GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

# GEOTECHNICAL INVESTIGATION

**FOR**

# NSW LAND AND HOUSING CORPORATION

*35 Francis & 16-20 Sanita Streets, Goulburn, New South Wales*

*Report No: 23/1345A*

*Project No: 32248/7584D-G*

September 2024

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# Table of Contents

# 1. INTRODUCTION

This report presents the results of a Geotechnical Investigation carried out by STS Geotechnics Pty Limited (STS) for a proposed new residential development to be constructed at 35 Francis & 16-20 Sanita Streets, Goulburn, New South Wales. At the time of writing this report STS were not provided with architectural drawings for the project. The report has been prepared assuming site development will be limited to one and two storey residential buildings without basement excavation.

The purpose of the investigation was to provide information on:

- Site conditions and regional geology,
- Subsurface conditions,
- Site Classification according to AS2870-2011 (soil reactivity),
- Foundation design parameters including foundation options, and
- Exposure classification/soil aggressiveness according to AS2870-2011 and AS2159-2009.

The investigation was undertaken in accordance with STS proposal P23-199 dated May 1, 2023.

# 2. NATURE OF THE INVESTIGATION

## 2.1. Fieldwork

The fieldwork consisted of drilling seven (7) boreholes numbered BH1 to BH7, inclusive, at the locations shown on attached Drawing No. 23/1345**.** All boreholes were drilled using a utility mounted Christie drilling rig, owned, and operated by STS. Soil strengths were assessed by carrying out a Dynamic Cone Penetrometer (DCP) test adjacent to each borehole location.

Drilling operations were undertaken by one of STS's senior technical officers who also logged the subsurface conditions encountered.

Representative soil samples were collected from the boreholes for subsequent laboratory testing.

### 2.2. Laboratory Testing

To assess the soils for their aggressiveness, four (4) representative soil samples were tested to determine the following:

- pH,
- Sulphate content ($SO_4$),
- Chloride (Cl)
- Electrical Conductivity (EC), and

To assist with determining the Site Classification, four (4) representative soil samples were tested to determine the shrink/swell index.

Detailed test reports are given in Appendix B.

## 3. GEOLOGY AND SITE CONDITIONS

The Goulburn geological series map at a scale of 1:100,000 shows the site is underlain by Siluro-Devon Age Boxers Creek Formation of the Mount Fairy Group. Rocks within this formation comprise of fawn, cream and brown very thinly to very thickly bedded fine to very coarse-grained feldspar – lithic sandstone, siltstone, shale; crystal rich in places with some metasedimentary, tuffaceous chert and meta-veined quartz lithic fragments, and rare rhyolitic sandstone.

The site is trapezoidal in shape with an approximate area of 3519 $m^2$. At the time of the fieldwork, there were single storey dwellings present on the site. The vegetation comprises of trees and shrubs. The ground surface falls approximately 1.5 metres to the northeast.

The site is bound by Francis Street to the west, Sanita Street to the north and residential dwellings in the adjoining properties.

## 4. SUBSURFACE CONDITIONS

When assessing the subsurface conditions across a site from a limited number of boreholes, there is the possibility that variations may occur between test locations. The data derived from the site investigation programme are extrapolated across the site to form a geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour regarding the proposed development. The actual condition at the site may differ from those inferred, since no subsurface exploration programme, no matter how comprehensive, can reveal all subsurface details and anomalies, particularly on a site such as this where there has been previous development.

The subsurface conditions generally consist of fill, silty clays, sandy clays, sandy silty clays, and gravelly sandy clays overlying weathered rock. The fill is present from the surface to depths of 0.2 to 0.35 metres. Stiff, becoming very stiff with depth, natural silty clays, sandy clays, and sandy silty clays grading to gravelly sandy clays underlie the fill to the depths of auger refusal on weathered rock, 0.9 to 1.9 metres.

No groundwater was observed during the fieldwork.

The subsurface conditions observed are recorded on the borehole logs given in Appendix A. An explanation of the terms used on the logs is also given in Appendix A. Notes relating to geotechnical reports are also attached.

# 5. GEOTECHNICAL DISCUSSION

## 5.1. Site Classification to AS2870-2011

The classification has been prepared in accordance with the guidelines set out in the "Residential Slabs and Footings" Code, AS2870 – 2011.

To assist with determining the site classification, one (1) shrink/swell test and two (2) Atterberg tests were carried out on representative samples retrieved from the site. The detailed test report is attached and summarised below:

Table 5.1 – Shrink/Swell Test Summary

| Location | Depth (m) | Material Description | Shrink/Swell Index (% per ΔpF) |
|---|---|---|---|
| BH4 | 0.4 – 0.7 | Silty Sandy CLAY: low to medium plasticity, red, red brown/yellow | 3.4 |

Two soil samples retrieved were unsuitable for shrink/swell testing and Atterberg testing was carried out instead. Experience has shown that at times, the shrink swell index can be estimated by dividing the soil Plasticity Index (PI) by a factor of 10. Two soil samples tested at this site have PIs of 10% and 11% which implies the shrink swell index is 1.0 and 1.1% per ΔpF, respectively.

The remaining soil sample was unsuitable for testing.

Because there are trees, abnormal moisture conditions (AMC) prevail at the site. (Refer to Section 1.3.3 of AS2870-2011).

Because of the AMC, the site is classified a *Problem Site (P).* However, provided the recommendations given below are adopted the site may be reclassified *Highly Reactive (H1).*

Foundation design and construction consistent with this classification shall be adopted as specified in the above referenced standard and in accordance with the following design details.

## 5.2. Foundation Design Parameters

Pad and/or strip footings founded in the natural soils may be proportioned using an allowable bearing pressure of 100 kPa. The minimum depth of founding must comply with the requirements of AS2870-2011. To overcome the presence of trees, the foundations should be designed in accordance with the procedures given in Appendices H and CH of AS2870-2011.

Piers founded in very stiff natural materials may be proportioned using an allowable end bearing pressure of 300 kPa, provided their depth to diameter ratio exceeds a value of 4. An allowable adhesion value of 20 kPa may be adopted for the portion of the shaft below a depth of 0.5 metres.

Piers founded in weathered rock may be proportioned using an allowable end bearing pressure of 700 kPa. An allowable adhesion value of 70 kPa may be adopted for the portion of the shaft in weathered rock. When piers are founded in rock the adhesion within the overlying soils must be ignored.

To ensure the bearing values given can be achieved, care should be taken to ensure the base of the excavations is free of all loose material prior to concreting. To this end, it is recommended that all excavations be concreted as soon as possible, preferably immediately after excavating, cleaning, inspecting and approval. Pier excavations should not be left open overnight. The possibility of groundwater inflow needs to be considered when drilling the piers and pouring concrete.

The site is considered suitable for slab on ground construction provided due regard is given to the ground surface slope.

During foundation construction, should the subsurface conditions vary to those inferred in this report, a suitably experienced geotechnical engineer should review the design and recommendations given above to determine if any alterations are required.

## 5.3. Soil Aggressiveness

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of soil pH and the types of salts present, generally sulphates and chlorides. To determine the degree of aggressiveness, the test values obtained are

compared to Tables 6.4.2 (C) and 6.5.2 (C) in AS2159 – 2009 Piling – Design and Installation. The test results are summarised in Table 5.2.

Table 5.2– Soil Aggressiveness Summary

| Sample No. | Location | Depth (m) | pH | Sulfate (mg/kg) | Chloride (mg/kg) | Electrical Conductivity (dS/m) | |
|---|---|---|---|---|---|---|---|
| | | | | | | $EC_{1:5}$ | $EC_e$ |
| S1 | BH1 | 0.2 - 0.3 | 6.6 | <10 | <10 | 0.038 | 0.4 |
| S2 | BH3 | 0.2 - 0.3 | 6.4 | 10 | 40 | 0.046 | 0.5 |
| S3 | BH5 | 0.2 - 0.3 | 7.4 | 20 | 40 | 0.036 | 0.4 |
| S4 | BH7 | 0.2 - 0.3 | 6.4 | <10 | 20 | 0.021 | 0.2 |

The soils on the site are above groundwater. Therefore, soil conditions B are considered appropriate (AS2159-2009).

A review of the durability aspects indicates that:

- pH : minimum value of 6.4
- $SO_4$ : maximum value of 20 mg/kg (ppm) < 5000 ppm
- Cl : maximum value of 40 mg/kg (ppm) < 5000 ppm
- $EC_e$ : maximum value of 0.5 dS/m

In accordance with AS2159-2009 the exposure classification for the onsite soils is non-aggressive to both steel and concrete. In accordance with AS2870-2011 the soils are classified as A1.

Reference to DLWC (2002) “Site Investigations for Urban Salinity” indicates that $EC_e$ values of 0.2 to 0.5 dS/m are consistent with the presence of non-saline soils.

## 6. FINAL COMMENTS

During construction, should the subsurface conditions vary from those inferred above, we would be contacted to determine if any changes should be made to our recommendations. The exposed bearing surfaces for footings should be inspected by a geotechnical engineer to ensure the allowable pressure given has been achieved.

The above classification has been made assuming that all footings will bear in either natural ground or in controlled filling. Prior to the placement of any filling the existing surface should be stripped of all vegetation and topsoil.

If excavations for rainwater or detention tanks are to be made within 6 metres of the building foundations, advice should be sought regarding their effect on the foundations.

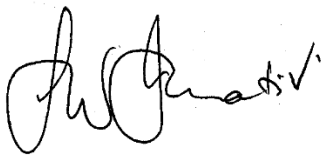
Placing absorption trenches on the high side of the property may create abnormal moisture conditions for the foundations (Refer to Section 1.3.3 of AS2870). This could have a negative effect on the foundation performance and more than likely alter the site classification provided above.

This report has been prepared assuming that no trees other than the vegetation noted will be present on the site. If future tree planting is planned, e.g., there is a landscaping plan, their effect on the foundation performance must be considered.

This report has been prepared assuming the site development will be limited to one and two storey residential buildings. The information and interpretation may not be relevant if the design proposal changes (e.g., to a five-storey building involving major cuts during the site preparation). If changes occur, we would be pleased to review the report and advise on the adequacy of the investigation.

Yours faithfully,

*Mrigesh Tamang*
*Senior Geotechnical Engineer*
*STS Geotechnics Pty Limited*



*Laurie Ihnativ*
*Principal Geotechnical Engineer*
*STS Geotechnics Pty Limited*


| | | |
|---|---|---|
| **STS Geotechnics Pty. Ltd.** | Scale: Unknown | Date: May 2023 |
| **Client: NSW LAND & HOUSING CORPORATION** | | |
| **GEOTECHNICAL INVESTIGATION**<br>**35 FRANCIS & 16-20 SANITA STREETS, GOULBURN**<br>**BOREHOLE AND PENETROMETER LOCATIONS** | | Project No. 32248/7584D-G<br>Drawing No: 23/1345 |

# Important Information

GEOTECHNICS PTY LTD
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## INTRODUCTION

These notes have been provided to outline the methodology and limitations inherent in geotechnical reporting. The issues discussed are not relevant to all reports and further advice should be sought if there are any queries regarding any advice or report. When copies of reports are made, they should be reproduced in full.

## GEOTECHNICAL REPORTS

Geotechnical reports are prepared by qualified personnel on the information supplied or obtained and are based on current engineering standards of interpretation and analysis.

Information may be gained from limited subsurface testing, surface observations, previous work and is supplemented by knowledge of the local geology and experience of the range of properties that may be exhibited by the materials present. For this reason, geotechnical reports should be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Where the report has been prepared for a specific purpose (eg. design of a three-storey building), the information and interpretation may not be appropriate if the design is changed (eg. a twenty storey building). In such cases, the report and the sufficiency of the existing work should be reviewed by STS Geotechnics Pty Limited in the light of the new proposal.

Every care is taken with the report content, however, it is not always possible to anticipate or assume responsibility for the following conditions:

- Unexpected variations in ground conditions. The potential for this depends on the amount of investigative work undertaken.
- Changes in policy or interpretation by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, STS Geotechnics Pty Limited would be pleased to resolve the matter through further investigation, analysis or advice.

## UNFORSEEN CONDITIONS

Should conditions encountered on site differ markedly from those anticipated from the information contained in the report, STS Geotechnics Pty Limited should be notified immediately. Early identification of site anomalies generally results in any problems being more readily resolved and allows re-interpretation and assessment of the implications for future work.

## SUBSURFACE CONDITIONS

Logs of a borehole, recovered core, test pit, excavated face or cone penetration test are an engineering and/or geological interpretation of the subsurface conditions. The reliability of the logged information depends on the drilling/testing method, sampling and/or observation spacings and the ground conditions. It is not always possible or economic to obtain continuous high quality data. It should also be recognised that the volume or material observed or tested is only a fraction of the total subsurface profile.

Interpretation of subsurface information and application to design and construction must take into consideration the spacing of the test locations, the frequency of observations and testing, and the possibility that geological boundaries may vary between observation points.

Groundwater observations and measurements outside of specially designed and constructed piezometers should be treated with care for the following reasons:

- In low permeability soils groundwater may not seep into an excavation or bore in the short time it is left open.
- A localised perched water table may not represent the true water table.
- Groundwater levels vary according to rainfall events or season.
- Some drilling and testing procedures mask or prevent groundwater inflow.

The installation of piezometers and long term monitoring of groundwater levels may be required to adequately identify groundwater conditions.

## SUPPLY OF GETEOECHNICAL INFORMATION OR TENDERING PURPOSES

It is recommended tenderers are provided with as much geological and geotechnical information that is available and that where there are uncertainties regarding the ground conditions, prospective tenders should be provided with comments discussing the range of likely conditions in addition to the investigation data.

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# APPENDIX A – BOREHOLE LOGS AND EXPLANATION SHEETS

**STS Geotechnics Pty Ltd**

# GEOTECHNICAL LOG - NON CORE BOREHOLE

| | | | |
|---|---|---|---|
| Client: | NSW Land & Housing Corporation | Project: 32248/7584D-G | **BOREHOLE NO.: BH 1** |
| Project: | 35 Francis & 16-20 Sanita Streets, Goulburn | Date : May 11, 2023 | |
| Location: | Refer to Drawing No. 23/1345 | Logged: MKSJ Checked By: MT | Sheet 1 of 1 |

| WATER TABLE | SAMPLES | DEPTH (m) | DESCRIPTION OF DRILLED PRODUCT<br>Soil Name, grain size /plasticity, colour; secondary constituents (Inc. Description) , minor constituents including other remarks | SYMBOL | CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels) | MOISTURE |
|---|---|---|---|---|---|---|
| | S1 @ 0.3 m | | FILL: SANDY CLAY: fine to medium to coarse grained sand, low plasticity, brown, some gravel | CL | — | M-D |
| | U50 | 0.5 | SANDY CLAY: fine to medium to coarse grained sand, low plasticity, yellow brown, some gravel | CL | VERY STIFF | M-D |
| | | 1.0 | GRAVELLY SANDY CLAY: fine to medium to coarse grained sand, low plasticity, yellow brown, fine to medium gravel | CL | VERY STIFF | D |
| | | 1.5 | AUGER REFUSAL AT 1.4 M ON WEATHERED ROCK | | | |
| | | 2.0 | | | | |
| | | 2.5 | | | | |

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

**STS Geotechnics Pty Ltd**

# GEOTECHNICAL LOG - NON CORE BOREHOLE

| | | | |
|---|---|---|---|
| Client: | NSW Land & Housing Corporation | Project: 32248/7584D-G | **BOREHOLE NO.: BH 2** |
| Project: | 35 Francis & 16-20 Sanita Streets, Goulburn | Date : May 11, 2023 | |
| Location: | Refer to Drawing No. 23/1345 | Logged: MKSJ Checked By: MT | Sheet 1 of 1 |

| WATER TABLE | SAMPLES | DEPTH (m) | DESCRIPTION OF DRILLED PRODUCT<br>Soil Name, grain size /plasticity, colour; secondary constituents (Inc. Description) , minor constituents including other remarks | SYMBOL | CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels) | MOISTURE |
|---|---|---|---|---|---|---|
| | | | FILL: SILTY CLAY: low plasticity, brown, fine to medium grained sand, gravel | CL | — | M |
| | | | SANDY SILTY CLAY: fine to medium to coarse grained sand, low plasticity, brown, trace of gravel | CL | STIFF<br>VERY STIFF | M |
| | | 0.5 | GRAVELLY SANDY CLAY: fine to medium to coarse grained sand, low plasticity, yellow brown, fine to medium gravel | CL | VERY STIFF | M-D<br>D |
| | | 1.0 | | | | |
| | | 1.5 | | | | |
| | | | AUGER REFUSAL AT 1.9 M ON WEATHERED ROCK | | | |
| | | 2.0 | | | | |
| | | 2.5 | | | | |

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

**STS Geotechnics Pty Ltd**

# GEOTECHNICAL LOG - NON CORE BOREHOLE

| | | | |
|---|---|---|---|
| Client: | NSW Land & Housing Corporation | Project: 32248/7584D-G | **BOREHOLE NO.: BH 3** |
| Project: | 35 Francis & 16-20 Sanita Streets, Goulburn | Date : May 11, 2023 | |
| Location: | Refer to Drawing No. 23/1345 | Logged: MKSJ Checked By: MT | Sheet 1 of 1 |

| WATER TABLE | SAMPLES | DEPTH (m) | DESCRIPTION OF DRILLED PRODUCT<br>Soil Name, grain size /plasticity, colour; secondary constituents (Inc. Description) , minor constituents including other remarks | SYMBOL | CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels) | MOISTURE |
|---|---|---|---|---|---|---|
| | | | FILL: SILTY CLAY: low plasticity, brown, fine to medium grained sand, gravel | CL | — | M |
| | S2 @ 0.3 m | | SANDY SILTY CLAY: fine to medium to coarse grained sand, low plasticity, brown, trace of gravel | CL | STIFF<br>VERY STIFF | M |
| | U50 | 0.5 | GRAVELLY SANDY CLAY: fine to medium to coarse grained sand, low plasticity, yellow brown, fine to medium gravel | CL | VERY STIFF | D |
| | | 1.0 | | | | |
| | | 1.5 | AUGER REFUSAL AT 1.5 M ON WEATHERED ROCK | | | |
| | | 2.0 | | | | |
| | | 2.5 | | | | |

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

**STS Geotechnics Pty Ltd**

# GEOTECHNICAL LOG - NON CORE BOREHOLE

| | | | |
|---|---|---|---|
| Client: | NSW Land & Housing Corporation | Project: 32248/7584D-G | **BOREHOLE NO.: BH 4** |
| Project: | 35 Francis & 16-20 Sanita Streets, Goulburn | Date : May 11, 2023 | |
| Location: | Refer to Drawing No. 23/1345 | Logged: MKSJ Checked By: MT | Sheet 1 of 1 |

| WATER TABLE | SAMPLES | DEPTH (m) | DESCRIPTION OF DRILLED PRODUCT<br>Soil Name, grain size /plasticity, colour; secondary constituents (Inc. Description) , minor constituents including other remarks | SYMBOL | CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels) | MOISTURE |
|---|---|---|---|---|---|---|
| | | | FILL: GRAVELLY SANDY CLAY: low plasticity, brown, fine to medium grained sand, gravel | CL | — | M |
| | | | SILTY CLAY: low to medium plasticity, red brown<br>brown, trace of gravel | CL/CI | VERY STIFF | M |
| | U50 | 0.5 | | | | |
| | | | grading to medium plasticity, red yellow brown, trace of gravel | | | |
| | | 1.0 | | | | |
| | | | GRAVELLY SANDY CLAY: fine to medium grained sand, low plasticity, yellow<br>orange brown, some gravel | CL | VERY STIFF | M-D |
| | | | | | | D |
| | | | AUGER REFUSAL AT 1.4 M ON WEATHERED ROCK | | | |
| | | 1.5 | | | | |
| | | 2.0 | | | | |
| | | 2.5 | | | | |

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

**STS Geotechnics Pty Ltd**

# GEOTECHNICAL LOG - NON CORE BOREHOLE

| | | | |
|---|---|---|---|
| Client: | NSW Land & Housing Corporation | Project: 32248/7584D-G | **BOREHOLE NO.: BH 5** |
| Project: | 35 Francis & 16-20 Sanita Streets, Goulburn | Date : May 11, 2023 | Sheet 1 of 1 |
| Location: | Refer to Drawing No. 23/1345 | Logged: MKSJ Checked By: MT | |

| WATER TABLE | SAMPLES | DEPTH (m) | DESCRIPTION OF DRILLED PRODUCT<br>Soil Name, grain size /plasticity, colour; secondary constituents (Inc. Description) , minor constituents including other remarks | SYMBOL | CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels) | MOISTURE |
|---|---|---|---|---|---|---|
| | S3 @ 0.3 m | | FILL: SILTY CLAY: low plasticity, brown, fine to medium gravel | CL | — | M |
| | | 0.5 | GRAVELLY SANDY CLAY: low plasticity, fine to medium to coarse grained sand, yellow brown, fine to medium gravel | CL | VERY STIFF | M |
| | U50 | | | | | D |
| | | 1.0 | | | | |
| | | 1.5 | AUGER REFUSAL AT 1.5 M ON WEATHERED ROCK | | | |
| | | 2.0 | | | | |
| | | 2.5 | | | | |

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

**STS Geotechnics Pty Ltd**

# GEOTECHNICAL LOG - NON CORE BOREHOLE

| | | | |
|---|---|---|---|
| Client: | NSW Land & Housing Corporation | Project: 32248/7584D-G | **BOREHOLE NO.: BH 6** |
| Project: | 35 Francis & 16-20 Sanita Streets, Goulburn | Date : May 11, 2023 | Sheet 1 of 1 |
| Location: | Refer to Drawing No. 23/1345 | Logged: MKSJ Checked By: MT | |

| WATER TABLE | SAMPLES | DEPTH (m) | DESCRIPTION OF DRILLED PRODUCT<br>Soil Name, grain size /plasticity, colour; secondary constituents (Inc. Description) , minor constituents including other remarks | SYMBOL | CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels) | MOISTURE |
|---|---|---|---|---|---|---|
| | | | FILL: GRAVELLY SILTY CLAY: low plasticity, brown, fine to medium gravel | CL | — | M |
| | | | GRAVELLY SANDY CLAY: low plasticity, fine to medium to coarse grained sand, yellow brown, fine to medium gravel | CL | VERY STIFF | D-M |
| | | 0.5 | | | | D |
| | | | AUGER REFUSAL AT 0.9 M ON WEATHERED ROCK | | | |
| | | 1.0 | | | | |
| | | 1.5 | | | | |
| | | 2.0 | | | | |
| | | 2.5 | | | | |

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

**STS Geotechnics Pty Ltd**

# GEOTECHNICAL LOG - NON CORE BOREHOLE

| | | | |
|---|---|---|---|
| Client: | NSW Land & Housing Corporation | Project: 32248/7584D-G | **BOREHOLE NO.: BH 7** |
| Project: | 35 Francis & 16-20 Sanita Streets, Goulburn | Date : May 11, 2023 | |
| Location: | Refer to Drawing No. 23/1345 | Logged: MKSJ Checked By: MT | Sheet 1 of 1 |

| WATER TABLE | SAMPLES | DEPTH (m) | DESCRIPTION OF DRILLED PRODUCT<br>Soil Name, grain size /plasticity, colour; secondary constituents (Inc. Description) , minor constituents including other remarks | SYMBOL | CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels) | MOISTURE |
|---|---|---|---|---|---|---|
| | S4 @ 0.3 m | | FILL: GRAVELLY SILTY CLAY: low plasticity, brown, fine to medium gravel | CL | — | M |
| | | 0.5 | GRAVELLY SANDY CLAY: low plasticity, fine to medium to coarse grained sand, yellow brown, fine to medium gravel | CL | VERY STIFF | M-D<br>D |
| | | 1.0 | AUGER REFUSAL AT 0.9 M ON WEATHERED ROCK | | | |
| | | 1.5 | | | | |
| | | 2.0 | | | | |
| | | 2.5 | | | | |

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

STS GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

**STS Geotechnics Pty Ltd**
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au



# *Dynamic Cone Penetrometer Test Report*

Project: 35 FRANCIS & 16-20 SANITA STREETS, GOULBURN — Project No.: 32248/7584D

**Client: NSW LAND & HOUSING CORPORATION** — Report No.: 23/1344

Address: Level G, 12 Darcy Street. Parramatta — Report Date: May 17 2023

Test Method: AS 1289.6.3.2 — Page: 1 of 2

| Site No. | P1 | P2 | P3 | P4 | P5 | P6 |
|---|---|---|---|---|---|---|
| Location | Refer to Drawing No. 23/1345 | Refer to Drawing No. 23/1345 | Refer to Drawing No. 23/1345 | Refer to Drawing No. 23/1345 | Refer to Drawing No. 23/1345 | Refer to Drawing No. 23/1345 |
| Date Tested | 11/5/2023 | 11/5/2023 | 11/5/2023 | 11/5/2023 | 11/5/2023 | 11/5/2023 |
| Starting Level | Surface Level | Surface Level | Surface Level | Surface Level | Surface Level | Surface Level |
| Depth (m) | Penetration Resistance (blows / 150mm) | | | | | |
| 0.00 - 0.15 | 4 | 2 | 2 | 3 | 2 | 5 |
| 0.15 - 0.30 | 6 | 3 | 5 | 8 | 8 | 11 |
| 0.30 - 0.45 | 11 | 6 | 10 | 7 | 8 | 23+ |
| 0.45 - 0.60 | 21 | 7 | Refusal | 11 | 8 | Refusal |
| 0.60 - 0.75 | 23+ | 11 | | 20 | 12 | |
| 0.75 - 0.90 | Refusal | 17 | | 23+ | Refusal | |
| 0.90 - 1.05 | | 22 | | Refusal | | |
| 1.05 - 1.20 | | 23+ | | | | |
| 1.20 - 1.35 | | Refusal | | | | |
| 1.35 - 1.50 | | | | | | |
| 1.50 - 1.65 | | | | | | |
| 1.65 - 1.80 | | | | | | |
| 1.80 - 1.95 | | | | | | |
| 1.95 - 2.10 | | | | | | |
| 2.10 - 2.25 | | | | | | |
| 2.25 - 2.40 | | | | | | |
| 2.40 - 2.55 | | | | | | |
| 2.55 - 2.70 | | | | | | |
| 2.70 - 2.85 | | | | | | |
| 2.85 - 3.00 | | | | | | |
| 3.00 - 3.15 | | | | | | |
| 3.15 - 3.30 | | | | | | |
| 3.30 - 3.45 | | | | | | |
| 3.45 - 3.60 | | | | | | |
| 3.60 - 3.75 | | | | | | |

Remarks: * Pre drilled prior to testing

Approved Signatory..... .....

Technician: MKS/IS — Orlando Mendoza - Laboratory Manager

STS GEOTECHNICS PTY LTD
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**STS Geotechnics Pty Ltd**
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au



# *Dynamic Cone Penetrometer Test Report*

Project: 35 FRANCIS & 16-20 SANITA STREETS, GOULBURN — Project No.: 32248/7584D

**Client: NSW LAND & HOUSING CORPORATION** — Report No.: 23/1344

Address: Level G, 12 Darcy Street. Parramatta — Report Date: May 17 2023

Test Method: AS 1289.6.3.2 — Page: 2 of 2

| Site No. | P7 | | | | | |
|---|---|---|---|---|---|---|
| Location | Refer to Drawing No. 23/1345 | | | | | |
| Date Tested | 11/5/2023 | | | | | |
| Starting Level | Surface Level | | | | | |
| Depth (m) | Penetration Resistance (blows / 150mm) | | | | | |
| 0.00 - 0.15 | 3 | | | | | |
| 0.15 - 0.30 | 15 | | | | | |
| 0.30 - 0.45 | 21 | | | | | |
| 0.45 - 0.60 | 23+ | | | | | |
| 0.60 - 0.75 | Refusal | | | | | |
| 0.75 - 0.90 | | | | | | |
| 0.90 - 1.05 | | | | | | |
| 1.05 - 1.20 | | | | | | |
| 1.20 - 1.35 | | | | | | |
| 1.35 - 1.50 | | | | | | |
| 1.50 - 1.65 | | | | | | |
| 1.65 - 1.80 | | | | | | |
| 1.80 - 1.95 | | | | | | |
| 1.95 - 2.10 | | | | | | |
| 2.10 - 2.25 | | | | | | |
| 2.25 - 2.40 | | | | | | |
| 2.40 - 2.55 | | | | | | |
| 2.55 - 2.70 | | | | | | |
| 2.70 - 2.85 | | | | | | |
| 2.85 - 3.00 | | | | | | |
| 3.00 - 3.15 | | | | | | |
| 3.15 - 3.30 | | | | | | |
| 3.30 - 3.45 | | | | | | |
| 3.45 - 3.60 | | | | | | |
| 3.60 - 3.75 | | | | | | |

Remarks: * Pre drilled prior to testing

Approved Signatory..... .....

Technician: MKS/IS — Orlando Mendoza - Laboratory Manager

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# EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT LOGS

## DRILLING/EXCAVATION METHOD

| | | | | | |
|---|---|---|---|---|---|
| **HA** | Hand Auger | **ADH** | Hollow Auger | **NQ** | Diamond Core - 47 mm |
| **DT** | Diatube Coring | **RT** | Rotary Tricone bit | **NMLC** | Diamond Core - 52 mm |
| **NDD** | Non-destructive digging | **RAB** | Rotary Air Blast | **HQ** | Diamond Core - 63 mm |
| **AD*** | Auger Drilling | **RC** | Reverse Circulation | **HMLC** | Diamond Core - 63 mm |
| ***V** | V-Bit | **PT** | Push Tube | **EX** | Tracked Hydraulic Excavator |
| ***T** | TC-Bit, e.g. AD/T | **WB** | Washbore | **HAND** | Excavated by Hand Methods |

## PENETRATION RESISTANCE

| | | |
|---|---|---|
| **L** | **Low Resistance** | Rapid penetration/ excavation possible with little effort from equipment used. |
| **M** | **Medium Resistance** | Penetration/ excavation possible at an acceptable rate with moderate effort from equipment used. |
| **H** | **High Resistance** | Penetration/ excavation is possible but at a slow rate and requires significant effort from equipment used. |
| **R** | **Refusal/Practical Refusal** | No further progress possible without risk of damage or unacceptable wear to equipment used. |

These assessments are subjective and are dependent on many factors, including equipment power and weight, condition of excavation or drilling tools and experience of the operator.

## WATER

**Standing Water Level** **Partial water loss**

**Water Seepage** **Complete Water Loss**

| | |
|---|---|
| **GWNO** | GROUNDWATER NOT OBSERVED - Observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave-in of the borehole/ test pit. |
| **GWNE** | GROUNDWATER NOT ENCOUNTERED - Borehole/ test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/ test pit been left open for a longer period. |

## SAMPLING AND TESTING

| | |
|---|---|
| **SPT** | Standard Penetration Testing to AS1289.6.3.3 2004 |
| 4,7,11 N=18 | 4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following a 150mm seating drive |
| 30/80mm | Where practical refusal occurs, the blows and penetration for that interval are reported, N is not reported |
| RW | Penetration occurred under the rod weight only, N<1 |
| HW | Penetration occurred under the hammer and rod weight only, N<1 |
| HB | Hammer double bouncing on anvil, N is not reported |
| **Sampling** | |
| S1 | Jar sample – number indicates sample number |
| D | Disturbed Sample |
| B | Bulk disturbed Sample |
| U50 | Thin walled tube sample - number indicates nominal sample diameter in millimetres |
| **Testing** | |
| PP | Pocket Penetrometer test expressed as instrument reading in kPa |
| DCP | Dynamic Cone Penetrometer (AS1289.6.3.1 1997) |
| PSP | Perth Sand Penetrometer (AS1289.6.3.2 1997) |

## GEOLOGICAL BOUNDARIES

———— = Observed Boundary (Position known)

– – – – – – – – – – = Observed Boundary (Position approximate)

– –?– –?– –?– – = Boundary (Interpreted or inferred)

## ROCK CORE RECOVERY

TCR =Total Core Recovery (%)

$$= \frac{Length\ of\ core\ recovered}{Length\ of\ core\ run} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum Axial\ lengths\ of\ core > 100mm}{Length\ of\ core\ run} \times 100$$

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# METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT LOGS

FILL

COUBLES or BOULDERS

GRAVEL (GP or GW)

ORGANIC SOILS (OL, OH or Pt)

SILT (ML or MH)

CLAY (CL, CI or CH)

SAND (SP or SW)

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay

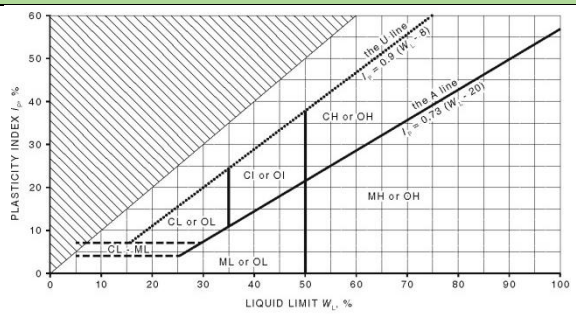
## CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS 1726:2017, Section 6.1 – Soil description and classification.

## PARTICLE SIZE CHARACTERISTICS

| Fraction | Components | Sub Division | Size mm |
|---|---|---|---|
| Oversize | BOULDERS | | >200 |
| | COBBLES | | 63 to 200 |
| Coarse grained soil | GRAVEL | Coarse | 19 to 63 |
| | | Medium | 6.7 to 19 |
| | | Fine | 2.36 to 6.7 |
| | SAND | Coarse | 0.6 to 2.36 |
| | | Medium | 0.21 to 0.6 |
| | | Fine | 0.075 to 0.21 |
| Fine grained soil | SILT | | 0.002 to 0.075 |
| | CLAY | | <0.002 |

## PLASTICITY PROPERTIES




## GROUP SYMBOLS

| Major Divisions | | Symbol | Description |
|---|---|---|---|
| COARSE GRAINED SOILS More than 65% of soil excluding oversize fraction is greater than 0.075mm | GRAVEL More than 50% of coarse fraction is >2.36mm | GW | Well graded gravel and gravel-sand mixtures, little or no fines, no dry strength. |
| | | GP | Poorly graded gravel and gravel-sand mixtures, little or no fines, no dry strength. |
| | | GM | Silty gravel, gravel-sand-silt mixtures, zero to medium dry strength. |
| | | GC | Clayey gravel, gravel-sand-clay mixtures, medium to high dry strength. |
| | SAND More than 50% of coarse fraction is <2.36 mm | SW | Well graded sand and gravelly sand, little or no fines, no dry strength. |
| | | SP | Poorly graded sand and gravelly sand, little or no fines, no dry strength. |
| | | SM | Silty sand, sand-silt mixtures, zero to medium dry strength. |
| | | SC | Clayey sand, sandy-clay mixtures, medium to high dry strength. |
| FINE GRAINED SOILS More than 35% of soil excluding oversized fraction is less than 0.075mm | Liquid Limit less < 50% | ML | Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands, zero to medium dry strength. |
| | | CL, CI | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, medium to high dry strength. |
| | | OL | Organic silts and organic silty clays of low plasticity, low to medium dry strength. |
| | Liquid Limit > than 50% | MH | Inorganic silts of high plasticity, high to very high dry strength. |
| | | CH | Inorganic clays of high plasticity, high to very high dry strength. |
| | | OH | Organic clays of medium to high plasticity, medium to high dry strength. |
| Highly Organic soil | | PT | Peat muck and other highly organic soils. |

## MOISTURE CONDITION

| Symbol | Term | Description |
|---|---|---|
| D | Dry | Non- cohesive and free running. |
| M | Moist | Soils feel cool, darkened in colour. Soil tends to stick together. |
| W | Wet | Soils feel cool, darkened in colour. Soil tends to stick together, free water forms when handling. |

Moisture content of cohesive soils shall be described in relation to plastic limit (PL) or liquid limit (LL) for soils with higher moisture content as follows: Moist, dry of plastic limit ($w$ < PL); Moist, near plastic limit ($w \approx$ PL); Moist, wet of plastic limit ($w$ < PL); Wet, near liquid limit ($w \approx$ LL), Wet, wet of liquid limit ($w$ > LL),

## CONSISTENCY

| Symbol | Term | Undrained Shear Strength (kPa) | SPT "N" # |
|---|---|---|---|
| VS | Very Soft | ≤ 12 | ≤ 2 |
| S | Soft | >12 to ≤ 25 | >2 to ≤ 4 |
| F | Firm | >25 to ≤ 50 | >4 to 8 |
| St | Stiff | >50 to ≤ 100 | >8 to 15 |
| VSt | Very Stiff | >100 to ≤ 200 | >15 to 30 |
| H | Hard | >200 | >30 |
| Fr | Friable | - | |

## DENSITY

| Symbol | Term | Density Index % | SPT "N" # |
|---|---|---|---|
| VL | Very Loose | ≤ 15 | 0 to 4 |
| L | Loose | >15 to ≤ 35 | 4 to 10 |
| MD | Medium Dense | >35 to ≤ 65 | 10 to 30 |
| D | Dense | >65 to ≤ 85 | 30 to 50 |
| VD | Very Dense | >85 | Above 50 |

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material. # SPT correlations are not stated in AS1726:2017, and may be subject to corrections for overburden pressure, moisture content of the soil, and equipment type.

## MINOR COMPONENTS

| Term | Assessment Guide | Proportion by Mass |
|---|---|---|
| Add 'Trace' | Presence just detectable by feel or eye but soil properties little or no different to general properties of primary component | Coarse grained soils: ≤ 5%<br>Fine grained soil: ≤ 15% |
| Add 'With' | Presence easily detectable by feel or eye but soil properties little or no different to general properties of primary component | Coarse grained soils: 5 - 12%<br>Fine grained soil: 15 - 30% |
| Prefix soil name | Presence easily detectable by feel or eye in conjunction with the general properties of primary component | Coarse grained soils: >12%<br>Fine grained soil: >30% |

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# TERMS FOR ROCK MATERIAL STRENGTH AND WEATHERING

## CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

## ROCK MATERIAL STRENGTH CLASSIFICATION

| Symbol | Term | Point Load Index, $Is_{(50)}$ (MPa) # | Field Guide |
|---|---|---|---|
| VL | Very Low | 0.03 to 0.1 | Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure. |
| L | Low | 0.1 to 0.3 | Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling. |
| M | Medium | 0.3 to 1 | Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty. |
| H | High | 1 to 3 | A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer. |
| VH | Very High | 3 to 10 | Hand specimen breaks with pick after more than one blow; rock rings under hammer. |
| EH | Extremely High | >10 | Specimen requires many blows with geological pick to break through intact material; rock rings under hammer. |

**# Rock Strength Test Results**

▼ Point Load Strength Index, $Is_{(50)}$, Axial test (MPa)

● Point Load Strength Index, $Is_{(50)}$, Diametral test (MPa)

Relationship between rock strength test result ($Is_{(50)}$) and unconfined compressive strength (UCS) will vary with rock type and strength, and should be determined on a site-specific basis. However UCS is typically 20 x $Is_{(50)}$.

## ROCK MATERIAL WEATHERING CLASSIFICATION

| Symbol | | Term | Field Guide |
|---|---|---|---|
| RS | | Residual Soil | Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported. |
| XW | | Extremely Weathered | Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water. |
| DW | HW | Distinctly Weathered | Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW. |
| | MW | | |
| SW | | Slightly Weathered | Rock slightly discoloured but shows little or no change of strength relative to fresh rock. |
| FR | | Fresh | Rock shows no sign of decomposition or staining. |

# ABBREVIATIONS AND DESCRIPTIONS FOR ROCK MATERIAL AND DEFECTS

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## CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

## DETAILED ROCK DEFECT SPACING

**Defect Spacing**

| Spacing/width (mm) | Descriptor | Symbol |
|---|---|---|
| <20 | Extremely Close | EC |
| 20-60 | Very Close | VC |
| 60-200 | Close | C |
| 200-600 | Medium | M |
| 600-2000 | Wide | W |
| 2000-6000 | Very Wide | VW |

**Bedding Thickness (Stratification)**

| Term | Spacing (mm) |
|---|---|
| Thinly laminated | <6 |
| Laminated | 6 – 20 |
| Very thinly bedded | 20 – 60 |
| Thinly bedded | 60 – 200 |
| Medium bedded | 200 – 600 |
| Thickly bedded | 600 – 2,000 |
| Very thickly bedded | > 2,000 |

## ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT TYPES

| Defect Type | Abbr. | Description |
|---|---|---|
| Joint | JT | Surface of a fracture or parting, formed without displacement, across which the rock has little or no tensile strength. May be closed or filled by air, water or soil or rock substance, which acts as cement. |
| Bedding Parting | BP | Surface of fracture or parting, across which the rock has little or no tensile strength, parallel or sub-parallel to layering/ bedding. Bedding refers to the layering or stratification of a rock, indicating orientation during deposition, resulting in planar anisotropy in the rock material. |
| Contact | CO | The surface between two types or ages of rock. |
| Sheared Surface | SSU | A near planar, curved or undulating surface which is usually smooth, polished or slickensided. |
| Sheared Seam/ Zone (Fault) | SS/SZ | Seam or zone with roughly parallel almost planar boundaries of rock substance cut by closely spaced (often <50 mm) parallel and usually smooth or slickensided joints or cleavage planes. |
| Crushed Seam/ Zone (Fault) | CS/CZ | Seam or zone composed of disoriented usually angular fragments of the host rock substance, with roughly parallel near-planar boundaries. The brecciated fragments may be of clay, silt, sand or gravel sizes or mixtures of these. |
| Extremely Weathered Seam/ Zone | XWS/XWZ | Seam of soil substance, often with gradational boundaries, formed by weathering of the rock material in places. |
| Infilled Seam | IS | Seam of soil substance, usually clay or clayey, with very distinct roughly parallel boundaries, formed by soil migrating into joint or open cavity. |
| Vein | VN | Distinct sheet-like body of minerals crystallised within rock through typically open-space filling or crack-seal growth. |

NOTE: Defects size of <100mm SS, CS and XWS. Defects size of >100mm SZ, CZ and XWZ.

## ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT SHAPE AND ROUGHNESS

| Shape | Abbr. | Description | Roughness | Abbr. | Description |
|---|---|---|---|---|---|
| Planar | PR | Consistent orientation | Polished | POL | Shiny smooth surface |
| Curved | CU | Gradual change in orientation | Slickensided | SL | Grooved or striated surface, usually polished |
| Undulating | UN | Wavy surface | Smooth | SM | Smooth to touch. Few or no surface irregularities |
| Stepped | ST | One or more well defined steps | Rough | RO | Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper |
| Irregular | IR | Many sharp changes in orientation | Very Rough | VR | Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper |

**Orientation:** **Vertical Boreholes –** The dip (inclination from horizontal) of the defect.
**Inclined Boreholes –** The inclination is measured as the acute angle to the core axis.

## ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT COATING

| Coating | Abbr. | Description |
|---|---|---|
| Clean | CN | No visible coating or infilling |
| Stain | SN | No visible coating but surfaces are discoloured by staining, often limonite (orange-brown) |
| Veneer | VNR | A visible coating of soil or mineral substance, usually too thin to measure (< 1 mm); may be patchy |

## DEFECT APERTURE

| Aperture | Abbr. | Description |
|---|---|---|
| Closed | CL | Closed. |
| Open | OP | Without any infill material. |
| Infilled | - | Soil or rock i.e. clay, silt, talc, pyrite, quartz, etc. |

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# APPENDIX B – LABORATORY TEST RESULTS

STS GEOTECHNICS PTY LTD
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**STS Geotechnics Pty Ltd**
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au



# *Shrink Swell Index Report*

Project: 35 FRANCIS & 16-20 SANITA STREETS, GOULBURN
**Client: NSW LAND & HOUSING CORPORATION**
Address: Level G, 12 Darcy Street. Parramatta
Test Method: AS 1289.7.1.1

Project No.: 32248
Report No.: 23/1372
Report Date: 18/05/2023
Page: 1 of 1

Sampling Procedure: AS 1289.1.3.1 Clause 3.1.3.2 - Thin Walled Sampler

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| STS / Sample No. | | 7584D-L/1 | | | | | |
| Sample Location | | Borehole 4 Refer to Drawing No. 23/1345 | | | | | |
| Material Description | | Silty Sandy Clay, red, red brown/yellow | | | | | |
| Depth (m) | | 0.4 - 0.7 | | | | | |
| Sample Date | | 11/05/2023 | | | | | |
| Shrink | Moisture Content (%) | 32.0 | | | | | |
| | Soil Crumbling | Nil | | | | | |
| | Extent of Cracking | Fine Cracks | | | | | |
| | Strain (%) | 4.6 | | | | | |
| Swell | Moisture Content Initial (%) | 26.4 | | | | | |
| | Moisture Content Final (%) | 33.4 | | | | | |
| | Strain (%) | 3.0 | | | | | |
| Inert Inclusions (%) | | <40 | | | | | |
| **Shrink Swell Index (%)** | | **3.4** | | | | | |

Remarks:

Approved Signatory.....

Technician: DH

Orlando Mendoza - Laboratory Manager

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**STS Geotechnics Pty Ltd**
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au



# *Atterberg Limits and Linear Shrinkage Report*

Project: 35 FRANCIS & 16-20 SANITA STREETS, GOULBURN — Project No.: 32248

**Client: NSW LAND & HOUSING CORPORATION** — Report No.: 23/1419

Address: Level G, 12 Darcy Street. Parramatta — Report Date: 22/05/2023

Test Method: AS1289.3.1.2,3.2.1,3.4.1,2.1.1 — Page: 1 OF 1

Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)

| STS / Sample No. | 7584D-L/1 | 7584D-L/2 | | | | |
|---|---|---|---|---|---|---|
| Sample Location | Borehole 1 Refer to Drawing No.23/1345 | Borehole 5 Refer to Drawing No.23/1345 | | | | |
| Material Description | Silty Gravelly Clay, yellow grey | Silty Gravelly Clay, yellow grey | | | | |
| Depth (m) | 0.5 - 0.7 | 0.6 - 0.8 | | | | |
| Sample Date | 11/05/2023 | 11/05/2023 | | | | |
| Sample History | Oven Dried | Oven Dried | | | | |
| Method of Preparation | Dry Sieved | Dry Sieved | | | | |
| **Liquid Limit (%)** | **29** | **30** | | | | |
| **Plastic Limit (%)** | **19** | **19** | | | | |
| **Plasticity Index** | **10** | **11** | | | | |
| **Linear Shrinkage (%)** | **5.5** | **6.0** | | | | |
| Mould Size (mm) | 127 | 127 | | | | |
| Crumbing | N | N | | | | |
| Curling | N | N | | | | |

Remarks:

Approved Signatory..... .....

Technician: DH

Orlando Mendoza - Laboratory Manager

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2315813** | Page | : 1 of 4 |
| Client | : **STS Geotechnics** | Laboratory | : Environmental Division Sydney |
| Contact | : ENQUIRES STS | Contact | : Customer Services ES |
| Address | : Unit 14/1 Cowpasture Place<br>Wetherill Park 2164 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : ---- | Telephone | : +61-2-8784 8555 |
| Project | : 30055/30060/32248 | Date Samples Received | : 12-May-2023 10:00 |
| Order number | : 2023-165 | Date Analysis Commenced | : 15-May-2023 |
| C-O-C number | : ---- | Issue Date | : 18-May-2023 15:09 |
| Sampler | : MB/MKS | | |
| Site | : ---- | | |
| Quote number | : EN/222 | | |
| No. of samples received | : 9 | | |
| No. of samples analysed | : 9 | | |

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Ankit Joshi | Senior Chemist - Inorganics | Sydney Inorganics, Smithfield, NSW |

## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

## Analytical Results

| Sub-Matrix: SOIL (Matrix: SOIL) | | | Sample ID | 30055/8901 | 30055/8902 | 30055/8903 | 30055/8904 | 30060/1777 |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 11-May-2023 00:00 | 11-May-2023 00:00 | 11-May-2023 00:00 | 11-May-2023 00:00 | 11-May-2023 00:00 |
| Compound | CAS Number | LOR | Unit | ES2315813-001 | ES2315813-002 | ES2315813-003 | ES2315813-004 | ES2315813-005 |
| | | | | Result | Result | Result | Result | Result |
| **EA002: pH 1:5 (Soils)** | | | | | | | | |
| pH Value | ---- | 0.1 | pH Unit | **8.1** | **6.9** | **7.6** | **7.9** | **6.4** |
| **EA010: Conductivity (1:5)** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | **638** | **353** | **325** | **271** | **78** |
| **EA055: Moisture Content (Dried @ 105-110°C)** | | | | | | | | |
| Moisture Content | ---- | 0.1 | % | **10.7** | **10.0** | **10.8** | **12.8** | **24.0** |
| **ED040S : Soluble Sulfate by ICPAES** | | | | | | | | |
| Sulfate as SO4 2- | 14808-79-8 | 10 | mg/kg | **820** | **370** | **300** | **210** | **150** |

## Analytical Results

| Sub-Matrix: SOIL (Matrix: SOIL) | | | Sample ID | 32248/S1 | 32248/S2 | 32248/S3 | 32248/S4 | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 11-May-2023 00:00 | 11-May-2023 00:00 | 11-May-2023 00:00 | 11-May-2023 00:00 | ---- |
| Compound | CAS Number | LOR | Unit | ES2315813-006 | ES2315813-007 | ES2315813-008 | ES2315813-009 | -------- |
| | | | | Result | Result | Result | Result | ---- |
| **EA002: pH 1:5 (Soils)** | | | | | | | | |
| pH Value | ---- | 0.1 | pH Unit | 6.6 | 6.4 | 7.4 | 6.4 | ---- |
| **EA010: Conductivity (1:5)** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 38 | 46 | 36 | 21 | ---- |
| **EA055: Moisture Content (Dried @ 105-110°C)** | | | | | | | | |
| Moisture Content | ---- | 0.1 | % | 15.9 | 18.1 | 13.8 | 14.4 | ---- |
| **ED040S : Soluble Sulfate by ICPAES** | | | | | | | | |
| Sulfate as SO4 2- | 14808-79-8 | 10 | mg/kg | <10 | 10 | 20 | <10 | ---- |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 10 | mg/kg | <10 | 40 | 40 | 20 | ---- |