REPORT OF
GEOTECHNICAL EXPLORATION

PROPOSED DELRAY BEACH CRA OFFICE BUILDING
95 SW 5TH AVENUE
DELRAY BEACH, FLORIDA

FOR

SONG & ASSOCIATES, INC.
1545 CENTRE PARK DRIVE NORTH
WEST PALM BEACH, FLORIDA 33401

PREPARED BY

NUTTING ENGINEERS OF FLORIDA, INC.
1310 NEPTUNE DRIVE
BOYNTON BEACH, FLORIDA 33426

ORDER NO. 18311.3

OCTOBER 2022
October 31, 2022

Mr. Henrique Certad
Song & Associates, Inc.
1545 Centrepark Drive North
West Palm Beach, Florida 33401
Phone: 561-655-2423 ext. 121  Email: hcertad@songandassociates.com

Subject: Report of Geotechnical Exploration
Proposed Delray Beach CRA Office Building
95 SW 5th Avenue
Delray Beach, Florida

Dear Mr. Certad:

Nutting Engineers of Florida, Inc. (NE), has performed a Geotechnical Exploration for the proposed office building at the above referenced site in Delray Beach, Florida. This exploration was performed in accordance with the written authorization to proceed provided by Song & Associates, Inc. dated October 19, 2022. This evaluation was performed to develop information regarding subsurface soil conditions at specific test locations which along with proposed construction information provided was used to develop opinions regarding earthwork procedures and foundations for support of the proposed construction. This report presents our findings and recommendations based upon the information examined at the time of this evaluation.

PROJECT INFORMATION

We understand that plans include the demolition of any existing structures or features at the site for the development of a new one to a two-story office building. The building will have a total area of approximately 7,000 square feet and consist of concrete block construction. We were provided with a boundary survey detailing the existing site conditions. Plans for the new construction were not provided at the time of this report; therefore, if any information is incorrect our office must be notified in writing in order to review our recommendations provided herein. The building is proposed to be supported upon a shallow foundation system similar to nearby structures. Along with the building associated asphalt paved parking lots, roadways, sidewalks, landscaped islands, dumpster pad, and other typical commercial development ancillary features will be constructed.

Based on current site elevations, we estimate that one to two feet of fill may be required to bring the site up to construction grade; however, the final building pad elevation shall be determined by a professional architect, civil engineer, or other qualified party.
NE should be notified in writing by the client of any changes in the proposed construction along with a request to amend our foundation analysis and/or recommendations within this report as appropriate.

GENERAL SUBSURFACE CONDITIONS

Soil Survey Maps

As part of the geotechnical exploration, we have reviewed available Soil Conservation Service (SCS) survey maps for Palm Beach County. These SCS maps provide qualitative information about potential general shallow soil conditions in the project vicinity. This information was derived from approximately 6 ft. deep manual auger borings, aerial photo, and surface feature interpretation at some point in the past (mid 1980’s to early 1970’s). The SCS data may or may not reflect actual current site conditions. The United States Soil Conservation Soils Map for Palm Beach County indicates St. Lucie sand in the area of the site. This nearly level to sloping, excessively drained, deep, sandy soil is on long narrow, dune-like coastal ridges and on isolated knolls. A representative pedon contains a surface layer of gray sand about 5 inches thick. Below this is white sand that extends to a depth of 80 inches or more. We note that the maximum depth of the survey is six feet.

Subsurface Exploration

NUTTING ENGINEERS OF FLORIDA, INC. performed three Standard Penetration Test (SPT) borings (ASTM D-1586) to depths of twenty-five feet below land surface. The locations of the test borings are indicated on the boring location plan presented in the Appendix of this report. The boring locations were identified in the field using approximate methods; namely, a measuring wheel and available surface controls. As such the soil boring locations should be considered to be approximate. We note that due to the potential for underground utilities at the test boring locations, the upper four feet of the soil profile at the test boring locations were manually cleared. Because of this, the relative density of the upper four feet was not obtained.

Test Boring Results

In general, the soil boring locations recorded loose to medium dense light gray to light brown sand in the upper seventeen feet, underlain by soft porous gray limestone and sand to a depth of twenty-five feet, the maximum depth explored. Please see the enclosed soil classification sheet in the Appendix of this report for additional important information regarding these descriptions, the field evaluation and other related information.

Note: Substantially different subsurface conditions may exist at other areas of the site. Buried debris may or may not be identified or adequately delineated by soil borings. Test pit excavation can provide more insight into such conditions and rock lithology if present. Such conditions may be revealed during site development activities (e.g., proof rolling, utility & foundation excavation activities) or other related activities. Should additional assurance be desired by the client, further subsurface investigation could be performed.
Groundwater Information

The immediate groundwater level was measured at the boring locations at the time of drilling. The groundwater level was encountered at an approximate depth thirteen and a half to fourteen feet below the existing ground surface at the time of drilling.

The immediate depth to groundwater measurements presented in this report will not provide a reliable indication of stabilized or more long-term depth to groundwater at this site. Water table elevations can vary dramatically with time through rainfall, droughts, storm events, flood control activities, nearby surface water bodies, tidal activity, pumping and many other factors. For these reasons, this immediate depth to water data should not be relied upon alone for project design considerations.

ANALYSIS AND RECOMMENDATIONS

The borings performed for this project suggest that loose to very loose sands exist in the upper twenty-five feet of the soil profile. In order to prepare the site for the proposed construction, we recommend that an undercut and compaction program be implemented. Once the site has been prepared in accordance with our site preparation recommendations presented in this report, the proposed office building may be supported on a shallow foundation system using an allowable soil bearing pressure of 2,500 pounds per square foot. Once plans are finalized for the proposed construction, a copy should be provided to Nutting Engineers for review to determine whether additional details or changes to our recommendations are warranted. All work should be completed in accordance with applicable building codes, other regulations as appropriate, and good standard local practice.

For one-story construction, we recommend a minimum width of 16 inches for continuous footings and 24 inches for individual footings, even though the soil bearing pressure may not be fully developed in all cases. For two-story construction, we recommend a minimum width of 24 inches for continuous footings and 30 inches for individual footings, even though the soil bearing pressure may not be fully developed in all cases. We recommend that the bottom of footings be at least 12 inches below the lowest adjacent finished grade.

It is our opinion that the floor slab system may be constructed as a slab on grade. We recommend that a vapor barrier be placed between the soil and concrete. We also recommend that the reinforcing steel mesh be placed at the approximate center of the slab for tensile support.

Settlement Analysis

We performed a settlement evaluation based upon a hypothetical improved soil profile following completion of the undercut and compaction operations using a moderately sized vibratory compactor for the construction. This method should improve the soils to provide an allowable bearing capacity of 2,500 pounds per square foot.
It was estimated that upon proper completion, long-term total settlements should be on the order of less than approximately one inch. Differential settlements should be approximately one-half of the total settlement. Most of this settlement should occur upon the application of the dead load during construction.

We note that in order to maintain the calculated settlement throughout the life of the structure it would be necessary to grade the site such that stormwater is directed away from the foundations. Any ponding nearby/adjacent to walls and foundations should be avoided.

**Site Preparation**

Any debris from the clearing operations, and any unsuitable soils as determined by the Geotechnical Engineer will need to be completely removed within the construction area and to a lateral distance of at least 5 feet beyond the footprint limits. A Nutting Engineer’s representative should be present to observe that the stripping operations are performed as we have discussed herein.

Upon approval by the geotechnical engineer, the building area should then be **undercut to a depth of two feet (24-inches) below existing site elevation**. The undercut surface should then be thoroughly soaked with water and compacted with at least 20 overlapping passes of a vibratory compactor operated no faster than at a slow walking pace. The coverages should be equally divided into two perpendicular directions. **The compaction operations must be observed by a representative of Nutting Engineers.**

In addition, the surface should also be compacted until a density equivalent to at least 98 percent of the modified Proctor maximum dry density (ASTM D-1557) is achieved to a depth of at least 12 inches below the compacted surface.

The stockpiled backfill and any structural fill needed to bring the site to construction grade may then be placed in lifts not exceeding twelve inches in loose thickness. Each lift should be thoroughly compacted until densities equivalent to at least 98 percent of the modified Proctor maximum dry density are uniformly obtained. Fill should consist of granular soil, with less than 10% passing the No. 200 sieve, free of rubble, organics (5% or less) clay, debris, and other unsuitable material. The fill should have ASTM designation (D-2487) of GP, GW, SP, or SW, with a maximum particle size of no more than 3 inches or as otherwise approved by Nutting Engineers.

Following site and building pad construction as discussed above, the foundation area should be excavated, and the footings formed.

The bottom of foundation excavations should be compacted after excavation to develop a minimum density requirement of 98 percent of the maximum modified Proctor dry density, for a minimum depth of one (1) foot below the bottom of the footing depth, as determined by field density compaction tests. The floor slab area should also be compacted in the same manner.
### Pavements

The results of the test borings suggest that conventional pavement construction practices may be implemented for the new parking lots and driveway areas. Based on the borings performed, the soils in the upper three feet consist of sand. Because of this it should be anticipated that new material will need to be imported to the site in order to prepare the base and sub-base course.

For asphalt pavement, the areas should be compacted to a minimum of 98 percent of the modified Proctor maximum dry density to a depth of at least 12 inches below the subgrade level. We recommend that stabilized subgrade having a minimum Limerock Bearing Ratio (LBR) of 40 be placed to a depth of approximately one foot below the base course. The base course will range from approximately 6 to 8 inches and should have a minimum LBR of 100.

Where concrete pavement is used, a minimum concrete pavement thickness of 6 inches is recommended for the standard and heavy-duty pavement design. The minimum thickness is based upon concrete with a compressive strength of 3,500 psi, and a modulus of rupture of 550 psi. The pavement section should bear on properly compacted subgrade similar to asphalt pavement sections discussed in the paragraph above.

### GENERAL INFORMATION

Our client for this geotechnical evaluation was:

Mr. Henrique Certad  
Song & Associates, Inc.  
1545 Centrepark Drive North  
West Palm Beach, Florida 33401

The contents of this report are for the exclusive use of the client, the client’s design & construction team and governmental authorities for this specific project exclusively. Information conveyed in this report shall not be used or relied upon by other parties or for other projects without the expressed written consent of Nutting Engineers of Florida, Inc. This report discusses geotechnical considerations for this site based upon observed conditions and our understanding of proposed construction for foundation support. Environmental issues including (but not limited to), soil and/or groundwater contamination, and other environmental considerations are beyond our scope of service for this project. As such, this report should not be used or relied upon for evaluation of environmental issues.

Prior to initiating compaction operations, we recommend that representative samples of the structural fill material to be used and acceptable in-place soils be collected and tested to determine their compaction and classification characteristics. The maximum dry density, optimum moisture content, gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill and existing soils, and to determine if the fill material is acceptable.
If conditions are encountered which are not consistent with the findings presented in this report, or if proposed construction is moved from the location investigated, this office shall be notified immediately so that the condition or change can be evaluated, and appropriate action taken.

The vibratory compaction equipment may cause vibrations that could be felt by persons within nearby buildings and could potentially induce structural settlements. Additionally, preexisting settlements may exist within these structures that could be construed to have been caused or worsened by the proposed vibratory compaction after the fact. Pre- and post-conditions surveys of these structures along with the vibration monitoring during vibratory compaction could be performed to better evaluate this concern. The contractor should exercise due care during the performance of the vibratory compaction work with due consideration of potential impacts on existing structures. If potential vibrations and impacts are not considered tolerable, then alternate foundation modification techniques should be considered.

Nutting Engineers of Florida, Inc. (NE), recommends that we be contracted to provide input to the design team and owner during the foundation and earthwork design process and that we review final foundation drawings and specifications to verify that our report recommendations and design intent have been properly implemented. NE shall also perform testing and inspections during the earthwork and foundation construction as recommended in this report. If NE is not engaged to perform these services as detailed herein, the Client agrees that NE shall bear no liability for the interpretation, implementation of our report, its recommendations and/or inspection and testing services as described in this report if implemented by others.

Excavations of five feet or more in depth should be sloped or shored in accordance with OSHA and State of Florida requirements.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with general accepted professional practice in the field of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.
We appreciate the opportunity to be of service on this project. If we can be of any further assistance, or if you need additional information, please contact us at your convenience.

Sincerely,

NUTTING ENGINEERS OF FLORIDA, INC.

Christopher E. Gworek, P.E. #69947
Senior Engineer

Richard C. Wohlfarth, P.E.
Director of Engineering

Appendix: Boring Location Plan
Test Boring Results
Limitations of Liability
Soil Classification Criteria

2022-11-01
### Boring Number B-1

**Client:** Song + Associates, Inc.  
**Project Location:** 95 SW 5th Avenue, Delray Beach, Florida

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>Material Description</th>
<th>Sample Type Number</th>
<th>Blows</th>
<th>N-Value</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>Gray to brown fine SAND, some limestone fragments</td>
<td>AU 1</td>
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<td></td>
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<td>5</td>
<td></td>
<td>Gray fine SAND</td>
<td>AU 2</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>LT. tan fine SAND</td>
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<td></td>
<td></td>
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<tr>
<td>10</td>
<td></td>
<td>Brown fine SAND</td>
<td>SS 4</td>
<td>2-2-2-2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LT. brown fine SAND</td>
<td>SS 5</td>
<td>2-2-2-2</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>SS 6</td>
<td>1-2-1-2</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>SS 7</td>
<td>1-1-2-1</td>
<td>3</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>LT. gray LIMESTONE and SAND</td>
<td>SS 8</td>
<td>1/12”-1/12”</td>
<td>1</td>
</tr>
</tbody>
</table>

**Bottom of hole at 25.0 feet.**

**Disclaimer:** Nutting Engineers of Florida, Inc. accepts no liability for the consequences of the independent interpretation of drilling logs by others.
Gray to brown fine SAND, little limestone fragments

Lt. gray fine SAND

Gray to brown fine SAND

Brown fine SAND

Lt. brown fine SAND

Lt. gray fine SAND, some limestone

Bottom of hole at 25.0 feet.
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Dk. gray fine SAND</td>
<td>AU 1</td>
</tr>
<tr>
<td>5</td>
<td>Lt. gray fine SAND</td>
<td>AU 2</td>
</tr>
<tr>
<td></td>
<td>Brown fine SAND</td>
<td>AU 3</td>
</tr>
<tr>
<td></td>
<td>Tan fine SAND</td>
<td>AU 4</td>
</tr>
</tbody>
</table>

Bottom of hole at 8.0 feet.

SURFACE ELEVATION REFERENCE: Approx. at Road Crown
GROUND WATER LEVELS: Hand Auger
APPROXIMATE LOCATION OF BORING: As located on site plan

Disclaimer: Nutting Engineers of Florida, Inc. accepts no liability for the consequences of the independent interpretation of drilling logs by others.
LIMITATIONS OF LIABILITY

WARRANTY
We warranty that the services performed by Nutting Engineers of Florida, Inc. are conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession in our area currently practicing under similar conditions at the time our services were performed. **No other warranties, expressed or implied, are made.** While the services of Nutting Engineers of Florida, Inc. are a valuable and integral part of the design and construction teams, we do not warrant, guarantee or insure the quality, completeness, or satisfactory performance of designs, construction plans, specifications we have not prepared, nor the ultimate performance of building site materials or assembly/construction.

SUBSURFACE EXPLORATION
Subsurface exploration is normally accomplished by test borings; test pits are sometimes employed. The method of determining the boring location and the surface elevation at the boring is noted in the report. This information is represented in the soil boring logs and/or a drawing. The location and elevation of the borings should be considered accurate only to the degree inherent with the method used and may be approximate.

The soil boring log includes sampling information, description of the materials recovered, approximate depths of boundaries between soil and rock strata as encountered and immediate depth to water data. The log represents conditions recorded specifically at the location where and when the boring was made. Site conditions may vary through time as will subsurface conditions. The boundaries between different soil strata as encountered are indicated at specific depths; however, these depths are in fact approximate and dependent upon the frequency of sampling, nature and consistency of the respective strata. Substantial variation between soil borings may commonly exist in subsurface conditions. Water level readings are made at the time and under conditions stated on the boring logs. Water levels change with time, precipitation, canal level, local well drawdown and other factors. Water level data provided on soil boring logs shall not be relied upon for groundwater based design or construction considerations.

LABORATORY AND FIELD TESTS
Tests are performed in **general** accordance with specific ASTM Standards unless otherwise indicated. All criteria included in a given ASTM Standard are not always required and performed. Each test boring report indicates the measurements and data developed at each specific test location.

ANALYSIS AND RECOMMENDATIONS
The geotechnical report is prepared primarily to aid in the design of site work and structural foundations. Although the information in the report is expected to be sufficient for these purposes, it shall not be utilized to determine the cost of construction nor to stand alone as a construction specification. Contractors shall verify subsurface conditions as may be appropriate prior to undertaking subsurface work.

Report recommendations are based primarily on data from test borings made at the locations shown on the test boring reports. Soil variations commonly exist between boring locations. Such variations may not become evident until construction. Test pits sometimes provide valuable supplemental information that derived from soil borings. If variations are then noted, the geotechnical engineer shall be contacted in writing immediately so that field conditions can be examined and recommendations revised if necessary.

The geotechnical report states our understanding as to the location, dimensions and structural features proposed for the site. **Any significant changes of the site improvements or site conditions must be communicated in writing to the geotechnical engineer immediately** so that the geotechnical analysis, conclusions, and recommendations can be reviewed and appropriately adjusted as necessary.

CONSTRUCTION OBSERVATION
Construction observation and testing is an important element of geotechnical services. The geotechnical engineer’s field representative (G.E.F.R.) is the “owner’s representative” observing the work of the contractor, performing tests and reporting data from such tests and observations. **The geotechnical engineer’s field representative does not direct the contractor’s construction means, methods, operations or personnel.** The G.E.F.R. does not interfere with the relationship between the owner and the contractor and, except as an observer, does not become a substitute owner on site. The G.E.F.R. is responsible for his/her safety, but has no responsibility for the safety of other personnel at the site. The G.E.F.R. is an important member of a team whose responsibility is to observe and test the work being done and report to the owner whether that work is being carried out in general conformance with the plans and specifications. The enclosed report may be relied upon solely by the named client.
### Laboratory classification criteria

#### SOIL AND ROCK CLASSIFICATION CRITERIA

**SOIL AND ROCK CLASSIFICATION CRITERIA**

<table>
<thead>
<tr>
<th>ROCK CLASSIFICATION CRITERIA</th>
<th>SOIL AND ROCK CLASSIFICATION CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N-VALUE</strong> (bpf)</td>
<td><strong>RELATIVE HARDNESS ROCK CHARACTERISTICS</strong></td>
</tr>
<tr>
<td>N&gt; 100</td>
<td>Hard to v. hard</td>
</tr>
<tr>
<td>25&lt; N ≤ 100</td>
<td>Medium hard to hard</td>
</tr>
<tr>
<td>5&lt; N ≤ 25</td>
<td>Soft to medium hard</td>
</tr>
</tbody>
</table>

Local rock formations vary in hardness from soft to very hard within short vertical and horizontal distances and often contain vertical solution holes of 3 to 36 inch diameter to varying depths and horizontal solution features. Rock may be brittle to split spoon impact, but more resistant to excavation.

### Particulate size

#### PARTICLE SIZE

<table>
<thead>
<tr>
<th>PARTICLE SIZE</th>
<th>DESCRIPTION MODIFIERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulder &gt;12 in.</td>
<td>0 – 5% Slight trace</td>
</tr>
<tr>
<td>Cobble 3 to 12 in.</td>
<td>6 – 10% Trace</td>
</tr>
<tr>
<td>Gravel 4.76 mm to 3 in.</td>
<td>11 – 20% Little</td>
</tr>
<tr>
<td>Sand 0.074 mm to 4.76 mm</td>
<td>21 – 35% Some</td>
</tr>
<tr>
<td>Silt 0.005 mm to 0.074 mm</td>
<td>&gt;35% And</td>
</tr>
<tr>
<td>Clay &lt;0.005 mm</td>
<td></td>
</tr>
</tbody>
</table>

### Sand/Silt

#### N-VALUE (bpf) | RELATIVE DENSITY |
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>0 – 4</td>
<td>Very Loose</td>
</tr>
<tr>
<td>5 – 10</td>
<td>Loose</td>
</tr>
<tr>
<td>11 – 29</td>
<td>Medium</td>
</tr>
<tr>
<td>30 – 49</td>
<td>Dense</td>
</tr>
<tr>
<td>&gt;50</td>
<td>Very dense</td>
</tr>
<tr>
<td>100</td>
<td>Refusal</td>
</tr>
</tbody>
</table>

### Clay/Silty Clay

#### N-VALUE (bpf) | UNCONFINED COMP. STRENGTH (tsf) | CONSISTENCY |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2</td>
<td>&lt;0.25</td>
<td>v. Soft</td>
</tr>
<tr>
<td>2 – 4</td>
<td>0.25 – 0.50</td>
<td>Soft</td>
</tr>
<tr>
<td>5 – 8</td>
<td>0.50 – 1.00</td>
<td>Medium</td>
</tr>
<tr>
<td>9 – 15</td>
<td>1.00 – 2.00</td>
<td>Stiff</td>
</tr>
<tr>
<td>16 – 30</td>
<td>2.00 – 4.00</td>
<td>v. Stiff</td>
</tr>
<tr>
<td>&gt;30</td>
<td>&gt;4.00</td>
<td>Hard</td>
</tr>
</tbody>
</table>

### Description modifiers

- **GW** = Clean gravels (Little or no fines)
- **GP** = Gravels (More than half of coarse fraction is larger than No. 4 sieve size)
- **GC** = Clayey gravels, gravel-sand-clay mixtures
- **SW** = Clean sands (Little or no fines)
- **SP** = Sands with fines (Appreciable amount of fines)
- **SM** = Silts and clays (Liquid limit less than 50)
- **SC** = Clayey sands, sand-clay mixtures
- **ML** = Inorganic silts and very fine sandy silts
- **CL** = Inorganic clays of low to medium plasticity
- **OL** = Organic silts and organic silty clays of low plasticity
- **MH** = Inorganic silts, micaceous or diatomaceous fine sandy or silty soils
- **CH** = Inorganic clays or high plasticity, fat clays
- **OH** = Organic clays of medium to high plasticity
- **PT** = Peat and other highly organic soils

### Plasticity Chart

The chart shows the relationship between liquid limit and plasticity index for different types of soils. The chart is used to classify soils based on their plasticity, which is crucial for understanding their behavior under different engineering conditions. The chart includes a section for GW, GP, SW, SP, and SC soils, with distinct zones indicating their classification based on Atterberg limits and plasticity index.

### Laboratory classification criteria

The chart illustrates the classification of soils based on their Atterberg limits and plasticity index. The criteria for classification are as follows:

- **GW** = Clean gravels (Little or no fines)
- **GP** = Gravels (More than half of coarse fraction is larger than No. 4 sieve size)
- **GC** = Clayey gravels, gravel-sand-clay mixtures
- **SW** = Clean sands (Little or no fines)
- **SP** = Sands with fines (Appreciable amount of fines)
- **SM** = Silts and clays (Liquid limit less than 50)
- **SC** = Clayey sands, sand-clay mixtures

The chart includes a grid for GW, GP, SW, SP, and SC soils, with distinct zones indicating their classification based on Atterberg limits and plasticity index. The chart is used to classify soils based on their plasticity, which is crucial for understanding their behavior under different engineering conditions. The chart includes a section for GW, GP, SW, SP, and SC soils, with distinct zones indicating their classification based on Atterberg limits and plasticity index.

### Typical names

- **GW** = Well-graded gravels, gravel-sand mixtures, little or no fines
- **GP** = Poorly graded gravels, gravel-sand mixtures, little or no fines
- **GC** = Clayey gravels, gravel-sand-clay mixtures
- **SW** = Well-graded sands, gravelly sands, little or no fines
- **SP** = Poorly graded sands, gravelly sands, little or no fines
- **SM** = Silts and clays, sand-silt mixtures
- **SC** = Clayey sands, sand-clay mixtures

### Determining percentages of sand and gravel

- Determine the percentage of sand and gravel from the grain-size curve. Depending on the percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
  - Less than five percent……….GW, GP, SW, SP
  - More than 12 percent……..GM, GC, SM, SC
  - 5 to 12 percent…………….…..

### Plasticity chart

The plasticity chart is used to determine the plasticity index of soils based on their liquid limit and plasticity index. The chart includes a grid with distinct zones for different types of soils, such as GW, GP, SW, SP, and SC, with lines indicating the boundary between different plasticity classes.

### Classification of soils

The classification of soils is based on their grain-size distribution, plasticity index, and Atterberg limits. The chart includes a grid for GW, GP, SW, SP, and SC soils, with distinct zones indicating their classification based on Atterberg limits and plasticity index. The chart is used to classify soils based on their plasticity, which is crucial for understanding their behavior under different engineering conditions.