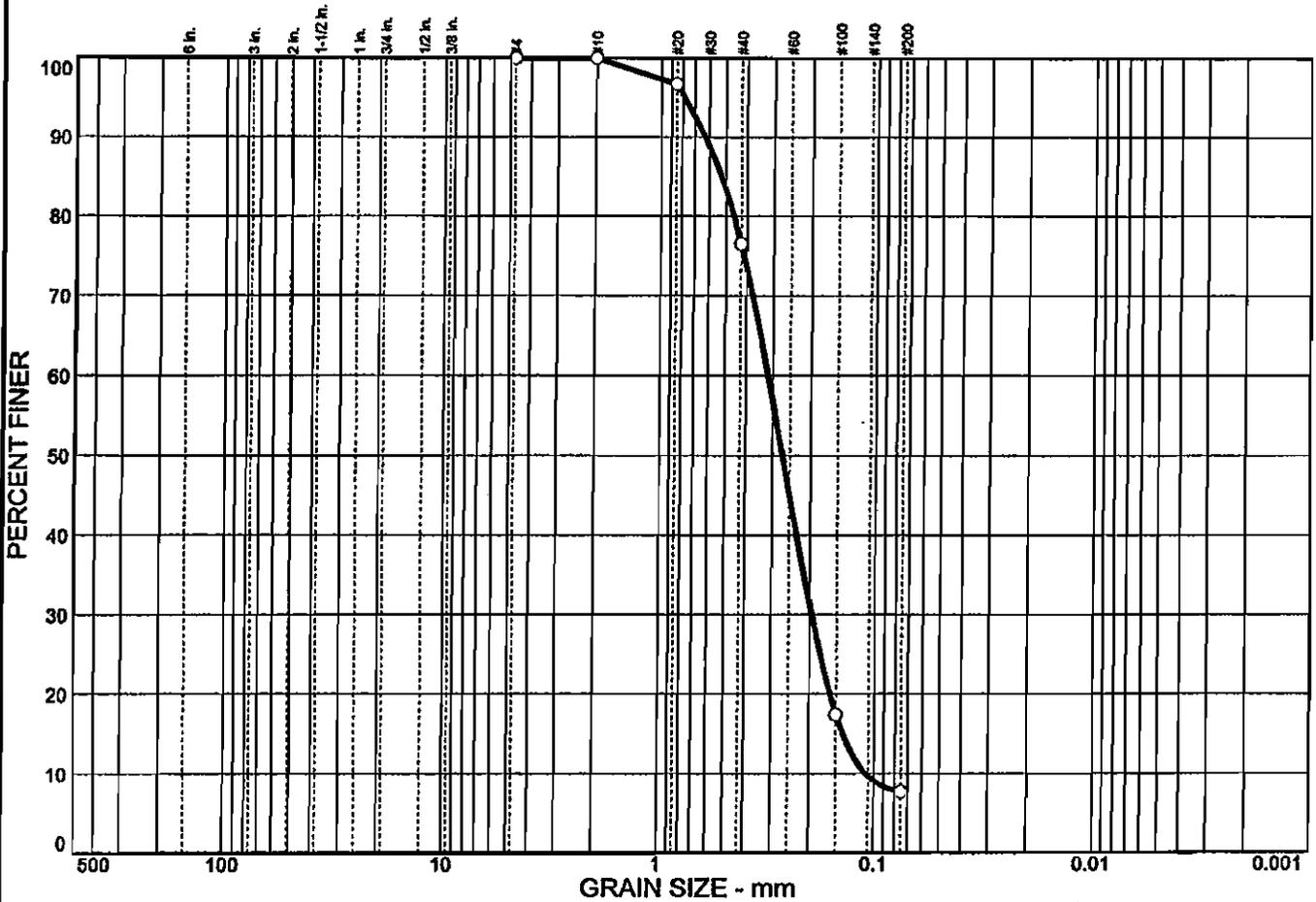
Sieve	Weight retained	Sieve tare	Percent finer
.375 inch	0.00	0.00	100.0
# 4	9.05	0.00	89.1
# 20	5.66	0.00	82.3
# 40	17.10	0.00	61.7
# 100	22.69	0.00	34.4
# 200	2.87	0.00	30.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 10.9 % SAND = 58.2
% FINES = 30.9

D85= 1.68 D60= 0.40 D50= 0.29

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT
0.0	0.0	92.3	7.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	96.7		
#40	76.5		
#100	17.4		
#200	7.7		

Soil Description

Sand, trace silt, brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.527 D₆₀= 0.316 D₅₀= 0.270
 D₃₀= 0.196 D₁₅= 0.139 D₁₀= 0.109
 C_u= 2.89 C_c= 1.11

Classification

USCS= SP-SM AASHTO= A-3

Remarks

* (no specification provided)

Sample No.: 7
 Location:

Source of Sample: BORING NO. AB-15

Date: 06/07/07
 Elev./Depth: 29.0' - 30.5'

GEO CIM, INC.

Client: AMEC
 Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-15
Sample No.: 7
Elev. or Depth: 29.0' - 30.5' **Sample Length (in./cm.):**
Location:
Description: Sand, trace silt, brown.
Date: 06/07/07 **PL:** **LL:** **PI:**
USCS Classification: SP-SM **AASHTO Classification:** A-3
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash	
Dry sample and tare=	187.10	176.14	
Tare =	40.29	40.29	
Dry sample weight =	146.81	135.85	
Minus #200 from wash=	7.5 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.08	0.00	100.0
# 20	4.73	0.00	96.7
# 40	29.65	0.00	76.5
# 100	86.83	0.00	17.4
# 200	14.25	0.00	7.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = **% GRAVEL =** **% SAND = 92.3**
% FINES = 7.7

D85= 0.53 D60= 0.32 D50= 0.27
D30= 0.20 D15= 0.14 D10= 0.11
Cc= 1.1079 Cu= 2.8924

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-17
Sample No.: 1
Elev. or Depth: 2.0' -3.5' Sample Length (in./cm.):
Location:
Description: Gravel (limestone fragment), little sand and silt, pale yellow to yellowish brown.
Date: 06/07/07 PL: LL: PI:
USCS Classification: GM AASHTO Classification: A-1-b
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash	
Dry sample and tare=	195.74	157.69	
Tare =	39.39	39.39	
Dry sample weight =	156.35	118.30	
Minus #200 from wash=	24.3 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
1.5 inch	0.00	0.00	100.0
1 inch	44.51	0.00	71.5
.75 inch	21.86	0.00	57.6
.5 inch	0.00	0.00	57.6
.375 inch	10.29	0.00	51.0
# 4	13.19	0.00	42.5
# 10	8.79	0.00	36.9
# 20	5.72	0.00	33.3
# 40	5.38	0.00	29.8
# 100	6.36	0.00	25.7
# 200	2.25	0.00	24.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 57.5 % SAND = 18.2
% FINES = 24.3

D85= 30.97 D60= 20.58 D50= 9.04
D30= 0.44

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-17
Sample No.: 3
Elev. or Depth: 9.0' - 10.5' **Sample Length (in./cm.):**
Location:
Description: Sand, little silt, trace gravel, gray.
Date: 06/07/07 **PL:** **LL:** **PI:**
USCS Classification: SM **AASHTO Classification:** A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	166.53	147.03
Tare =	40.87	40.87
Dry sample weight =	125.66	106.16
Minus #200 from wash=	15.5 %	

Sieve tare method

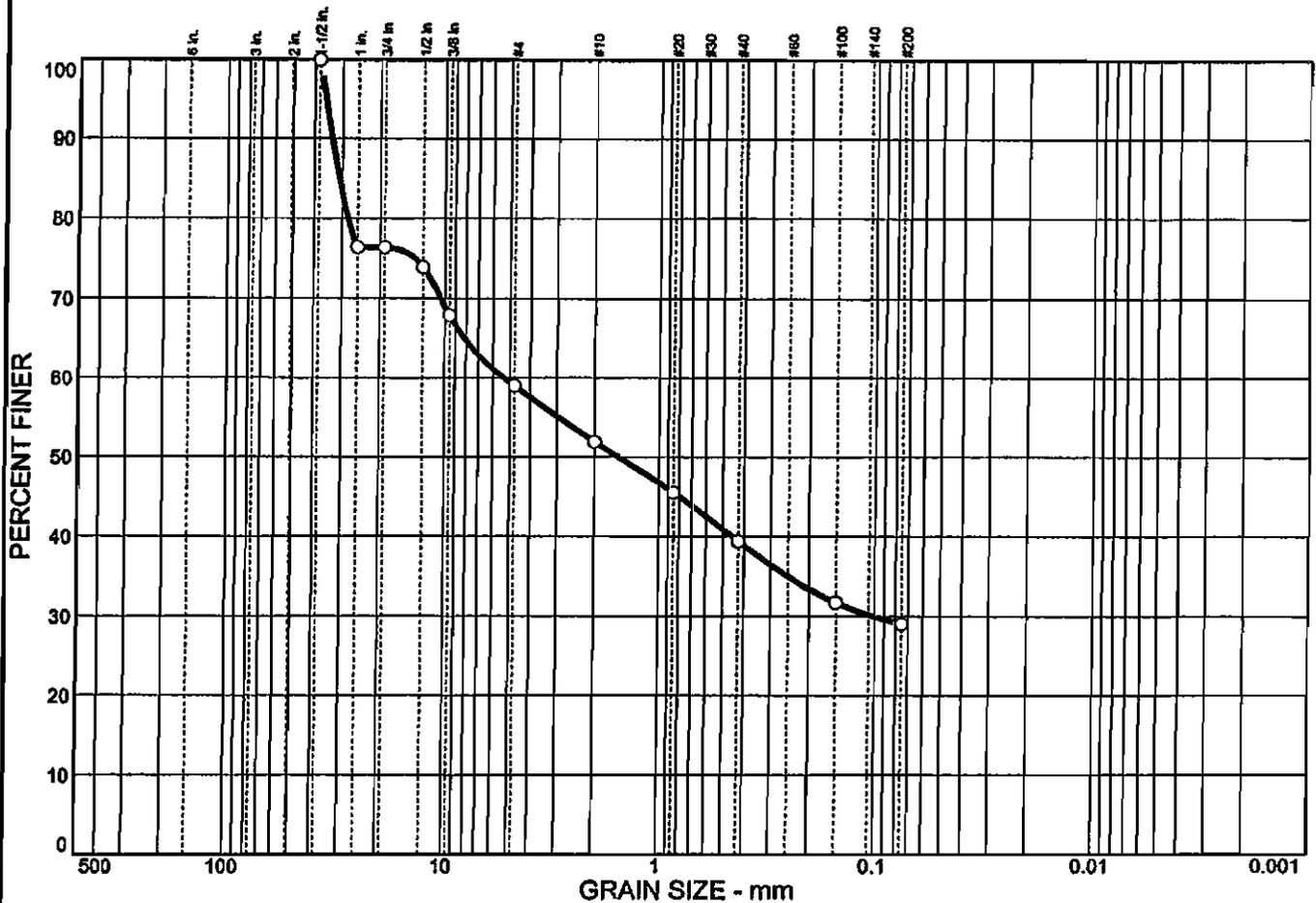
Sieve	Weight retained	Sieve tare	Percent finer
.375 inch	0.00	0.00	100.0
# 4	0.25	0.00	99.8
# 10	0.69	0.00	99.3
# 20	2.12	0.00	97.6
# 40	24.99	0.00	77.7
# 100	72.90	0.00	19.7
# 200	5.17	0.00	15.6

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = **% GRAVEL = 0.2** **% SAND = 84.2**
% FINES = 15.6

D₈₅ = 0.51 D₆₀ = 0.31 D₅₀ = 0.27
D₃₀ = 0.19

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	41.0	30.0	29.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	76.4		
.75 in.	76.4		
.5 in.	73.9		
.375 in.	67.9		
#4	59.0		
#10	51.9		
#20	45.5		
#40	39.4		
#100	31.7		
#200	29.0		

Soil Description

Gravel (calcareous), little silty sand, pale yellow.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 30.9 D₆₀= 5.32 D₅₀= 1.55
D₃₀= 0.101 D₁₅= D₁₀=
C_u= C_c=

Classification

USCS= GM AASHTO= A-2-4(0)

Remarks

* (no specification provided)

Sample No.: 12
 Location:

Source of Sample: BORING NO. AB-17

Date: 06/07/07
 Elev./Depth: 54.0' - 55.5'

GEO CIM, INC.

Client: AMEC
 Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-17
Sample No.: 12
Elev. or Depth: 54.0' - 55.5' Sample Length (in./cm.):
Location:
Description: Gravel (calcareous), little silty sand, pale yellow.
Date: 06/07/07 PL: LL: PI:
USCS Classification: GM AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

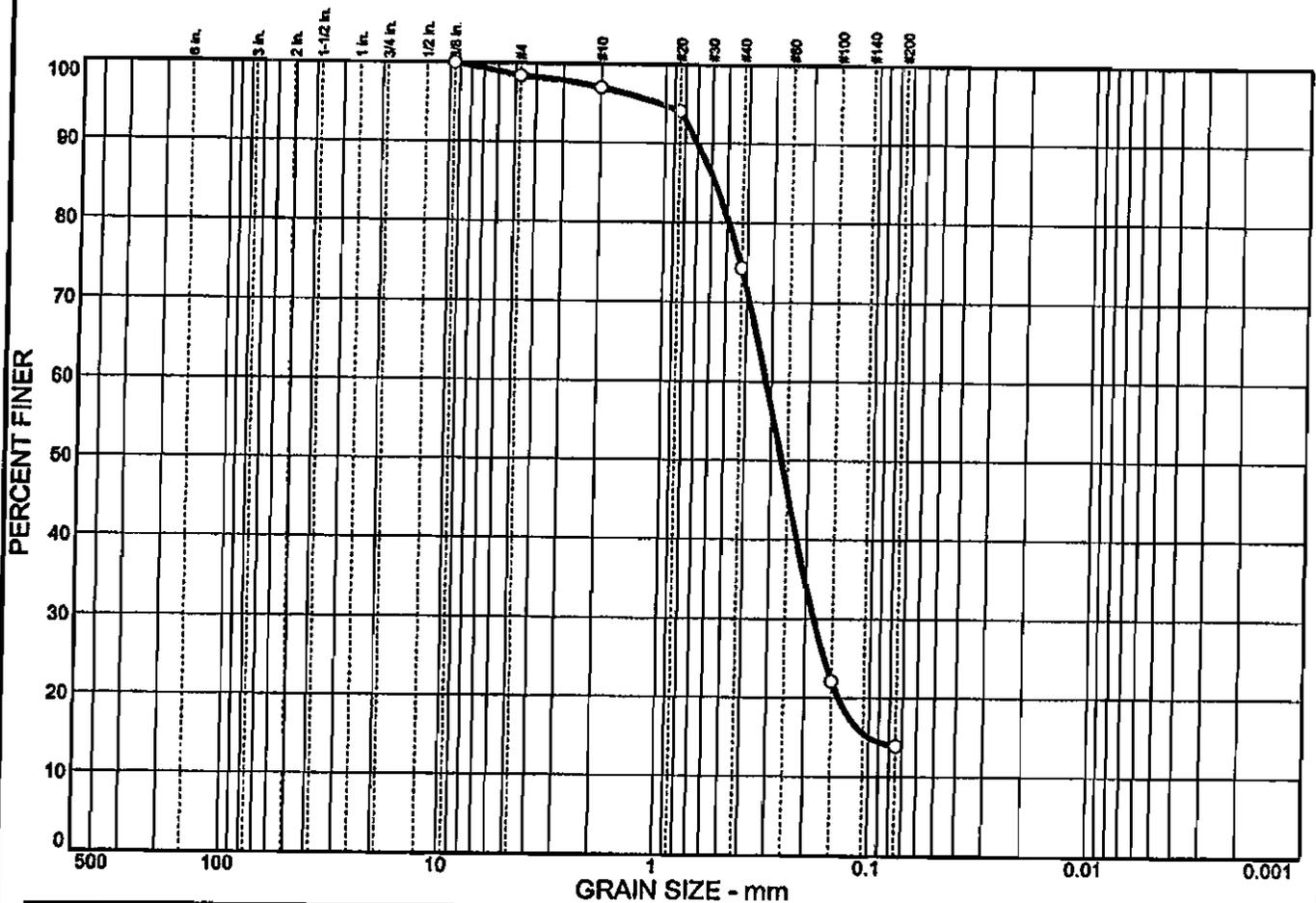
	Initial	After wash	
Dry sample and tare=	151.18	119.48	
Tare =	41.38	41.38	
Dry sample weight =	109.80	78.10	
Minus #200 from wash=	28.9 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
1.5 inch	0.00	0.00	100.0
1 inch	25.91	0.00	76.4
.75 inch	0.00	0.00	76.4
.5 inch	2.78	0.00	73.9
.375 inch	6.61	0.00	67.9
# 4	9.75	0.00	59.0
# 10	7.77	0.00	51.9
# 20	7.01	0.00	45.5
# 40	6.76	0.00	39.4
# 100	8.40	0.00	31.7
# 200	2.95	0.00	29.0

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 41.0 % SAND = 30.0
% FINES = 29.0

D85= 30.88 D60= 5.32 D50= 1.55
D30= 0.10

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	1.6	84.5	13.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	98.4		
#10	97.0		
#20	94.1		
#40	74.3		
#100	22.1		
#200	13.9		

Soil Description

Sand, little silt, trace gravel, brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.577 D₆₀= 0.320 D₅₀= 0.268

D₃₀= 0.184 D₁₅= 0.100 D₁₀=

C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

(no specification provided)

Sample No.: 2
Location:

Source of Sample: BORING NO. AB-19

Date: 06/07/07
Elev./Depth: 4.0' - 5.5'

GEO CIM, INC.

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT

Project No: 3640-07

R. Davila - GCI

GRAIN SIZE DISTRIBUTION TEST DATA

Client: AMEC
Project: SAN JUAN WATERFRONT PROJECT
Project Number: 3640-07

Sample Data

Source: BORING NO. AB-19
Sample No.: 2
Elev. or Depth: 4.0' - 5.5' Sample Length (in./cm.):
Location:
Description: Sand, little silt, trace gravel, brown.
Date: 06/07/07 PL: LL: PI:
USCS Classification: SM AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash	
Dry sample and tare=	135.50	122.64	
Tare =	42.10	42.10	
Dry sample weight =	93.40	80.54	
Minus #200 from wash=	13.8 %		
Sieve tare method			
Sieve	Weight retained	Sieve tare	Percent finer
.375 inch	0.00	0.00	100.0
# 4	1.51	0.00	98.4
# 10	1.26	0.00	97.0
# 20	2.78	0.00	94.1
# 40	18.46	0.00	74.3
# 100	48.71	0.00	22.1
# 200	7.68	0.00	13.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 1.6 % SAND = 84.5
% FINES = 13.9

D85= 0.58 D60= 0.32 D50= 0.27
D30= 0.18 D15= 0.10

APPENDIX C

Reports by Others

APPENDIX C
REPORTS BY OTHERS
7-660-00004

Attached are boring location plans and generalized geologic cross sections from reports by Geoconsult, for Pier 6 and for Piers 11-14.

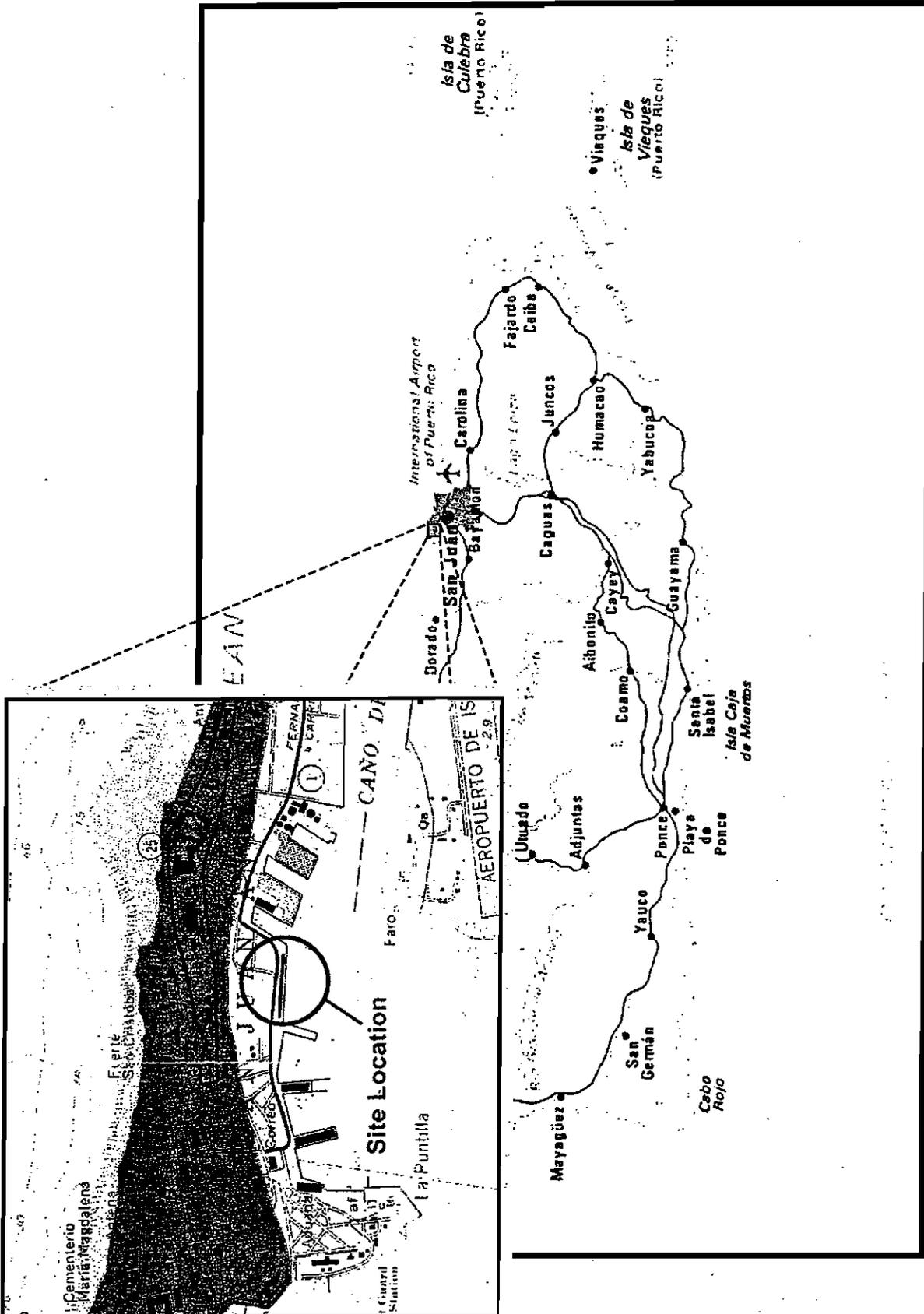
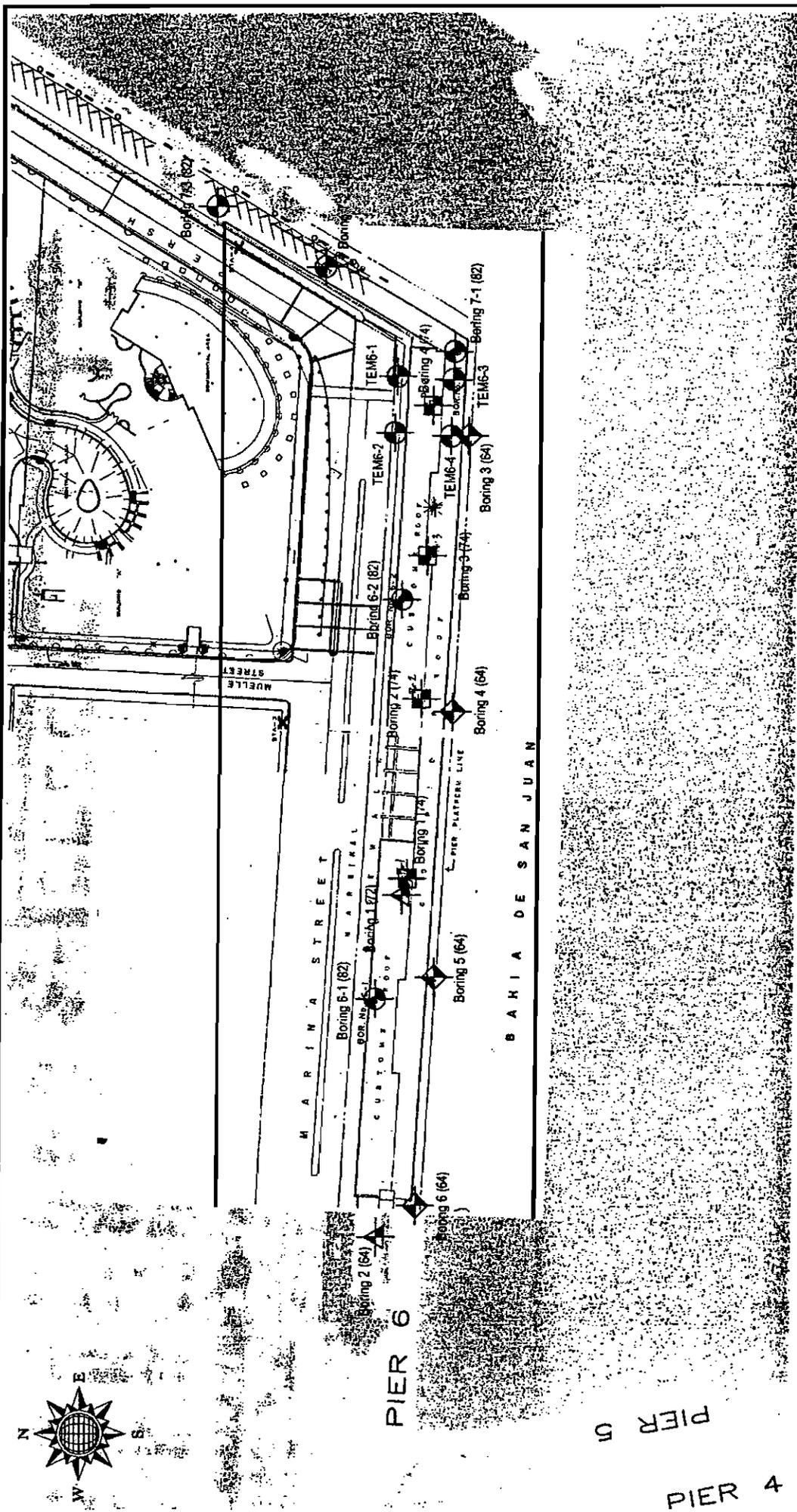


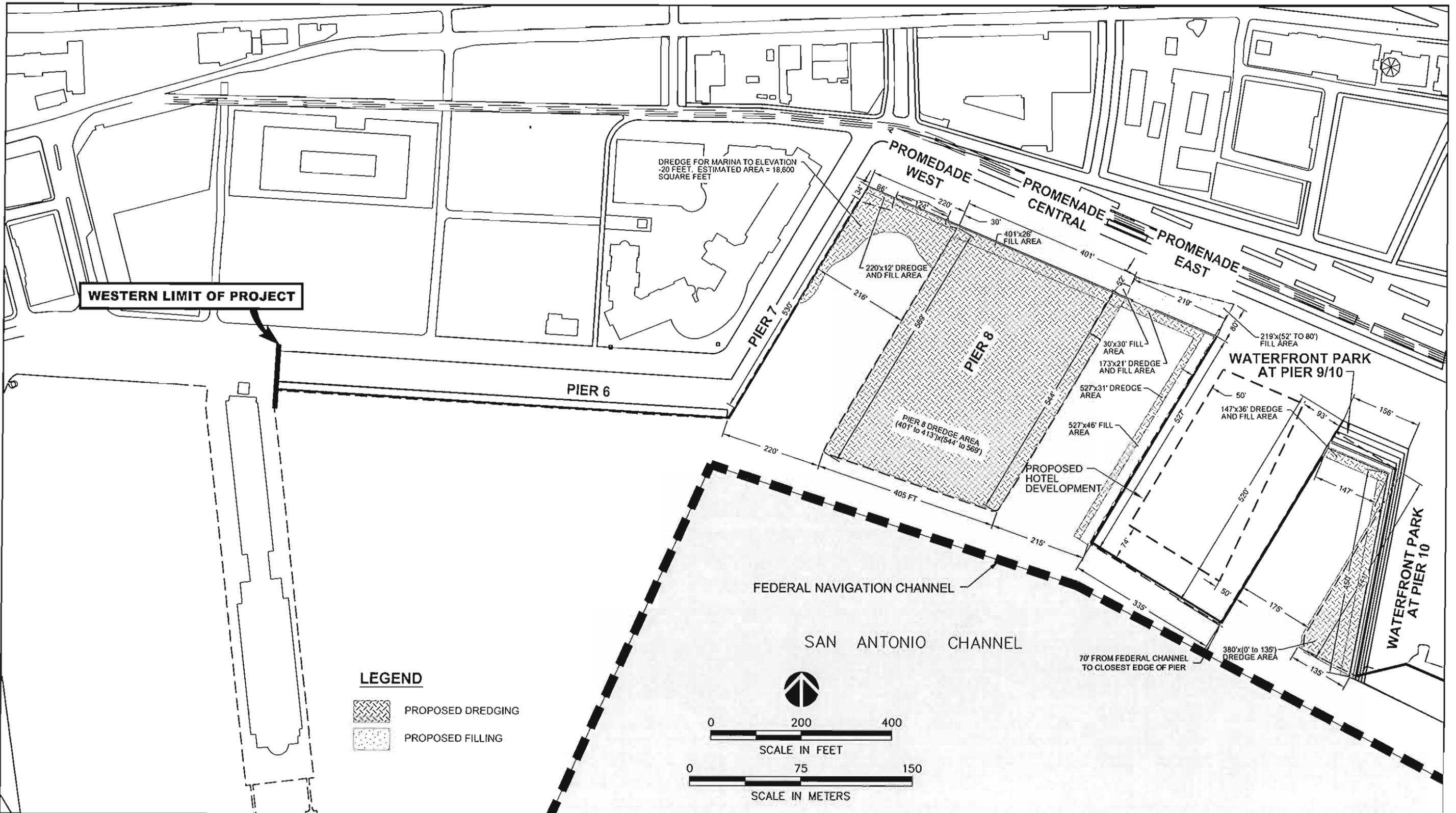
Figure 1. Site Location Plan and Generalized Geology. Trabajos Reparación Muelle 6 – Old San Juan, P.R.
 From: M.H. Peace, Jr., and W.H. Monroe (1977). "Geologic Map of the San Juan Quadrangle, Puerto Rico". Map No. I-1010, Department of the Interior, United States Geological Survey.



NOTA: UBICACIONES SON APROXIMADAS.

- Subsoil Exploration - Piers 6 & 7 (Sept. 29, 1982)
 Subsoil Investigation and Engineering Report - Pier 6 (August 22, 1974)
 Subsurface Investigation Report - Pier 6 (Nov. 22, 1972)
 Subsoil Investigation at Piers 6 & 8 (Nov. 10, 1964)

GEOCONSULT <small>Geotechnical Engineers - San Juan, Puerto Rico P.O. Box 352040, SAN JUAN P.R. 00936-2040 TEL. (787) 762-3534 / FAX (787) 793-9416 WWW.GEOCONSULT-INC.COM</small>	Project		Reference	Description	Code No.	Sheet No.
	TRABAJOS REPARACIÓN MUELLE 6 Viejo San Juan, Puerto Rico		Scale : 1:1,500 Date : 02/04/03 By : E.U.A.H. Revised : C.O.	LOCALIZACIÓN DE BARRENOS	Project No. 2480-03	FIGURA 2 (1 de 3)



NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC E & E CARIBE, LLP REPORT No. 7-660-00004.2000 DATED OCTOBER 31, 2007.



CLIENT:
COLLIERS TMT OF PUERTO RICO

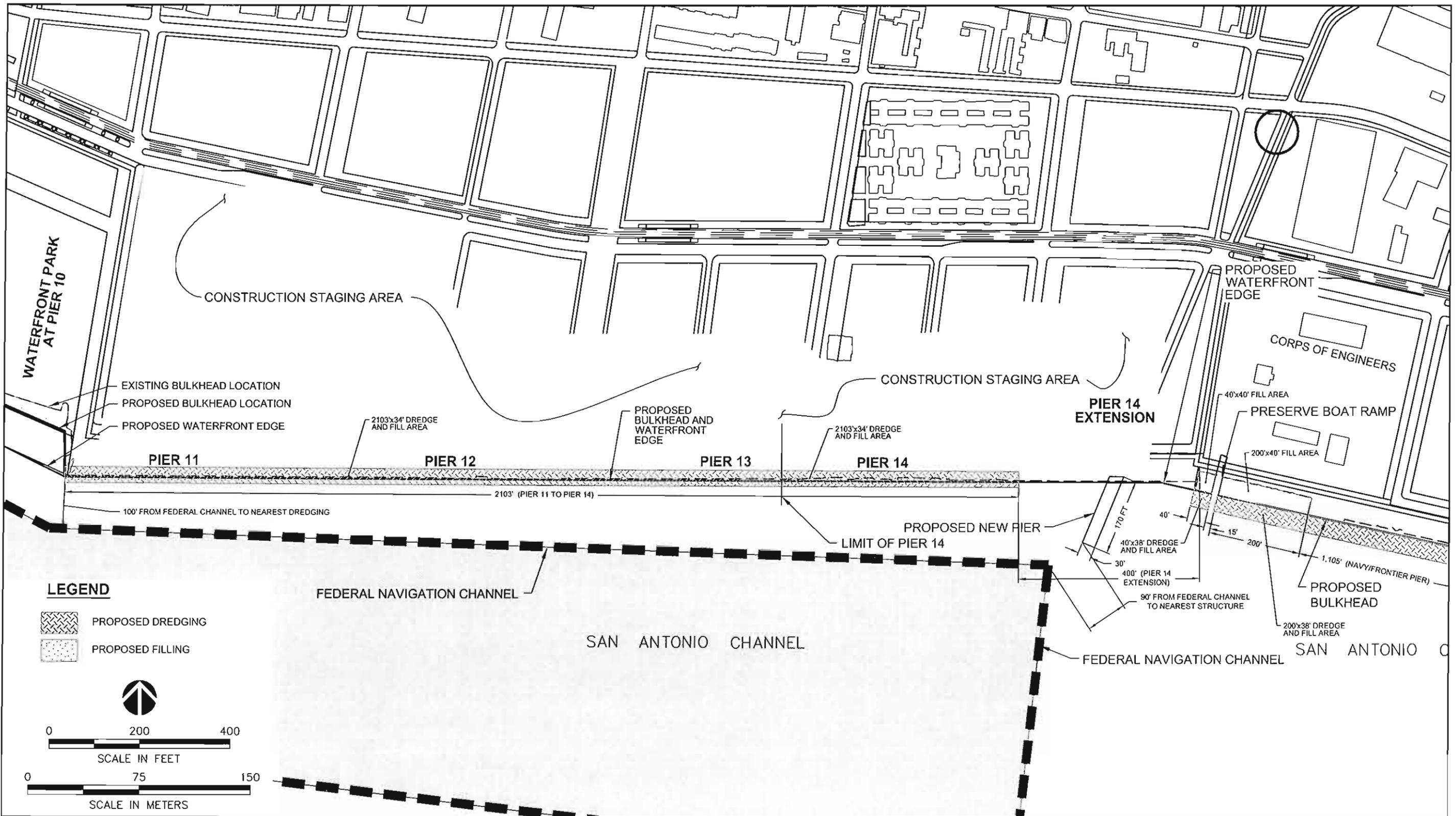
AMEC E & E Caribe, LLP
530 AVE DE LA CONSTITUTION
SAN JUAN, PUERTO RICO 00901-2304
PHONE (787) 289-7835 FAX (787) 289-8779



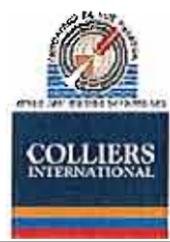
DRAWN BY:
JRS
CHECKED BY:
JD
DATUM:
PROJECTION:
SCALE:
AS SHOWN

PROJECT
SAN JUAN WATERFRONT PROJECT
SAN JUAN, PUERTO RICO
TITLE
PROPOSED WATERFRONT MODIFICATIONS

DATE:
OCTOBER 2007
PROJECT NO:
766000004
REV. NO.:
FIGURE No.
FIGURE 1A



NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC E & E CARIBE, LLP REPORT No. 7-660-00004.2000 DATED OCTOBER 31, 2007.



CLIENT: COLLIERS TMT OF PUERTO RICO

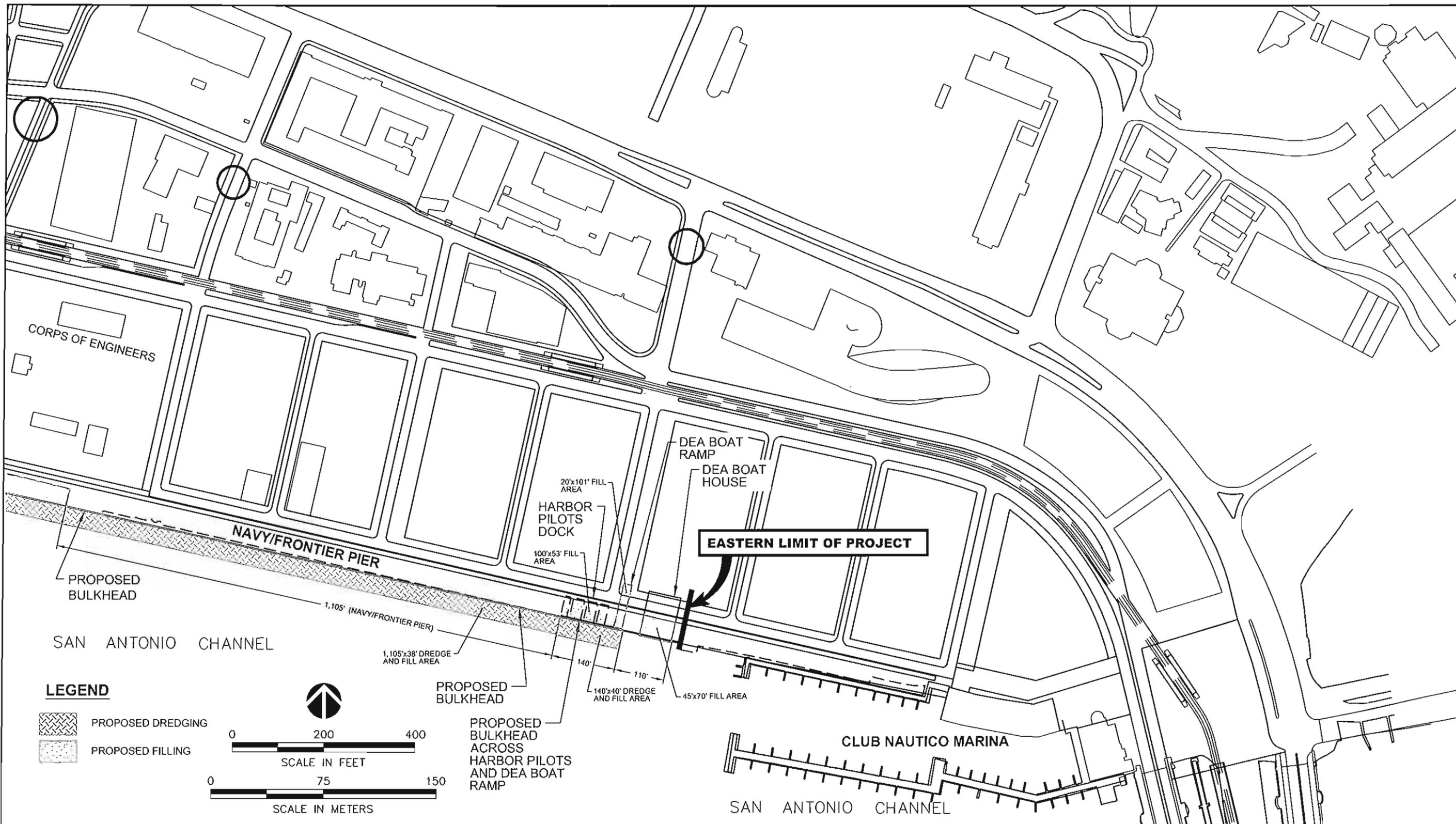
AMEC E & E Caribe, LLP
 530 AVE DE LA CONSTITUTION
 SAN JUAN, PUERTO RICO 00901-2304
 PHONE (787) 289-7835 FAX (787) 289-8779

DRAWN BY: JRS
 CHECKED BY: JD
 DATUM:
 PROJECTION:
 SCALE: AS SHOWN

PROJECT: SAN JUAN WATERFRONT PROJECT
 SAN JUAN, PUERTO RICO

TITLE: PROPOSED WATERFRONT MODIFICATIONS

DATE: OCTOBER 2007
 PROJECT NO.: 766000004
 REV. NO.:
 FIGURE No. FIGURE 1B



NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC E & E CARIBE, LLP REPORT No. 7-660-00004.2000 DATED OCTOBER 31, 2007.



CLIENT:
COLLIERS TMT OF PUERTO RICO

AMEC E & E Caribe, LLP
 530 AVE DE LA CONSTITUCION
 SAN JUAN, PUERTO RICO 00901-2304
 PHONE (787) 289-7835 FAX (787) 289-8779



DRAWN BY:
 JRS

CHECKED BY:
 JD

DATUM:

PROJECTION:

SCALE:
 AS SHOWN

PROJECT
**SAN JUAN WATERFRONT PROJECT
 SAN JUAN, PUERTO RICO**

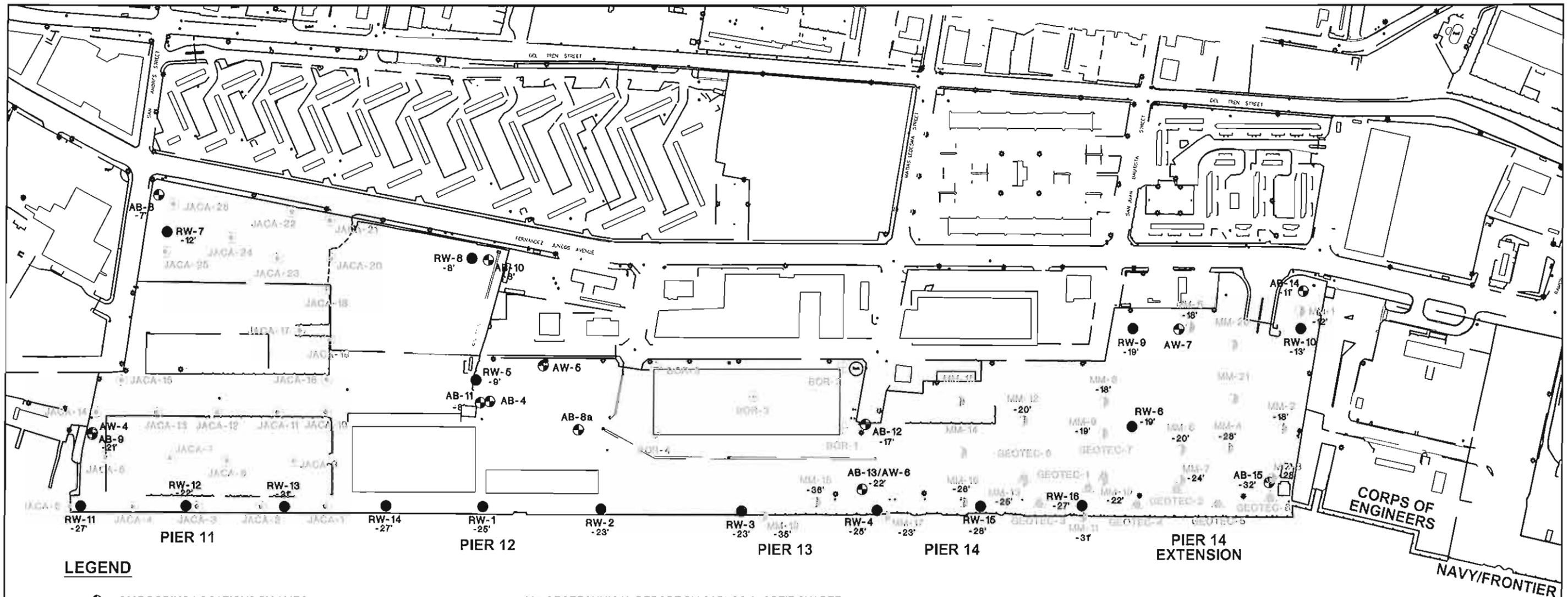
TITLE
PROPOSED WATERFRONT MODIFICATIONS

DATE:
 OCTOBER 2007

PROJECT NO:
 766000004

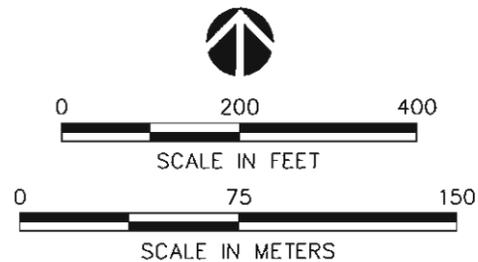
REV. NO.:

FIGURE No.
 FIGURE 1C



LEGEND

- ⊕ 2007 BORING LOCATIONS BY AMEC
AB1 through AB19
AW-1 through AW-7
AW-9 and AW-10
- 2003 GEOTECHNICAL REPORT BY GEOCONSULT
RW-1 through RW-16
- 2002 GEOTECHNICAL REPORT BY GEOENGINEERING
BOR-1 through BOR-5
- 1992 GEOTECHNICAL REPORT BY GEOCONSULT
MM-1 through MM-21
- 1989 GEOTECHNICAL REPORT BY JACA AND SIERRA TESTING LABORATORY
JACA-1 through JACA-26
- 1987 GEOTECHNICAL REPORT BY CARLOS A. ORTIZ SUAREZ
GEOTEC-1 through GEOTEC-8
- 22' APPROXIMATE ELEVATION OF BEARING SOIL (FEET) (NAVD88 DATUM)



NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC E & E CARIBE, LLP REPORT No. 7-660-00004.2000 DATED OCTOBER 31, 2007.



CLIENT:
COLLIERS TMT OF PUERTO RICO

AMEC E & E Caribe, LLP
530 AVE DE LA CONSTITUTION
SAN JUAN, PUERTO RICO 00901-2304
PHONE (787) 289-7835 FAX (787) 289-8779

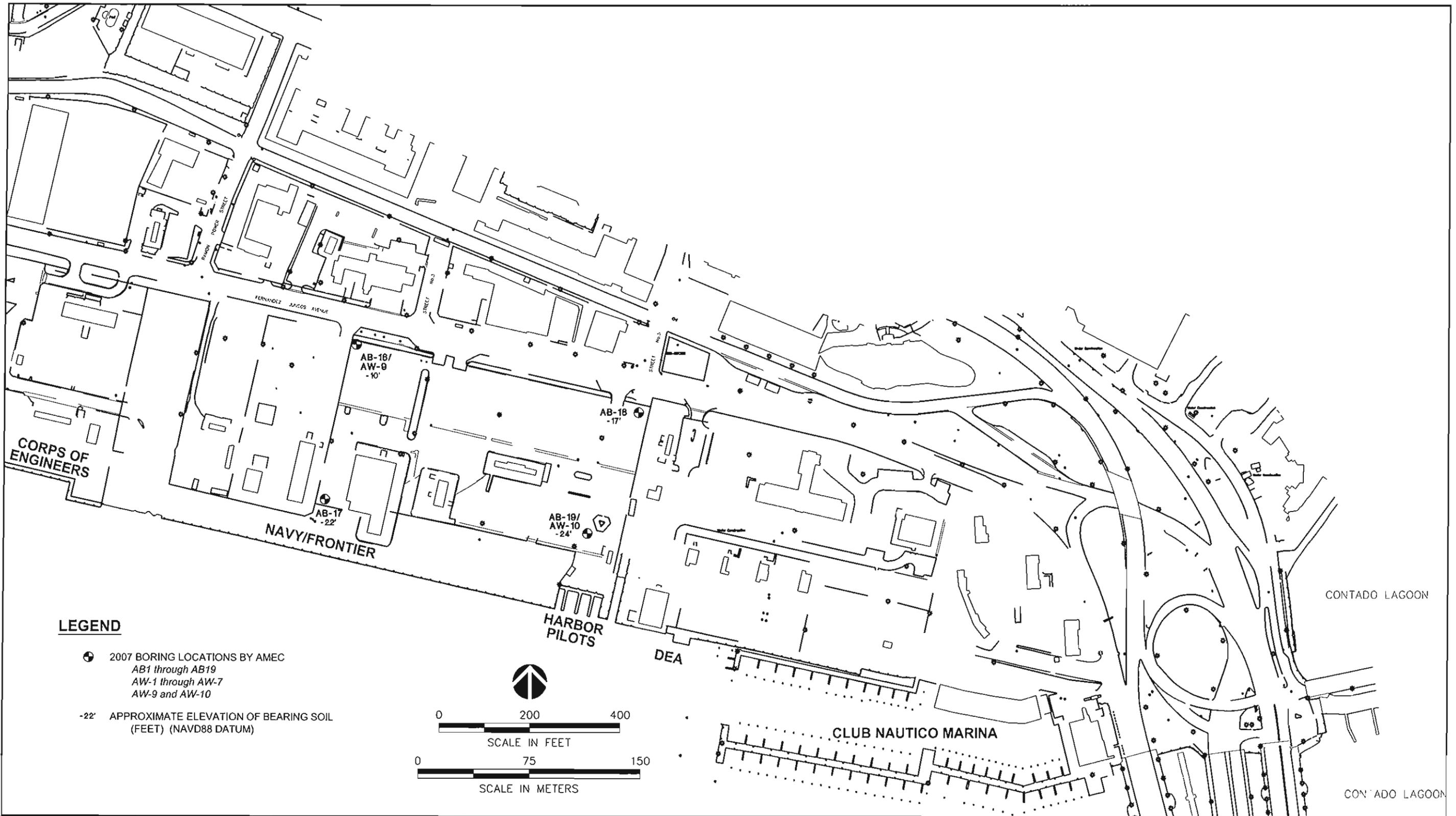


DRAWN BY:
JRS
CHECKED BY:
WJL
DATUM:
PROJECTION:
SCALE:
AS SHOWN

PROJECT
**SAN JUAN WATERFRONT PROJECT
SAN JUAN, PUERTO RICO**

TITLE
SITE AND EXPLORATION PLAN

DATE:
OCTOBER 2007
PROJECT NO:
766000004
REV. NO.:
FIGURE No.
FIGURE 2b



NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC E & E CARIBE, LLP REPORT No. 7-660-00004.2000 DATED OCTOBER 31, 2007.



CLIENT: COLLIERS TMT OF PUERTO RICO

AMEC E & E Caribe, LLP
 530 AVE DE LA CONSTITUTION
 SAN JUAN, PUERTO RICO 00901-2304
 PHONE (787) 289-7835 FAX (787) 289-8779

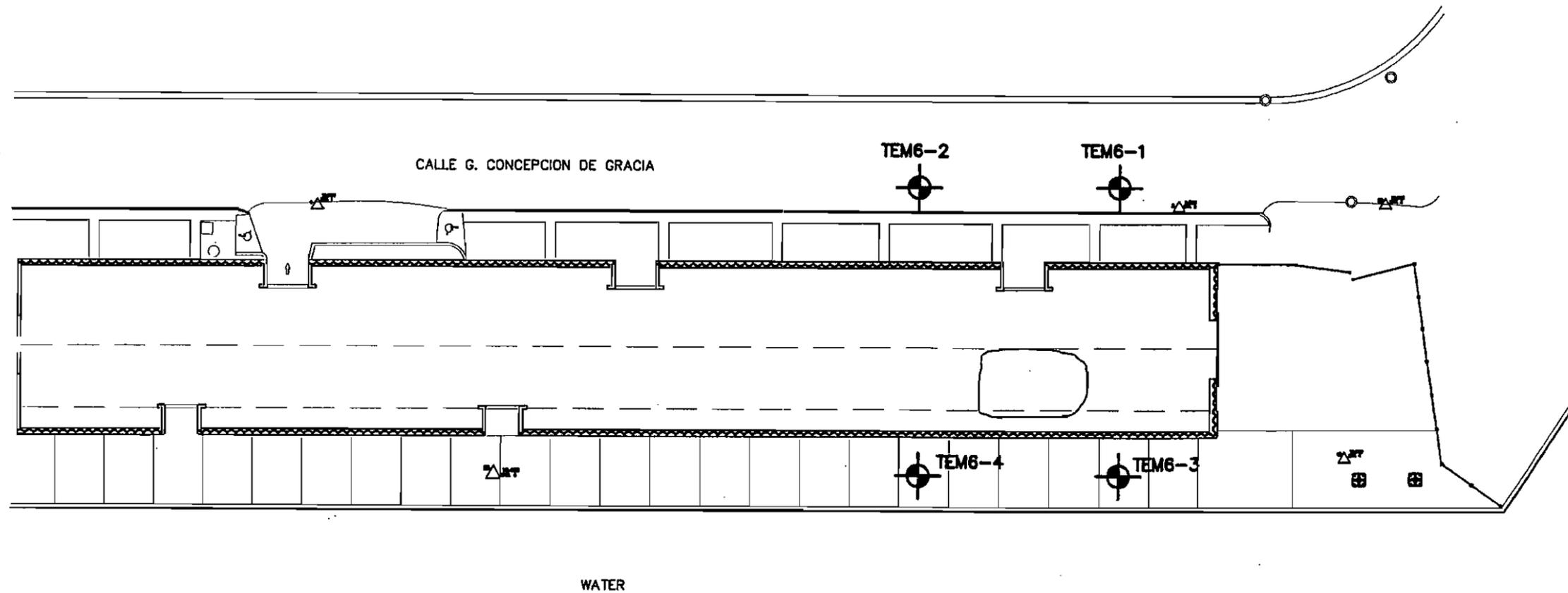
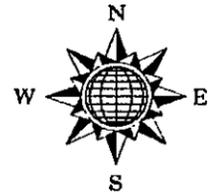


DRAWN BY: JRS
 CHECKED BY: WJL
 DATUM:
 PROJECTION:
 SCALE: AS SHOWN

PROJECT: SAN JUAN WATERFRONT PROJECT
 SAN JUAN, PUERTO RICO

TITLE: SITE AND EXPLORATION PLAN

DATE: OCTOBER 2007
 PROJECT NO: 766000004
 REV. NO.:
 FIGURE No. FIGURE 2c



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 WWW.GEOCONSULT-INC.COM

Client / Project

REPARACIONES MUELLE 6
 Viejo San Juan, Puerto Rico

Scale

1" = 30'

Reference

Drawn : E. Aponte	Created Date : 3/03/04
Checked : C.J.R.	Revision Date : 1/30/04
Approved : C.J.R.	Drawing Ref. : -

Title / Description

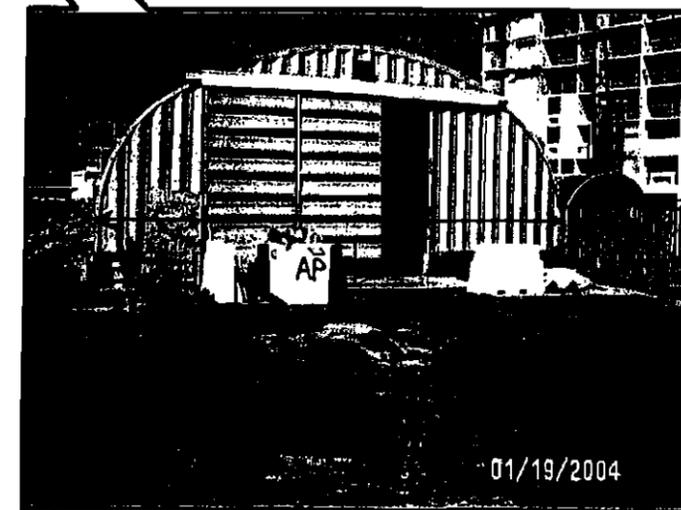
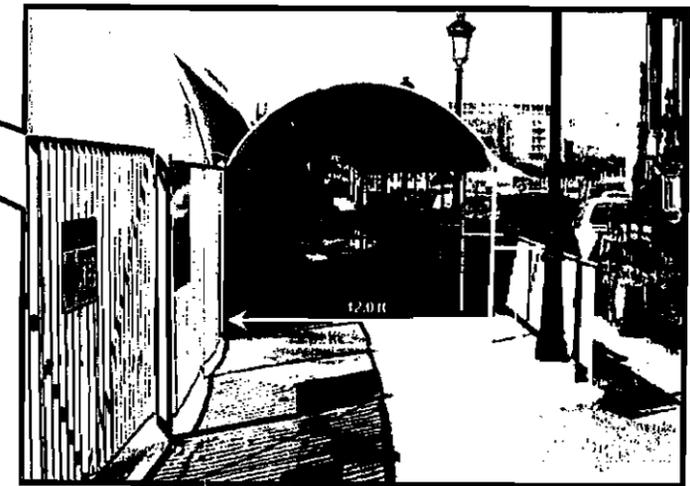
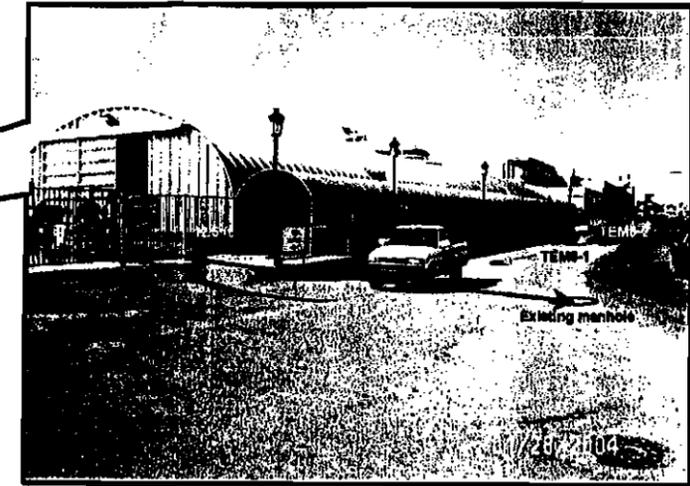
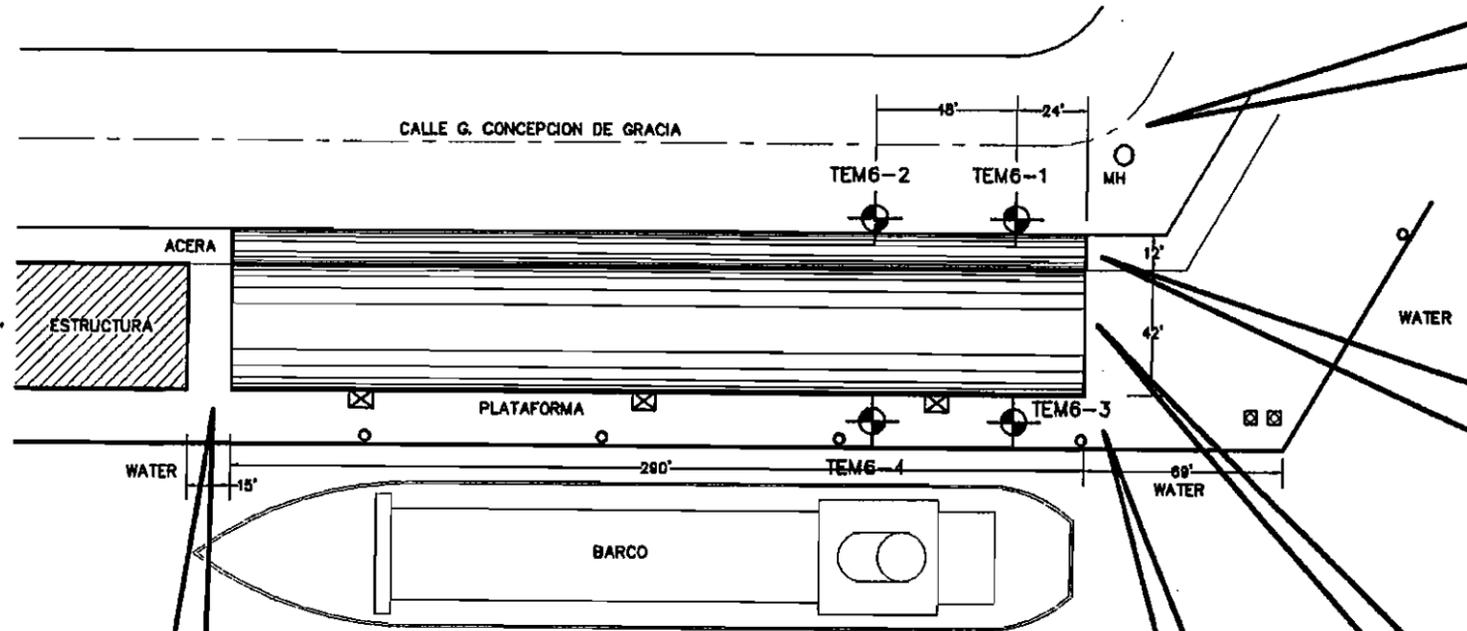
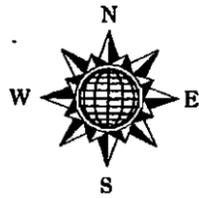
UBICACION ESQUEMATICA
 DE LAS PREFORACIONES

Code No.

Project No.
 2480-03

Sheet No.

FIGURA
 2
 (2 de 3)



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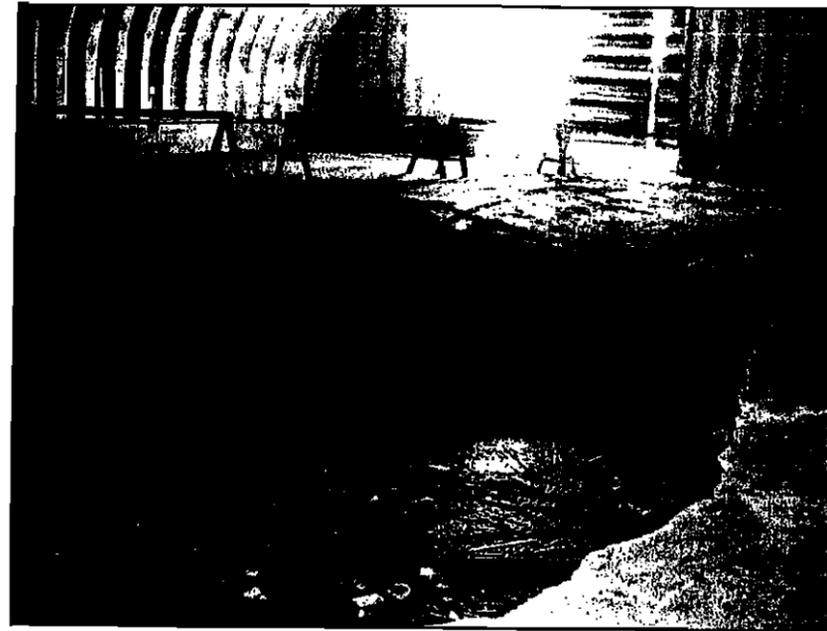
Client / Project
REPARACIONES MUELLE 6
Old San Juan, Puerto Rico

Scale
1" = 60'

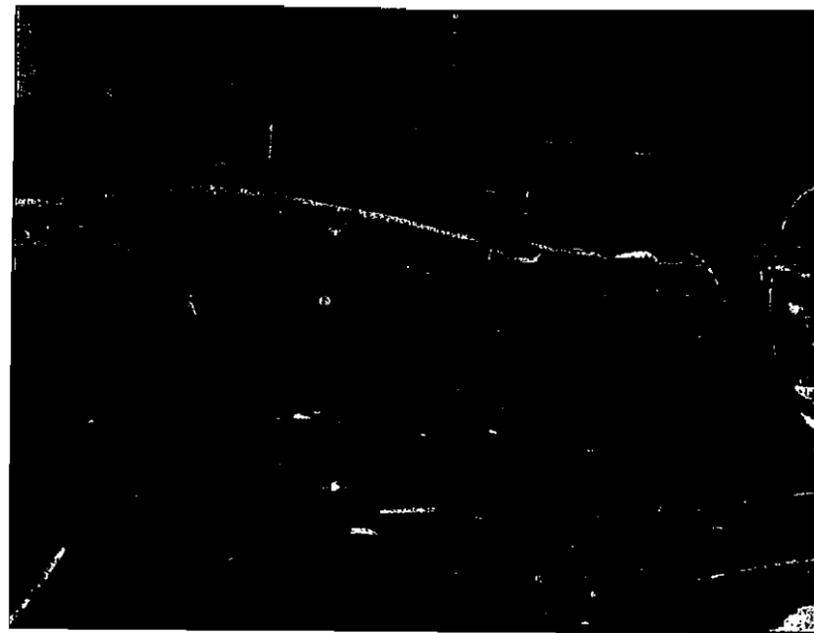
Reference
Drawn : E. Aponte Created Date : 1/29/04
Checked : J.W. Revision Date : 1/30/04
Approved : J.R. Drawing Ref. : -

Title / Description
**UBICACION ESQUEMATICA
DE LAS PREFORACIONES**

Code No. Sheet No.
Project No. FIGURA
2480-03 2
(3 de 3)



Material de relleno que fue lavado.



Zona fallada dentro del edificio donde se puede apreciar la tablestaca de hormigón existente.



Zona fallada detrás de la tablestaca dentro del edificio (esquina sureste).



Foto debajo de la plataforma donde se observa el arreglo de tablestacas de hormigón, viga, cabezal y pilote.



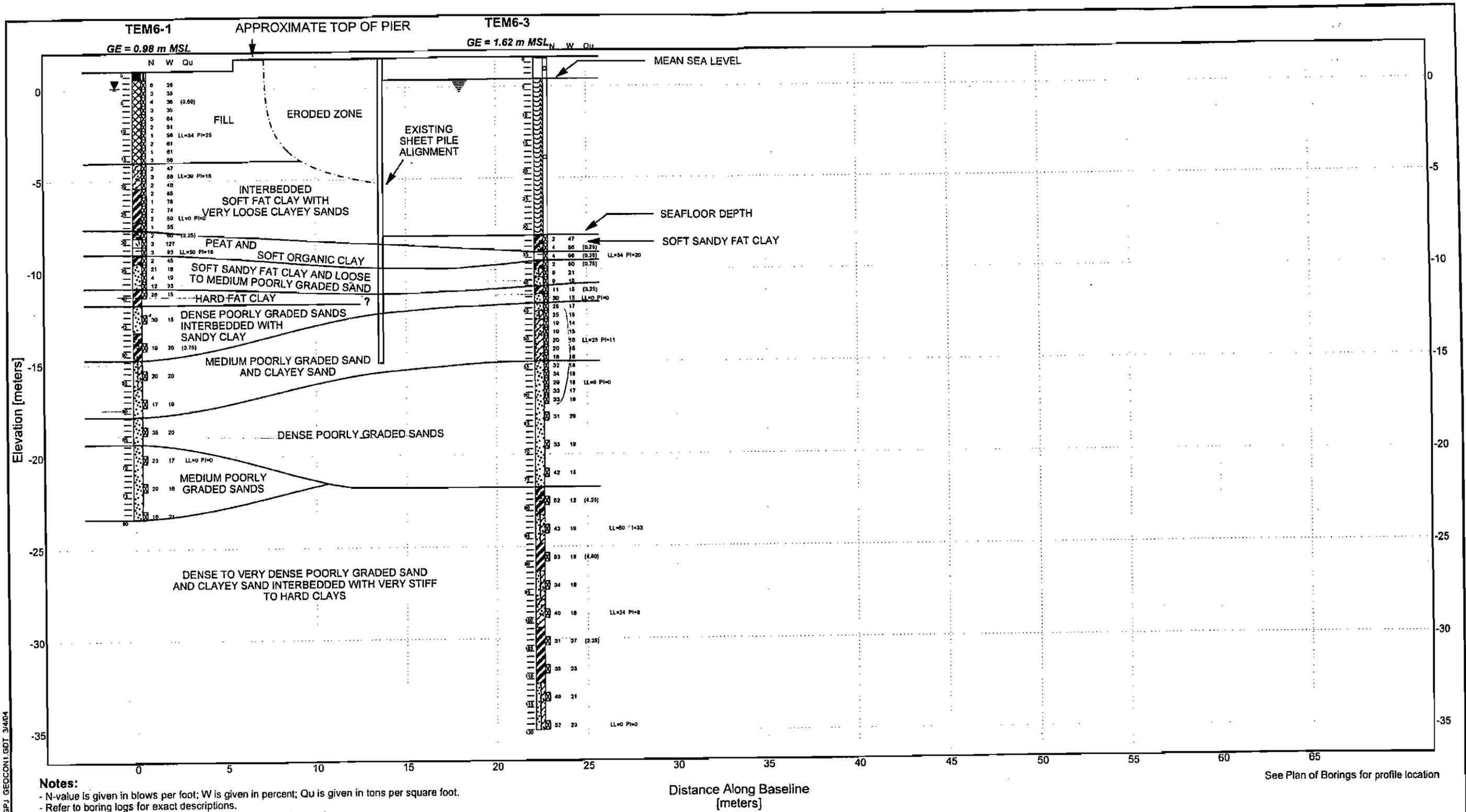
Foto debajo de la plataforma donde se observa la rotación de la tablestaca.

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Project	Reference	Description	Code No.	Sheet No.
REPARACIONES MUELLE 6 Old San Juan, Puerto Rico	Scale: NOT TO SCALE	FOTOGRAFIAS DE ZONA DE FALLA	-	FIGURA 3
	Date: 02/09/04			
	By: E.J.A.H. Revised: C.J.R.			
			Project No. 2480-03	

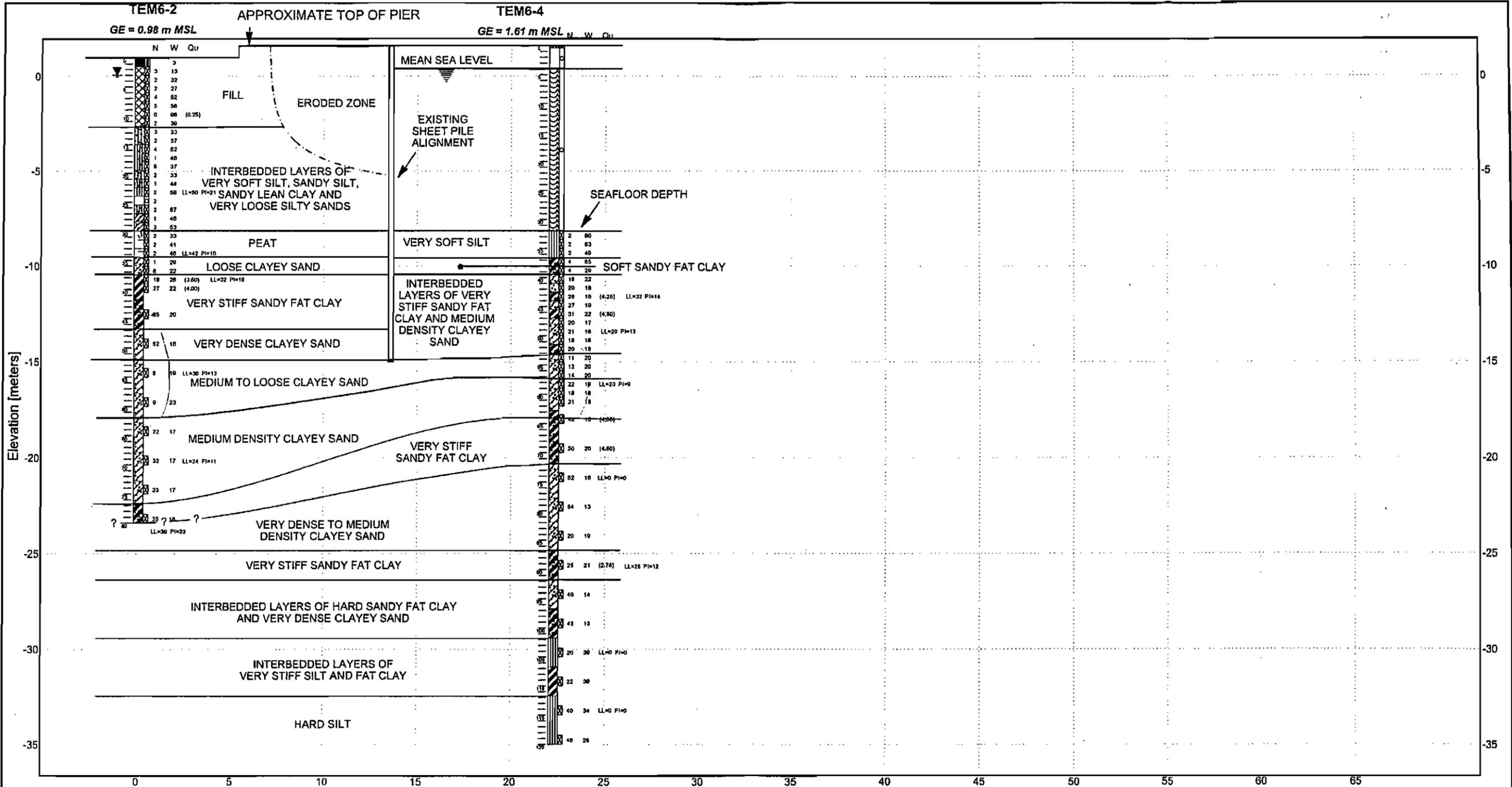


- Notes:**
- N-value is given in blows per foot; W is given in percent; Qu is given in tons per square foot.
 - Refer to boring logs for exact descriptions.
 - Subsurface conditions were determined at boring locations only.
 - Subsurface conditions may vary from the generalized subsurface profile shown here.
 - Refer to Boring Location Plan for profile alignments.

See Plan of Borings for profile location

GEOCONSULT-NEW 2480-03.GPJ GEOCONSULT.GDT 3/4/04

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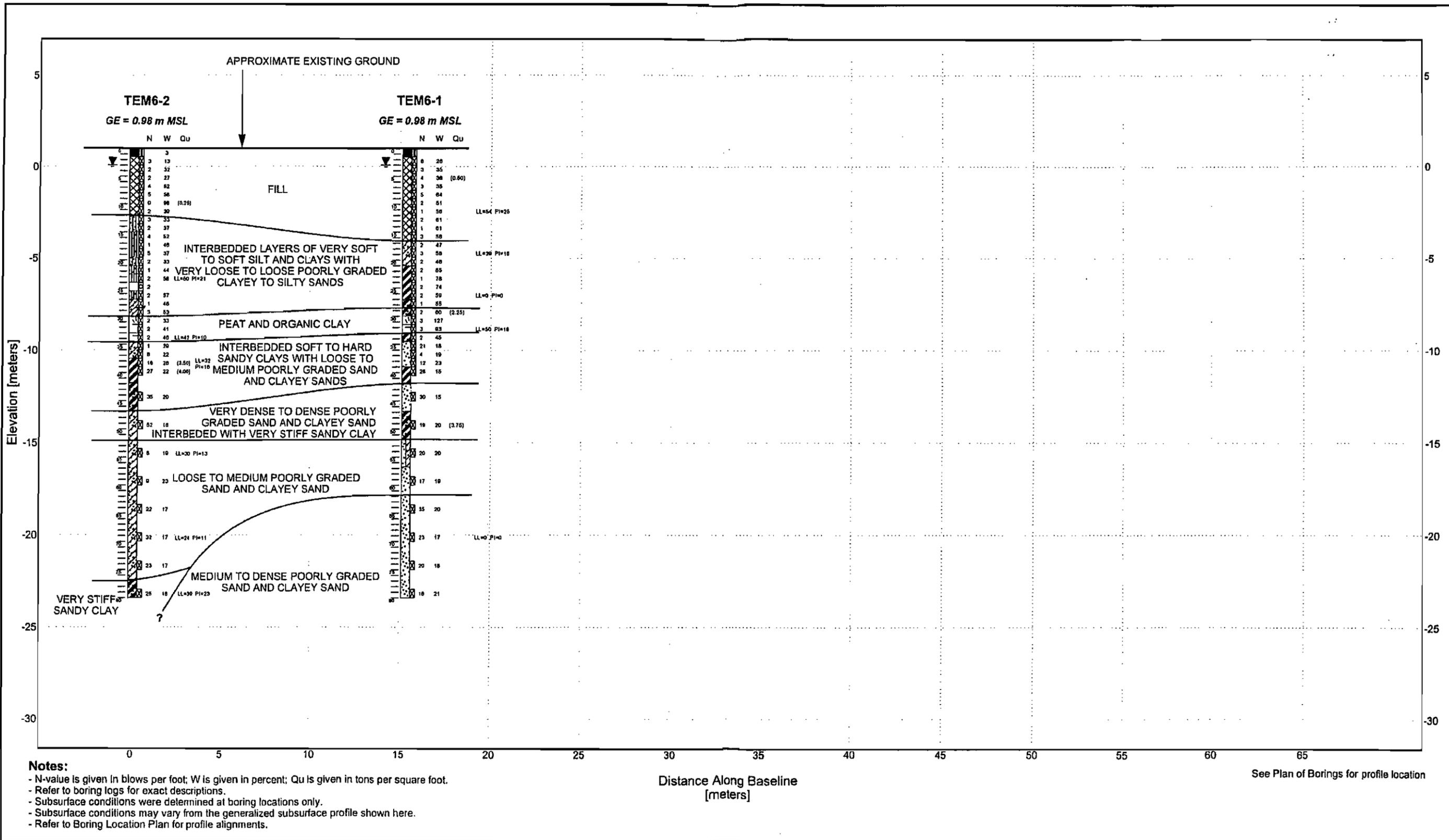
- Notes:**
- N-value is given in blows per foot; W is given in percent; Qu is given in tons per square foot.
 - Refer to boring logs for exact descriptions.
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 - Subsurface conditions may vary from the generalized subsurface profile shown here.
 - Refer to Boring Location Plan for profile alignments.

Distance Along Baseline [meters]

See Plan of Borings for profile location

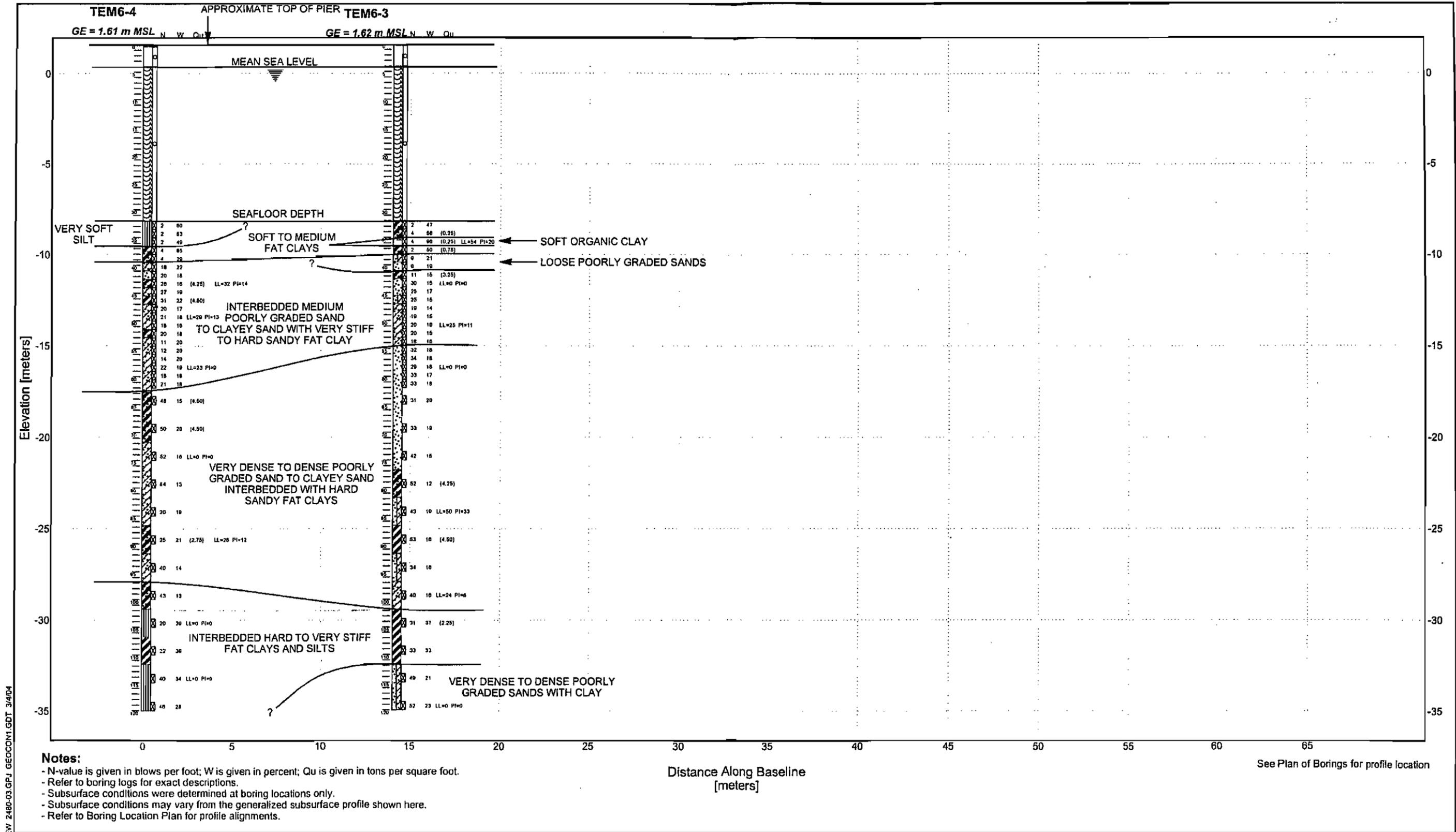
GEOCONSULT-NEW 2480-03.GPJ GEOCONSULT.GDT 3/4/04

GEOCONSULT Geotechnical Engineers - San Juan, PR P.O. Box 362040, San Juan, PR 00936-2040 Tel. (787) 782-3554 / Fax (787) 793-0410 www.geocconsult.us	CLIENT/PROJECT	REFERENCE	SCALE	DESCRIPTION	CODE NO.	SHEET NO.
	TRABAJOS DE REPARACION MUELLE 6 San Juan, Puerto Rico	Date : 3/4/2004 By : J.I.W.R. Check : C.J.R. Revised : C.J.R.	Vert./Horiz. 1:200/1:200	GENERALIZED SUBSURFACE PROFILE B-B'	PROJECT NO. 2480-03	FIGURE 4 (2 OF 4)



GEOCONSULT-NEW 2480-03.GPJ GEOCON1.GDT 3/4/04

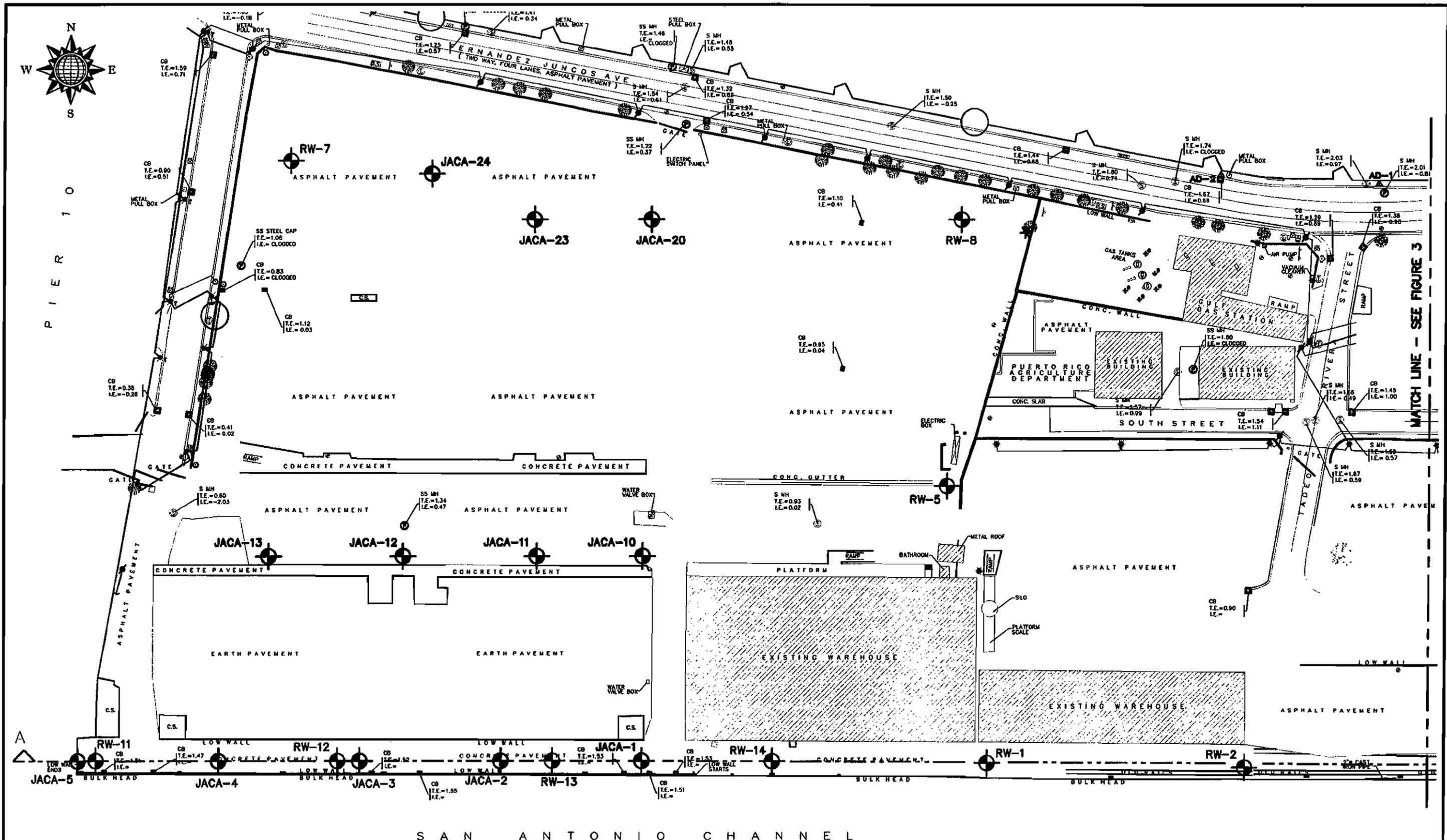
GEOCONSULT Geotechnical Engineers - San Juan, PR P.O. Box 362040, San Juan, PR 00936-2040 Tel. (787) 782-3554 / Fax (787) 793-0410 www.geoconsult.us	CLIENT/PROJECT	REFERENCE	SCALE	DESCRIPTION	CODE NO.	SHEET NO.
	TRABAJOS DE REPARACION MUELLE 6 San Juan, Puerto Rico	Date : 3/4/2004 By : J.I.W.R. Check : C.J.R. Revised : C.J.R.	Vert./Horiz. 1:200/1:200	GENERALIZED SUBSURFACE PROFILE C-C'	PROJECT NO. 2480-03	FIGURE 4 (3 OF 4)



GEOCONSULT6-NEW 2480-03.GPJ GEOCONSULT.GDT 3/4/04

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CLIENT/PROJECT	REFERENCE	SCALE	DESCRIPTION	CODE NO.	SHEET NO.
TRABAJOS DE REPARACION MUELLE 6 San Juan, Puerto Rico	Date : 3/4/2004	Vert./Horiz. 1:200/1:200	GENERALIZED SUBSURFACE PROFILE D-D'	-	FIGURE 4 (4 OF 4)
	By : J.I.W.R.				
Check : C.J.R.					
	Revised : C.J.R.			2480-03	



SAN ANTONIO CHANNEL

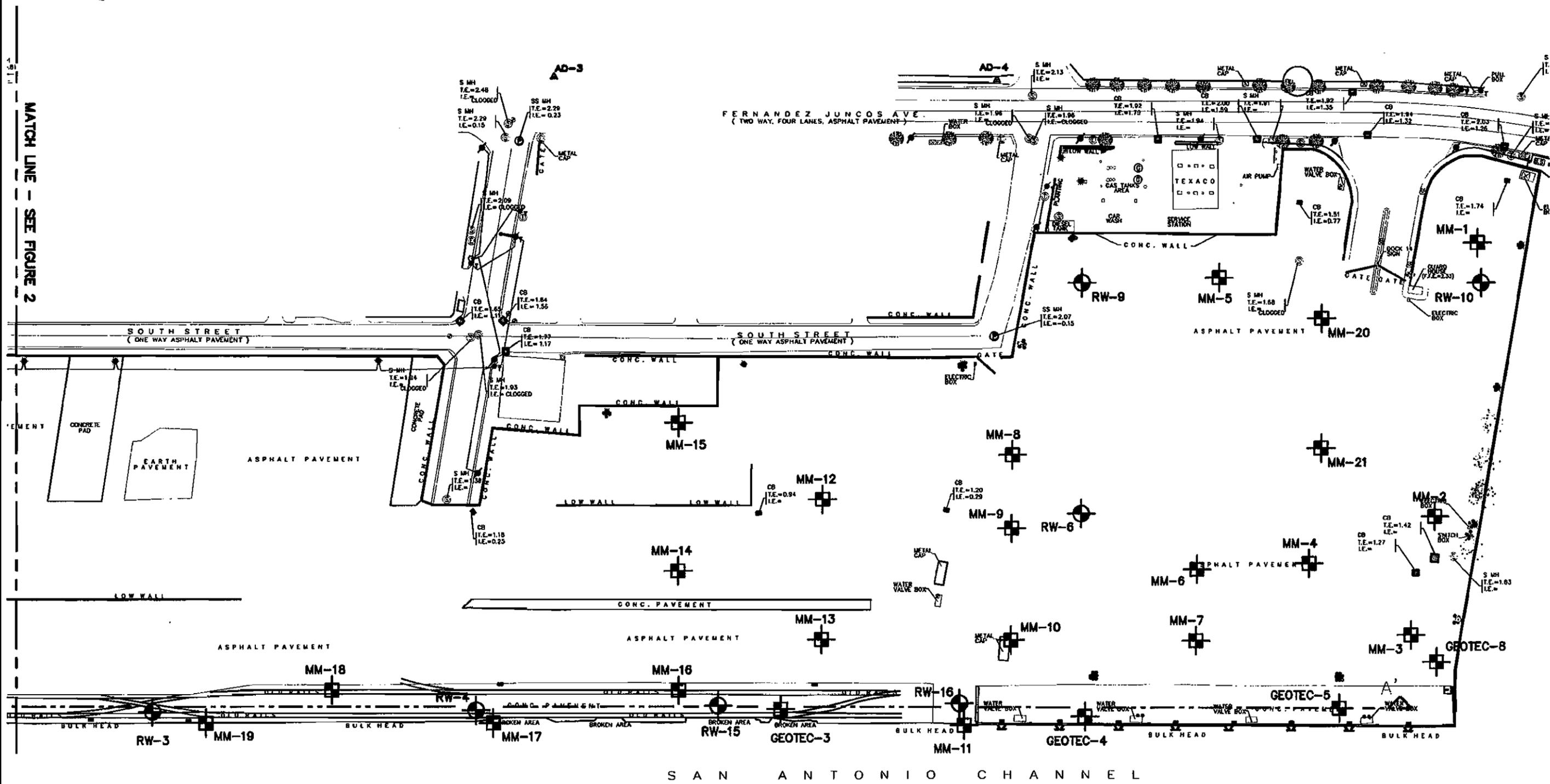
GEOCONSULT Geotechnical Engineers - San Juan, P.R.	P.O. Box 362040, San Juan P.R. 00936-2040 TEL. (787) 782-3554 / FAX (787) 793-0410 WWW.GEOCONSULT.PR	CLIENT/PROJECT	REFERENCE	SCALE	DESCRIPTION	CODE NO.	SHEET NO.
		RECONSTRUCTION OF WHARVES 11, 12, 13 AND 14 San Juan Dock Area - San Juan, Puerto Rico	Date: 10/21/03 By: E.J.A.H. Check: C.J.R. Revised: C.J.R.	GRAPHIC SCALE SCALE = 1:1,000	BORING LOCATION PLAN	PROJECT NO. 2456-02	FIGURE 2 (1 OF 2)



EMPTY LOT

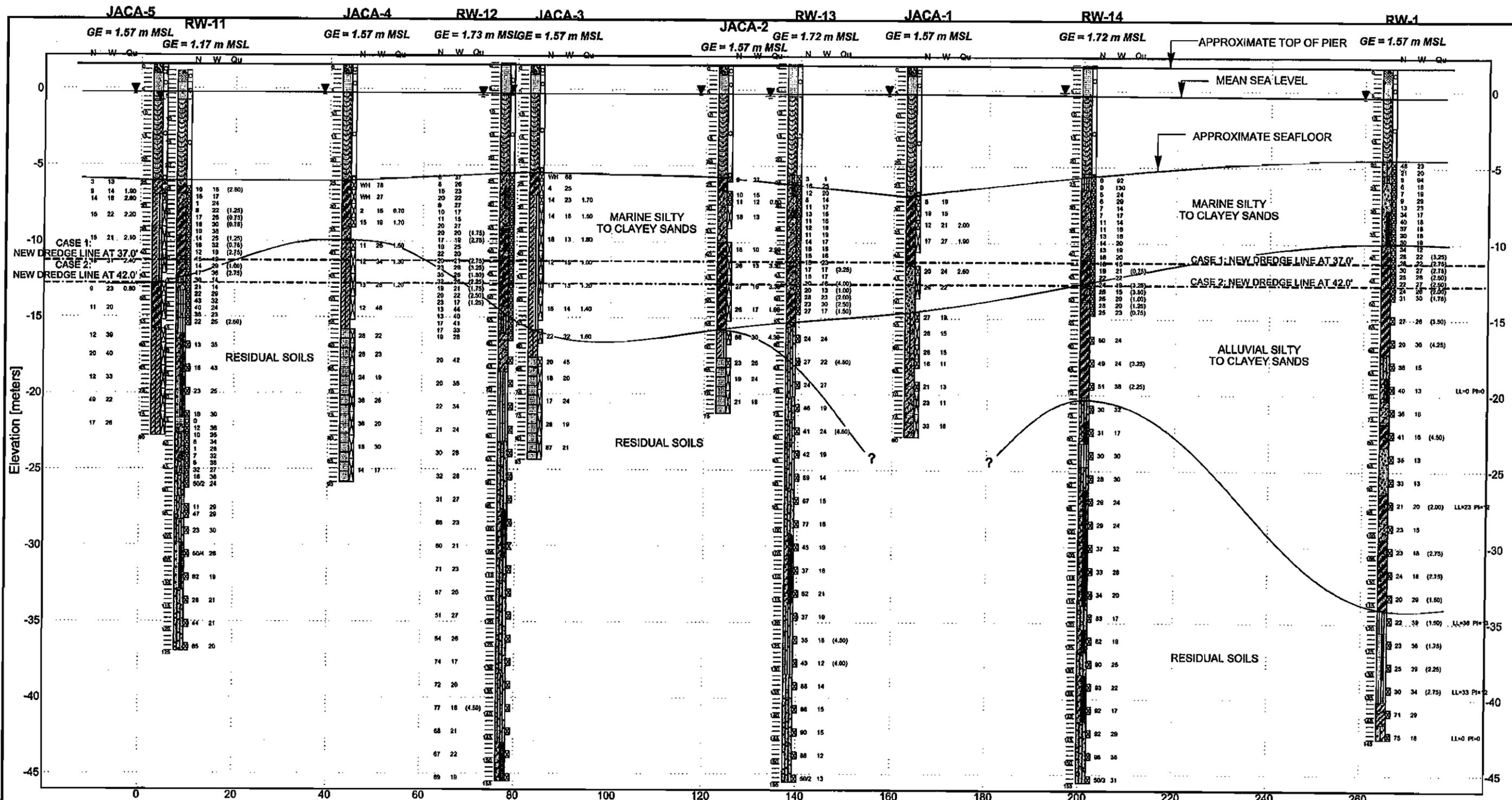
FALANSTERIO

SAN ANTONIO PUBLIC HOUSING



MATCH LINE - SEE FIGURE 2

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		RECONSTRUCTION OF WHARVES 11, 12, 13 AND 14 San Juan Dock Area - San Juan, Puerto Rico	Date : 10/21/03 By : E.J.A.H. Check : C.J.R. Revised : C.J.R.	GRAPHIC SCALE SCALE = 1:1,000	BORING LOCATION PLAN	PROJECT No. 2456-02	FIGURE 2 (2 OF 2)

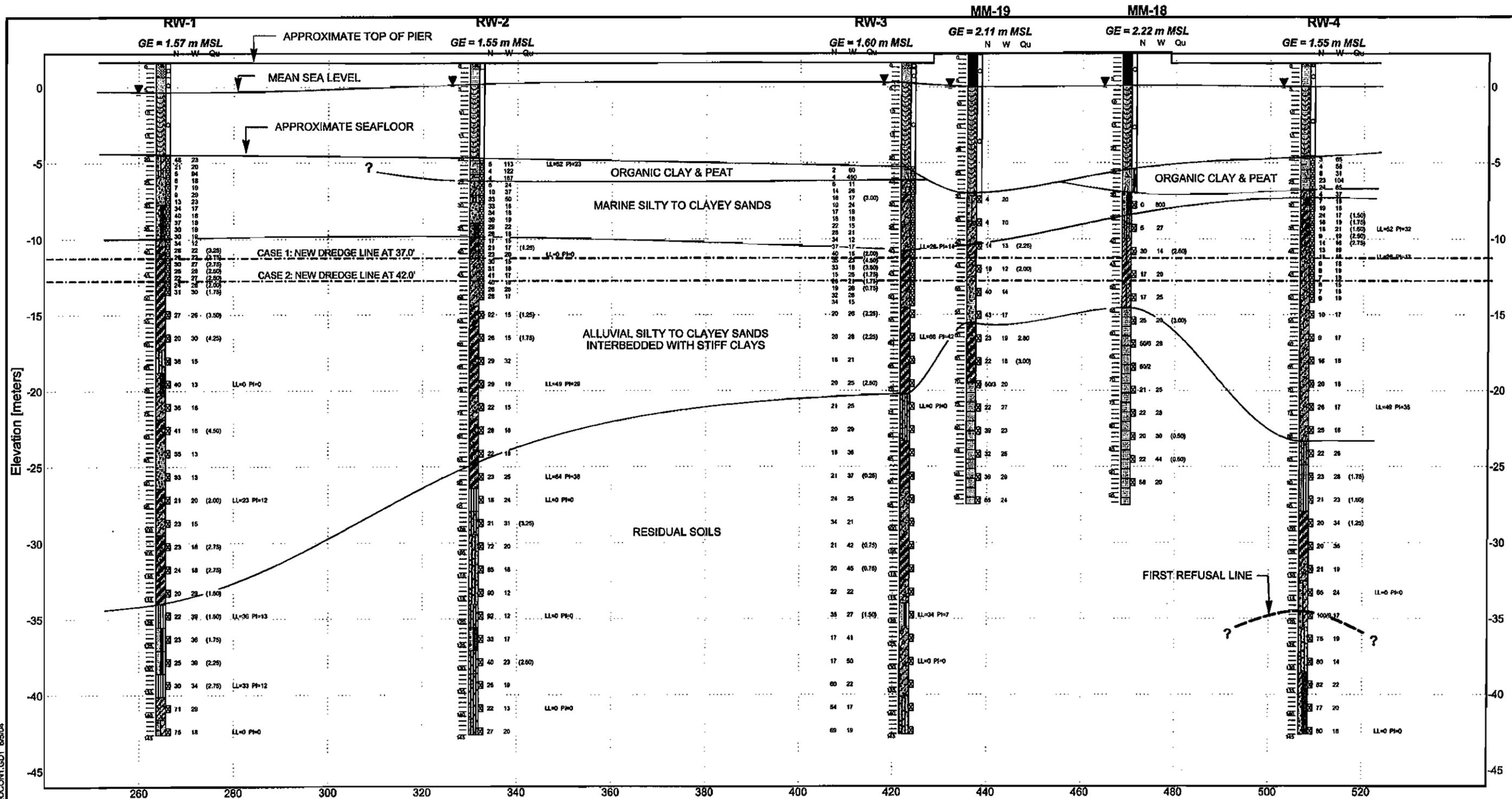


- Notes:**
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 - Refer to boring logs for exact descriptions.
 - Subsurface conditions were determined at boring locations only.
 - Subsurface conditions may vary from the generalized subsurface profile shown here.
 - Refer to Boring Location Plan for profile alignments.

See Plan of Borings for profile location

GEOCONSULT-NEW 2456-03W.GPJ_GEDCON1.GDT 6/5/04

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	RECONSTRUCTION OF WHARVES 11 TO 14 San Juan, PR	Date: 6/5/2004 By: J.I.W.R. Check: C.J.R.	Vert./Horiz. 1:250/1:800	GENERALIZED SUBSURFACE PROFILE A-A' SECTION 1:3	PROJECT NO. 2456-03	FIGURE 3 (1 OF 3)



Notes:

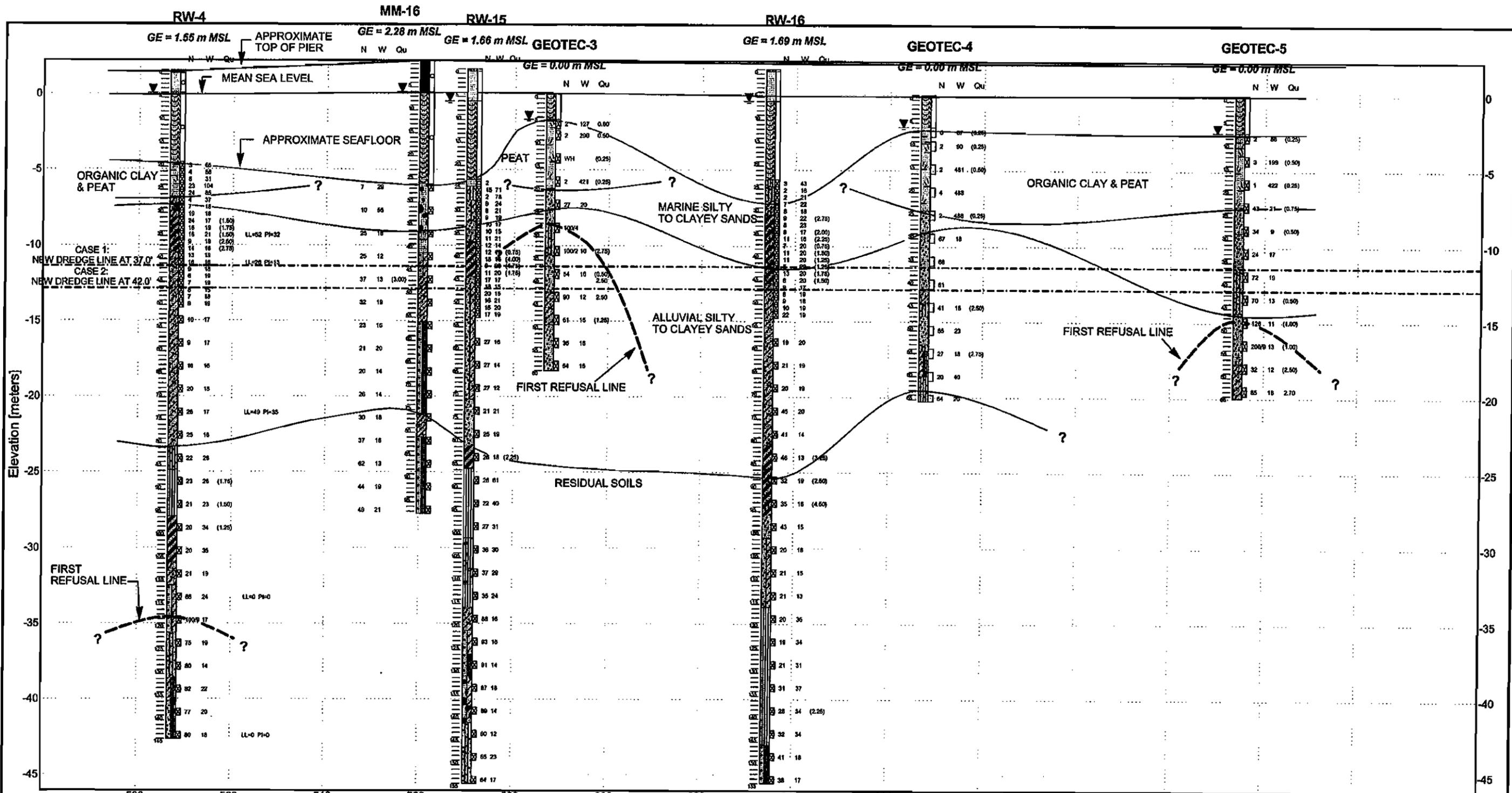
- N-value is given in blows per foot; W is given in percent; Qu is given in tons per square foot.
- Refer to boring logs for exact descriptions.
- Subsurface conditions were determined at boring locations only.
- Subsurface conditions may vary from the generalized subsurface profile shown here.
- Refer to Boring Location Plan for profile alignments.

Distance Along Baseline [meters]

See Plan of Borings for profile location

GEOCONSULTS-NEW 2456-03W.GPJ GEOCONSULT.GDT 05/04

GEOCONSULT Geotechnical Engineers - San Juan, PR P.O. Box 362040, San Juan, PR 00936-2040 Tel. (787) 782-3554 Fax (787) 793-0410 www.geoconsult.us	CLIENT/PROJECT RECONSTRUCTION OF WHARVES 11 TO 14 San Juan, PR	REFERENCE Date : 6/5/2004 By: J.I.W.R. Check: C.J.R. Check: C.J.R.	SCALE Vert./Horiz. 1:250/1:800	DESCRIPTION GENERALIZED SUBSURFACE PROFILE A-A' SECTION 2:3	CODE NO. PROJECT NO. 2456-03	SHEET NO. FIGURE 3 (2 OF 3)
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Notes:

- N-value is given in blows per foot; W is given in percent; Qu is given in tons per square foot.
- Refer to boring logs for exact descriptions.
- Subsurface conditions were determined at boring locations only.
- Subsurface conditions may vary from the generalized subsurface profile shown here.
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GEOCONSULT-NEW 2456-03W.GPJ GEOCONSULT.GDT 6/5/04

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	RECONSTRUCTION OF WHARVES 11 TO 14 San Juan, PR	Date: 6/5/2004 By: J.I.W.R. Check: C.J.R. Check: C.J.R.	Vert./Horiz. 1:250/1:800	GENERALIZED SUBSURFACE PROFILE A-A' SECTION 3:3	PROJECT NO. 2456-03	FIGURE 3 (3 OF 3)

See Plan of Borings for profile location

