

Our ref: 4428-L1 Rev 1
19 July 2017



Operations Director
Mr Michael Fearnside
Perisher Ski Resort
c/o Dabyne Planning Pty Ltd
PO Box 179
Jindabyne NSW 2627

Attention: Mr Ivan Pasalich

Dear Sir,

| | |
|---|---|
| The logo for the NSW Government, featuring a stylized white flower on a black background with the text "NSW GOVERNMENT" below it. | Department of Planning and Environment |
| <i>Issued under the Environmental Planning and Assessment Act 1979</i> | |
| Approved Application No DA 8637 | |
| Granted on the 3 June 2022 | |
| Signed Mark Brown | |
| Sheet No | 10 of 16 |

PROPOSED MODIFICATION TO SMIGGINS STAGE 1 SNOWMAKING, PERISHER SKI RESORT GEOTECHNICAL ASSESSMENT

1. INTRODUCTION

As requested, we have carried out a geotechnical assessment for the above project. Documents supplied to us for this assessment comprised:

- DA Plans by Steve Gibb (Plan 672017-1 dated 6 July 2017, 2 pages)
- Site Photos from Dabyne Planning Pty Ltd
- Details of Snow Factory Structure by Technoalpin (AU0006-17-03A dated 13 June 2017)

Based on the supplied information, we understand that the project involves construction of an elevated platform 14.5m x 4.6m plan area to accommodate a pre-fabricated 'snow factory', to be built immediately adjacent to the Kaaten Triple Chair top station.

The objective is to carry out a geotechnical assessment and provide a completed Form 4 with geotechnical recommendations for the development in accordance with DIPNR Geotechnical Policy – Kosciuszko Alpine Resorts.

This report must be read in conjunction with the attached "Important Information about your Geotechnical Report". Particular attention is drawn to the limitations inherent in site investigations and the importance of verifying the subsurface conditions inferred herein.

2. SCOPE OF WORK

In order to achieve the project objectives, the following scope of work:

- Review of existing regional maps and reports relevant to the site, held within our files.
- Examination of supplied site photographs, and previous site photographs taken by the undersigned.
- Engineering assessment and reporting.

3. SITE GEOLOGY & REGIONAL INSTABILITY

The 1:250,000 Tallangatta Geological Map indicates the site is underlain by Silurian aged intrusive granite.

All of the proposed development sites lie within the G line as defined in DIPNR's "Geotechnical Policy – Kosciuszko Alpine Resorts", November 2003.

4. SITE DESCRIPTION

The Kaaten Triple Chair top station is situated on a relatively steep slope of about 10 to 15°, within the ski slopes to the north-west of the main car park.

The proposed 'snow factory' station is located immediately adjacent to the station (north-eastern side), as indicated in Plate 1 (from Steve Gibb).

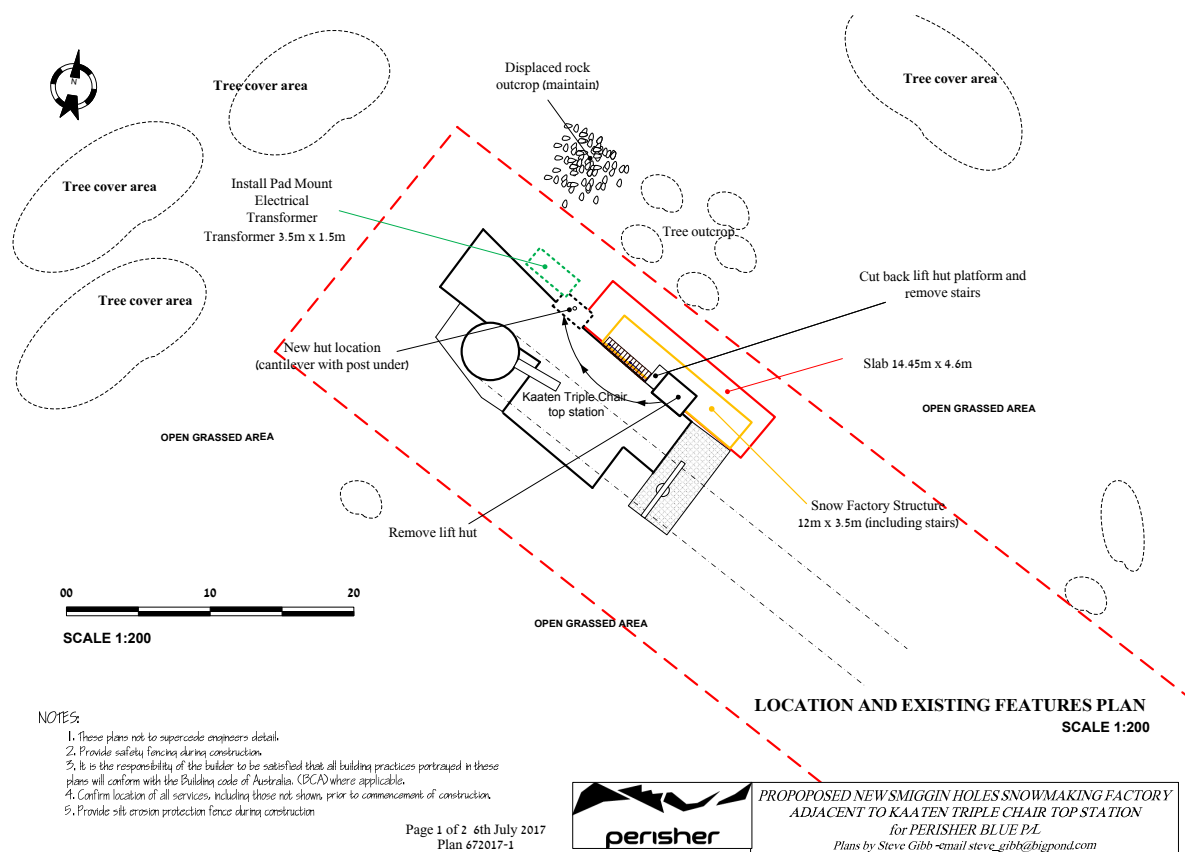


Plate 1 – Proposed Snow Factory Location Plan

Vegetation comprises thin grasses and some scattered bushes and small trees.

The ground surface slopes down to the southeast, dropping about 1.5m to 2m in level over the 15m long proposed concrete slab. Surface drainage is via overland flow, and there do not appear to be any areas of localised ponding of surface water concentration affecting the immediate site vicinity.

A view of the site from Woodrun, looking west, is shown in Plate 2.



Plate 2 – View of the site from Woodrun, looking west (courtesy Daybne Planning)

Granite outcrop and boulders are scattered across the development areas, including less weathered and intact granite boulders sitting proud of the terrain, to bedrock outcropping at the ground surface. The granite bedrock is variably weathered, from completely weathered granite with soil properties (i.e. clayey sand) ranging up to about 1.2m depth in some areas, to moderately weathered, high strength rock at the surface in other areas.

A topsoil covering of up to about 0.2m thickness supporting the grasses and undergrowth blankets the ground surface between the outcrop and protruding boulders.

There were no obvious signs of slope instability in the area of the proposed development, from our previous observations and by examination of the supplied site photos. It is expected that there could be shallow, surficial creep of the topsoils in some of the steeper areas, and in some of the open depressions where surface water and subsurface seepage concentrates. However, the depth of creeping soils is likely to be relatively shallow (less than about 0.3m to 0.5m depth), and the lateral extent is likely to be relatively limited.

5. DISCUSSIONS & RECOMMENDATIONS

It is understood that the 'snow making' facility comprises a 'snow factory' about 12.2m long by 3.5m wide by 8.5m high weighing 33,000kg, to be sited on a concrete slab 14.5m long by 4.6m wide. No cutting is proposed to the ground level, other than for excavation of footings. The slab will therefore be up to about 2.2m above the existing ground level. Options for slab construction include:

Option 1 – suspended slab on internal columns and perimeter walls

Option 2 – perimeter retaining walls with engineered fill to provide formwork for the slab

We consider that Option 1 is preferred over Option 2 from a geotechnical perspective, as Option 2 will impart substantial additional vertical loading on the ground, and will also require importing and compaction of a sizeable volume of fill. Compaction control would be required for the filling to ensure that it is suitable to support the slab as formwork. The level of compaction and material quality selection / control that would be required to ensure an engineered fill suitable to support the slab without experiencing excessive settlement is considered to be impractical.

Highly weathered or less weathered granite is considered to be a suitable founding stratum for the concrete slab. In view of the moderate slopes and anticipated subsurface profile, the site classification for footings onto the highly or less weathered granite is assessed to be Class S in accordance with AS2870-2011 "Residential Slabs and Footings".

Columns and strip footings should be founded not less than 0.75m below the existing ground surface level, onto the highly or less weathered granite, and may be designed for a maximum allowable bearing pressure of 300 kPa.

If filling is used beneath the slab (e.g. to dispose of surplus material from footing excavation, or to ensure there are no open spaces beneath the slab), we recommend that it could be adopted as formwork for the concrete slab but should not be relied upon as permanent slab support. However, it should still be placed in accordance with the recommendations for "controlled" fill contained in AS2870-2011 "Residential Slabs and Footings" and AS3798-2007 "Guidelines on Earthworks for Commercial and Residential Developments", adopting a minimum dry density ratio not less than 95% standard. A method specification could also be used, subject to the proposed material grading (e.g. if larger granite particles are to be included). Perimeter walls would also need to be designed as retaining walls in this event.

Surface drainage should be provided particularly around the uphill side of the slab to direct surface water around the perimeter walls.

The above classification and footing recommendations are provided on the basis that the performance expectations set out in Appendix B of AS2870-2011 are acceptable and that future site maintenance is in accordance with CSIRO BTF 18.

An experienced geotechnical engineer should review footing designs to check that the recommendations of the geotechnical report have been included. Inspection of footing excavations should be carried out by experienced and appropriately qualified personnel to confirm the subsurface profile and design assumptions.

6. LIMITATIONS

In addition to the limitations inherent in site investigations (refer to the attached Information Sheets), it must be pointed out that the recommendations in this report are based on assessed subsurface conditions from limited investigations. In order to confirm the assessed soil and rock properties in this report, further investigation would be required such as subsurface investigation, and should be carried out if the scale of the development warrants, or if any of the properties are critical to the design, construction or performance of the development.



Please do not hesitate to contact the undersigned if you have any questions regarding this report or if you require further assistance.

For and on behalf of

Asset Geotechnical Engineering Pty Ltd

Mark Bartel

Mark Bartel

BE MEngSc GMQ RPEQ MIEAust CPEng NER (Civil)
Managing Director / Senior Principal Geotechnical Engineer

Encl: Form 4

*Important Information about your Geotechnical Report
Explanation Sheets*

DOCUMENT CONTROL

Distribution Register

| Copy | Media | Recipient | Location |
|------|------------|-------------------|--------------------------------|
| 1 | Secure PDF | Ivan Pasalich | Dabyne Planning Pty Ltd |
| 2 | Secure PDF | Michael Fearnside | Perisher Blue |
| 3 | Secure PDF | Mark Bartel | Asset Geotechnical Engineering |

Document Status

| Rev | Revision Details | Author | Reviewer | | Approved for Issue | | |
|-----|--|-----------|-----------|------------|--------------------|------------|--------------|
| | | | Name | Initials | Name | Initials | Date |
| 0 | Initial issue | M. Bartel | M. Bartel | MAB | M. Bartel | MAB | 18 July 2017 |
| 1 | Updated with current plans and review comments | M. Bartel | M. Bartel | <i>MAB</i> | M. Bartel | <i>MAB</i> | 19 July 2017 |

© Copyright Asset Geotechnical Engineering Pty Ltd. All rights reserved.

This document is and shall remain the property of Asset Geotechnical Engineering Pty Ltd. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Agreement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.



Geotechnical Policy – Kosciuszko Alpine Resorts

Form 4 – Minimal Impact Certification

Date received: ____/____/____

DA no: _____

This form may be used where minor construction works which present minimal or no geotechnical impact on the site or related land are proposed to be erected within the “G” line area of the geotechnical maps. A geotechnical engineer or engineering geologist must inspect the site and/or review the proposed development documentation to determine if the proposed development requires a geotechnical report to be prepared to accompany the development application. Where the geotechnical engineer determines that such a report is not required then they must complete this form and attach design recommendations where required. A copy of form 4 with design recommendation, if required, must be submitted with the development application.

Please contact the Alpine Resorts Assessments Team in Jindabyne for further information.
Phone 02 6456 1733.

To complete this form, please place a cross in the boxes ☐ and fill out the white sections.

1. Declaration made by geotechnical engineer or engineering geologist in relation to a nil or minimal geotechnical impact assessment and site classification

I,

Mr ☐ Ms ☐ Mrs ☐ Dr ☐ Other ☐

First name

Family name

OF

Company/organisation

certify that I am a geotechnical engineer /engineering geologist as defined by the “Policy” and I have inspected the site and reviewed the proposed development known as

As a result of my site inspection and review of the following documentation

(List of documentation reviewed)

I have determined that;

ground

- ☐ the current load-bearing capacity of the existing ~~building~~ will not be exceeded or adversely impacted by the proposed development, and
- ☐ the proposed works are of such a minor nature that the requirement for geotechnical advice in the form of a geotechnical report, prepared in accordance with the "Policy", is considered unnecessary for the adequate and safe design of the structural elements to be incorporated into the new works, and
- ☐ in accordance with AS 2870.1 Residential Slabs and Footings, the site is to be classified as a type
(insert classification type)

- ☐ I have attached design recommendations to be incorporated in the structural design in accordance with this site classification.

I am aware that this declaration shall be used by the Department as an essential component in granting development consent for a structure to be erected within the "G" line area (as identified on the geotechnical maps) of Kosciuszko Alpine Resorts without requiring the submission of a geotechnical report in support of the development application.

4. Signatures

Signature

Mark Bartel

Chartered professional status

Name

Date

5. Contact details

Alpine Resorts Assessments team

Snowy River Avenue

PO Box 36 JINDABYNE 2627

t: 02 6456 1733

f: 02 6456 1736

e: alpineresorts_assessments@dipnr.nsw.gov.au

SCOPE OF SERVICES

The geotechnical report ("the report") has been prepared in accordance with the scope of services as set out in the contract, or as otherwise agreed, between the Client and Asset Geotechnical Engineering Pty Ltd ("Asset"), for the specific site investigated. The scope of work may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

The report should not be used if there have been changes to the project, without first consulting with Asset to assess if the report's recommendations are still valid. Asset does not accept responsibility for problems that occur due to project changes if they are not consulted.

RELIANCE ON DATA

Asset has relied on data provided by the Client and other individuals and organizations, to prepare the report. Such data may include surveys, analyses, designs, maps and plans. Asset has not verified the accuracy or completeness of the data except as stated in the report. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations ("conclusions") are based in whole or part on the data, Asset will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Asset.

GEOTECHNICAL ENGINEERING

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared for a specific client, for a specific project and to meet specific needs, and may not be adequate for other clients or other purposes (e.g. a report prepared for a consulting civil engineer may not be adequate for a construction contractor). The report should not be used for other than its intended purpose without seeking additional geotechnical advice. Also, unless further geotechnical advice is obtained, the report cannot be used where the nature and/or details of the proposed development are changed.

LIMITATIONS OF SITE INVESTIGATION

The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model, and an engineering opinion is rendered about overall subsurface conditions and their likely behavior with regard to the proposed development. Despite investigation, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The engineering logs are the subjective interpretation of subsurface conditions at a particular location and time, made by trained personnel. The actual interface between materials may be more gradual or abrupt than a report indicates.

Therefore, the recommendations in the report can only be regarded as preliminary. Asset should be retained during the project implementation to assess if the report's recommendations are valid and whether or not changes should be considered as the project proceeds.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions can be modified by changing natural forces or man-made influences. The report is based on conditions that existed at the time of subsurface exploration. Construction operations adjacent to the site, and natural events such as floods, or ground water fluctuations,

may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. Asset should be kept apprised of any such events, and should be consulted to determine if any additional tests are necessary.

VERIFICATION OF SITE CONDITIONS

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that Asset be notified of any variations and be provided with an opportunity to review the recommendations of this report. Recognition of change of soil and rock conditions requires experience and it is recommended that a suitably experienced geotechnical engineer be engaged to visit the site with sufficient frequency to detect if conditions have changed significantly.

REPRODUCTION OF REPORTS

This report is the subject of copyright and shall not be reproduced either totally or in part without the express permission of this Company. Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimize the likelihood of misinterpretation from logs.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the Client and no other party. Asset assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of Asset or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

DATA MUST NOT BE SEPARATED FROM THE REPORT

The report as a whole presents the site assessment, and must not be copied in part or altered in any way.

Logs, figures, drawings, test results etc. included in our reports are developed by professionals based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

PARTIAL USE OF REPORT

Where the recommendations of the report are only partially followed, there may be significant implications for the project and could lead to problems. Consult Asset if you are not intending to follow all of the report recommendations, to assess what the implications could be. Asset does not accept responsibility for problems that develop where the report recommendations have only been partially followed if they have not been consulted.

OTHER LIMITATIONS

Asset will not be liable to update or revise the report to take into account any events or emergent circumstances or fact occurring or becoming apparent after the date of the report.

LOG ABBREVIATIONS AND NOTES

METHOD

borehole logs

| | |
|--------------------------------|-------------------|
| AS | auger screw * |
| AD | auger drill * |
| RR | roller / tricone |
| W | washbore |
| CT | cable tool |
| HA | hand auger |
| D | diatube |
| B | blade / blank bit |
| V | V-bit |
| T | TC-bit |
| * bit shown by suffix e.g. ADV | |

excavation logs

| | |
|----|--------------------|
| NE | natural excavation |
| HE | hand excavation |
| BH | backhoe bucket |
| EX | excavator bucket |
| DZ | dozer blade |
| R | ripper tooth |

coring

NMLC, NQ, PQ, HQ

SUPPORT

borehole logs

| | |
|----|---------|
| N | nil |
| M | mud |
| C | casing |
| NQ | NQ rods |

excavation logs

| | |
|---|---------|
| N | nil |
| S | shoring |
| B | benched |

CORE—LIFT

| | |
|---|------------------|
| | casing installed |
| ⊢ | barrel withdrawn |

NOTES, SAMPLES, TESTS

| | |
|-----|---|
| D | disturbed |
| B | bulk disturbed |
| U50 | thin-walled sample, 50mm diameter |
| HP | hand penetrometer (kPa) |
| SV | shear vane test (kPa) |
| DCP | dynamic cone penetrometer (blows per 100mm penetration) |
| SPT | standard penetration test |
| N* | SPT value (blows per 300mm) |
| | * denotes sample taken |
| Nc | SPT with solid cone |
| R | refusal of DCP or SPT |

USCS SYMBOLS

| | |
|----|---|
| GW | Well graded gravels and gravel-sand mixtures, little or no fines. |
| GP | Poorly graded gravels and gravel-sand mixtures, little or no fines. |
| GM | Silty gravels, gravel-sand-silt mixtures. |
| GC | Clayey gravels, gravel-sand-clay mixtures. |
| SW | Well graded sands and gravelly sands, little or no fines. |
| SP | Poorly graded sands and gravelly sands, little or no fines. |
| SM | Silty sand, sand-silt mixtures. |
| SC | Clayey sand, sand-clay mixtures. |
| ML | Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands. |
| CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays. |
| OL | Organic silts and organic silty clays of low plasticity. |
| MH | Inorganic silts of high plasticity. |
| CH | Inorganic clays of high plasticity. |
| OH | Organic clays of medium to high plasticity. |
| PT | Peat muck and other highly organic soils. |

MOISTURE CONDITION

| | |
|----|---------------|
| D | dry |
| M | moist |
| W | wet |
| Wp | plastic limit |
| WI | liquid limit |

CONSISTENCY

| | |
|-----|------------|
| VS | very soft |
| S | soft |
| F | firm |
| St | stiff |
| VSt | very stiff |
| H | hard |
| Fb | friable |

DENSITY INDEX

| | |
|----|--------------|
| VL | very loose |
| L | loose |
| MD | medium dense |
| D | dense |
| VD | very dense |

GRAPHIC LOG

Soil

| | |
|--|----------------|
| | Fill |
| | Peat, Topsoil |
| | Clay |
| | Silty Clay |
| | Gravelly Clay |
| | Sandy Clay |
| | Silt |
| | Sandy Silt |
| | Clayey Silt |
| | Gravelly Silt |
| | Gravel |
| | Sandy Gravel |
| | Clayey Gravel |
| | Silty Gravel |
| | Sand |
| | Gravelly Sandy |
| | Silty Sand |
| | Clayey Sand |

Rock

| | |
|--|------------------|
| | Sandstone |
| | Shale |
| | Clayey Shale |
| | Siltstone |
| | Conglomerate |
| | Claystone |
| | Dolerite, Basalt |
| | Granite |
| | Limestone |
| | Tuff |
| | Porphyry |
| | Pegmatite |
| | Gneiss, Schist |
| | Quartzite |
| | Coal |

Other

| | |
|--|----------|
| | Asphalt |
| | Concrete |
| | Brick |

Water

| | |
|--|--------------------|
| | Level |
| | Inflow |
| | Outflow (complete) |
| | Outflow (partial) |

Boundaries

| | |
|--|----------|
| | Known |
| | Probable |
| | Possible |

WEATHERING

| | |
|----|----------------------|
| XW | extremely weathered |
| HW | highly weathered |
| MW | moderately weathered |
| SW | slightly weathered |
| FR | fresh |

STRENGTH

| | |
|----|----------------|
| EL | extremely low |
| VL | very low |
| L | low |
| M | medium |
| H | high |
| VH | very high |
| EH | extremely high |

RQD (%)

$$= \frac{\text{sum of intact core pieces} > 2 \times \text{diameter}}{\text{total length of section being evaluated}} \times 100$$

DEFECTS:

type

| | |
|----|------------|
| JT | joint |
| PT | parting |
| SZ | shear zone |
| SM | seam |

coating

| | |
|----|---------|
| cl | clean |
| st | stained |
| ve | veneer |
| co | coating |

shape

| | |
|----|------------|
| pl | planar |
| cu | curved |
| un | undulating |
| st | stepped |
| ir | irregular |

roughness

| | |
|----|--------------|
| po | polished |
| sl | slickensided |
| sm | smooth |
| ro | rough |
| vr | very rough |

inclination

measured above axis and perpendicular to core

AS1726-1993

Soils and rock are described in the following terms, which are broadly in accordance with AS1726-1993.

SOIL

MOISTURE CONDITION

| Term | Description |
|-------|---|
| Dry | Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Un-cemented granular soils run freely through the hand. |
| Moist | Feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere. |
| Wet | As for moist, but with free water forming on hands when handled. Moisture content of cohesive soils may also be described in relation to plastic limit (W_p) or liquid limit (W_L) [$>>$ much greater than, $>$ greater than, $<$ less than, $<<$ much less than]. |

CONSISTENCY OF COHESIVE SOILS

| Term | Su (kPa) | Term | Su (kPa) |
|-----------|----------|------------|-----------|
| Very soft | < 12 | Very Stiff | 100 – 200 |
| Soft | 12 – 25 | Hard | > 200 |
| Firm | 25 – 50 | Friable | – |
| Stiff | 50 – 100 | | |

DENSITY OF GRANULAR SOILS

| Term | Density Index (%) | Term | Density Index (%) |
|--------------|-------------------|------------|-------------------|
| Very Loose | < 15 | Dense | 65 – 85 |
| Loose | 15 – 35 | Very Dense | > 85 |
| Medium Dense | 35 – 65 | | |

PARTICLE SIZE

| Name | Subdivision | Size (mm) |
|-------------|-------------|-------------|
| Boulders | | > 200 |
| Cobbles | | 63 – 200 |
| Gravel | coarse | 20 – 63 |
| | medium | 6 – 20 |
| | fine | 2.36 – 6 |
| Sand | coarse | 0.6 – 2.36 |
| | medium | 0.2 – 0.6 |
| | fine | 0.075 – 0.2 |
| Silt & Clay | | < 0.075 |

MINOR COMPONENTS

| Term | Proportion by Mass: |
|-------|---|
| | <u>coarse grained</u> <u>fine grained</u> |
| Trace | = 5% = 15% |
| Some | 5 – 2% 15 – 30% |

SOIL ZONING

| | |
|---------|---|
| Layers | Continuous exposures. |
| Lenses | Discontinuous layers of lenticular shape. |
| Pockets | Irregular inclusions of different material. |

SOIL CEMENTING

| | |
|------------|--|
| Weakly | Easily broken up by hand. |
| Moderately | Effort is required to break up the soil by hand. |

USCS SYMBOLS

| Symbol | Description |
|--------|---|
| GW | Well graded gravels and gravel-sand mixtures, little or no fines. |
| GP | Poorly graded gravels and gravel-sand mixtures, little or no fines. |
| GM | Silty gravels, gravel-sand-silt mixtures. |
| GC | Clayey gravels, gravel-sand-clay mixtures. |
| SW | Well graded sands and gravelly sands, little or no fines. |
| SP | Poorly graded sands and gravelly sands, little or no fines. |
| SM | Silty sand, sand-silt mixtures. |
| SC | Clayey sand, sand-clay mixtures. |
| ML | Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands. |
| CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays. |
| OL | Organic silts and organic silty clays of low plasticity. |
| MH | Inorganic silts of high plasticity. |
| CH | Inorganic clays of high plasticity. |
| OH | Organic clays of medium to high plasticity. |
| PT | Peat muck and other highly organic soils. |

ROCK

SEDIMENTARY ROCK TYPE DEFINITIONS

| Rock Type | Definition (more than 50% of rock consists of) |
|--------------|--|
| Conglomerate | ... gravel sized ($> 2\text{mm}$) fragments. |
| Sandstone | ... sand sized (< 0.06 to 2mm) grains. |
| Siltstone | ... silt sized ($< 0.06\text{mm}$) particles, rock is not laminated. |
| Claystone | ... clay, rock is not laminated. |
| Shale | ... silt or clay sized particles, rock is laminated. |

LAYERING

| Term | Description |
|------------------|--|
| Massive | No layering apparent. |
| Poorly Developed | Layering just visible. Little effect on properties. |
| Well Developed | Layering distinct. Rock breaks more easily parallel to layering. |

STRUCTURE

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

STRENGTH (NOTE: Is50 = Point Load Strength Index)

| Term | Is50 (MPa) | Term | Is50 (MPa) |
|---------------|------------|----------------|------------|
| Extremely Low | < 0.03 | High | 1.0 – 3.0 |
| Very low | 0.03 – 0.1 | Very High | 3.0 – 10.0 |
| Low | 0.1 – 0.3 | Extremely High | > 10.0 |
| Medium | 0.3 – 1.0 | | |

WEATHERING

| Term | Description |
|------------------|---|
| Residual Soil | Soil derived from weathering of rock; the mass structure and substance fabric are no longer evident. |
| Extremely | Rock is weathered to the extent that it has soil properties (either disintegrates or can be remoulded). Fabric of original rock is still visible. |
| Highly | Rock strength usually highly changed by weathering; rock may be highly discoloured. |
| Moderately | Rock strength usually moderately changed by weathering; rock may be moderately discoloured. |
| Slightly | Rock is slightly discoloured but shows little or no change of strength from fresh rock. |
| Fresh | Rock shows no signs of decomposition or staining. |

DEFECT DESCRIPTION

| Type | |
|--------------|---|
| Joint | A surface or crack across which the rock has little or no tensile strength. May be open or closed. |
| Parting | A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering/bedding. May be open or closed. |
| Sheared Zone | Zone of rock substance with roughly parallel, near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. |
| Seam | Seam with deposited soil (infill), extremely weathered insitu rock (XW), or disoriented usually angular fragments of the host rock (crushed). |

Shape

| | |
|------------|------------------------------------|
| Planar | Consistent orientation. |
| Curved | Gradual change in orientation. |
| Undulating | Wavy surface. |
| Stepped | One or more well defined steps. |
| Irregular | Many sharp changes in orientation. |

Roughness

| | |
|--------------|---|
| Polished | Shiny smooth surface. |
| Slickensided | Grooved or striated surface, usually polished. |
| Smooth | Smooth to touch. Few or no surface irregularities. |
| Rough | Many small surface irregularities (amplitude generally $< 1\text{mm}$). Feels like fine to coarse sandpaper. |
| Very Rough | Many large surface irregularities, amplitude generally $> 1\text{mm}$. Feels like very coarse sandpaper. |

Coating

| | |
|---------|--|
| Clean | No visible coating or discolouring. |
| Stained | No visible coating but surfaces are discolored. |
| Veneer | A visible coating of soil or mineral, too thin to measure; may be patchy |
| Coating | Visible coating = 1mm thick. Thicker soil material described as seam. |