



**ACT**  
Government

Transport Canberra and  
City Services

## FREEDOM OF INFORMATION COVERSHEET

The following information is provided pursuant to section 28 of the *Freedom of Information Act 2016*.

FOI reference: TCCSFOI 21-022

Information to be published	Status
1. Access application	Published
2. Decision notice and schedule	Published
3. Documents	Published
4. Additional information identified	n/a
5. Fees	n/a
6. Processing time (in working days)	19 days
7. Decision made by Ombudsman	n/a
8. Additional information identified by Ombudsman	n/a
9. Decision made by ACAT	n/a
10. Additional information identified by ACAT	n/a

**From:** [REDACTED]  
**To:** [TCCS FreedomOfInformation](#)  
**Subject:** FOI Request  
**Date:** Monday, 1 March 2021 4:54:39 PM

---

**CAUTION:** This email originated from outside of the ACT Government. Do not click links or open attachments unless you recognise the sender and know the content is safe.

To whom it may concern,

I wish to make the following request under the Freedom of Information Act 2016:

I seek any or all geotechnical reports held or created by Transport Canberra and City Services and/or ACT Roads in relation to Tarra Place Ngunnawal.

**Charges:**

I ask that you waive processing charges for this request because it is limited in scope and can likely be processed quickly and access to the information is in the public interest.

**Size of request:**

The act empowers you to charge for access to documents, but section 2(2) says you should exercise your discretion "as far as possible to facilitate and promote, promptly and at the lowest reasonable cost, the disclosure of information".

Although this request is made under the ACT legislation, the Australian Information Commission has issued guidelines on interpreting the federal FOI Act, which is, in the relevant parts, almost identical to the ACT act. These guidelines urge FOI-decision makers to consider reducing or exempting charges when:

- the 'cost of calculating and collecting a charge might exceed the cost to the agency of processing the request'; and
- the 'agency was able to identify and retrieve the document easily and at marginal cost'

**The public interest**

Section 29(3)(c) of the act says that, when deciding whether to charge for access to a document, you must take into account whether access "is in the general public interest or in the interest of a substantial section of the public."

Road issues along Tarra Place in Ngunnawal have been well documented for at least several years and concerns have been raised among members of the general public about the road and underground reservoirs in recent weeks. Residents have said issues stemming from the road and underneath the road may be causing damage to homes in the street but also in the surrounding area, creating potential hazards for other people.

Please note, I have no intention in identifying any directorate official who may be identified in any requested document.

I believe I have provided sufficient reasons for you to provide the information I seek free of charge. However, please contact me on [REDACTED] if you face any barriers to releasing this information.

Looking forward to hearing from you.

Regards,

[REDACTED]

[REDACTED]

T  
A  
W  
M



The information contained in this e-mail message and any accompanying files is or may be confidential. If you are not the intended recipient, any use, dissemination, reliance, forwarding, printing or copying of this e-mail or any attached files is unauthorised. This e-mail is subject to copyright. No part of it should be reproduced, adapted or communicated without the written consent of the copyright owner. If you have received this e-mail in error please advise the sender immediately by return e-mail or telephone and delete all copies. [REDACTED] does not guarantee the accuracy or completeness of any information contained in this e-mail or attached files. Internet communications are not secure, therefore [REDACTED] does not accept legal responsibility for the contents of this message or attached files.



**ACT**  
Government

Transport Canberra and  
City Services

By email: [REDACTED].com.au

Dear [REDACTED]

**Freedom of information request:** Reference 21-022

I refer to your application made under the *Freedom of Information Act 2016* (the FOI Act) made to Transport Canberra and City Services (TCCS) on 2 March 2021. It is my understanding that you are seeking access to the following government information:

*“any or all geotechnical reports held or created by Transport Canberra and City Services and/or ACT Roads in relation to Tarra Place Ngunnawal.”*

I am an Information Officer appointed by the Director-General under section 18 of the Act to deal with access applications made under Part 5 of the Act. TCCS is required to decide on your application by 30 March 2021.

#### **Decision on access**

A search of TCCS records has been completed and one document, a report, has been found within the scope of your request. This report has been prepared for the consideration of TCCS but is not currently endorsed.

I have found that it is, on balance, in the public interest to provide you with partial access to these records. The reasons for my decision are detailed further below in the statement of reasons.

#### **Statement of Reasons**

In reaching my access decision, I have taken the following into account:

- the FOI Act
- the content of the documents that fall within the scope of your request; and
- the *Human Rights Act 2004*.

The FOI Act has a presumption in favour of disclosure. This means that information should be disclosed unless doing so would be contrary to the public interest. As an Information Officer, I must decide where, on balance, public interest lies in the disclosure of government information. Section 17(1) of the Act sets out the steps for completing the public interest test. As part of this process I must identify all relevant factors in schedules 1 and 2 of the FOI Act. Taking into consideration the information contained in the documents found to be within the scope of your request, I have identified that the following factors are relevant to determine if release of the information contained within these records are in the public interest.

**Factors favouring disclosure (Schedule 2.1)**

- Schedule 2.1(a)(i) - promote open discussion of public affairs and enhance the government's accountability.
- Schedule 2.1(a)(iii) - inform the community of the government's operations, including the policies, guidelines and codes of conduct followed by the government in its dealings with members of the community.
- Schedule 2.2(a)(viii) - reveal the reason for a government decision and any background or contextual information that informed the decision.

**Factors favouring non-disclosure (Schedule 2.2)**

- Section 2.2 (a)(ii) – prejudice the protection of an individual's right to privacy or any other right under the Human Rights Act 2004.
- Section 2.2(a)(xi) - prejudice trade secrets, business affairs or research of an agency or person.

I have considered the public interest in relation to government information held about roads maintained by Transport Canberra and City Services. I have considered that the disclosure of the information may provide increased transparency about the government's operations and can reveal the reason for government decisions.

In assessing the public interest on the disclosure of some information in the document, personal information about third parties were identified. Personal information means information or an opinion whether true or not about an individual whose identity is apparent or can be ascertained from the information or opinion. The *Information Privacy Act 2014* prescribes how government collects, uses, shares, and stores this information. I have considered the likelihood that disclosing this information would prejudice an individual's right to privacy or any other right under the *Human Rights Act 2004* (Human Rights Act). I have also taken into consideration that the personal information does not appear to be publicly available elsewhere. In this instance, I find that the disclosure of the personal information within this document is contrary to the public interest.

Information relating to sub-contractor arrangements were also identified within the relevant document. I have found that the disclosure of this information could prejudice third party business affairs and find that this information is, on balance, contrary to the public interest.

The records enclosed at [Attachment A](#) are provided with deletions applied to information I consider is contrary to the public interest to disclose.

**Charges**

No fee is applicable as the number of documents and pages does not exceed the threshold where fees are payable.

### **Online publishing – disclosure log**

In accordance with section 28 of the Act, TCCS maintains an online record of access applications called a disclosure log, which is accessible at [https://www.cityservices.act.gov.au/about-us/freedom\\_of\\_information/disclosure-log](https://www.cityservices.act.gov.au/about-us/freedom_of_information/disclosure-log).

Your access application, this notice of decision and records released to you will be published on the disclosure log within 3 – 10 business days.

### **Ombudsman review**

My decision on your access request is a reviewable decision as identified in Schedule 3 of the Act. You have the right to seek Ombudsman review of this outcome under section 73 of the Act within 20 working days from the day that my decision is published in TCCS' disclosure log or a longer period allowed by the Ombudsman.

If you wish to request a review of my decision, you may write to the Ombudsman at:

The ACT Ombudsman  
GPO Box 442  
CANBERRA ACT 2601  
[ombudsman@ombudsman.gov.au](mailto:ombudsman@ombudsman.gov.au)

### **ACT Civil and Administrative Tribunal (ACAT) review**

Under section 84 of the Act, if a decision is made under section 82(1) on an Ombudsman review, you may apply to the ACAT for review of the Ombudsman decision.

Further information may be obtained from ACAT at:

ACT Civil and Administrative Tribunal  
Level 4, 1 Moore Street  
GPO Box 370  
CANBERRA CITY ACT 2601  
Telephone: (02) 6207 1740  
[www.acat.act.gov.au](http://www.acat.act.gov.au)

If you have any queries concerning the directorate's processing of your request, or would like further information, please contact the TCCS FOI team on (02) 6207 2987 or email to [tccs.foi@act.gov.au](mailto:tccs.foi@act.gov.au).

Yours sincerely



Cherie Hughes  
Information Officer

29 March 2021

19 February 2021

Our ref: [REDACTED]

Roads ACT

Via email: [REDACTED]

**Attention:** [REDACTED]

**TARRA PLACE, NGUNNAWAL  
GEOTECHNICAL PAVEMENT ASSESSMENT**

**1 Introduction and Background**

At the request of Roads ACT, ACT Geotechnical Engineers Pty Ltd have undertaken a geotechnical assessment of the existing pavement on a section of Tarra Place, in Ngunnawal, ACT.

This report summarises the methods and findings of the field investigation and laboratory testing, and includes an assessment of the geotechnical and geological conditions based on the factual information obtained during the field investigation and subsequent laboratory testing, visual assessment of the pavement defects, and provides geotechnical and pavement recommendations for rehabilitation of the pavement. The object of the investigation was to assess the subsurface geotechnical conditions along the pavement and provide geotechnical parameters for the design of the project scope of work.

The scope of this report is:

- i) Identify subsurface conditions including the existing road pavement profile, extent and nature of any fill materials, bedrock type and depth, and any groundwater presence.
- ii) Subgrade conditions at each borehole location
- iii) Results of CBR and soil classification testing
- iv) Visual assessment of surface defects
- v) Presentation of interpretation of geotechnical models for detailed design of geotechnical elements
- vi) Summary of test results and comments on results
- vii) Pavement remediation recommendations

**2 Site Description & Geology**

The site is a section Tarra Place in Ngunnawal, ACT. Tarra Place is an approximately 80m long cul-de-sac to the west of Jabanungga Ave. Tarra Place slopes at approximately 3-4% to the west towards a stormwater channel with check dams/weirs located at regular intervals, with Horse Park Drive beyond. The Tarra Place pavement is a 4.5m wide single carriageway two direction road with kerb and gutter on both sides. A stormwater dam/wetland is located 140m north of the site. The road is surrounded by single storey residential dwellings.

The 1:100,000 Canberra & Environs Geology Map documents the site as being underlain by Silurian age Canberra formation, comprising mudstone, siltstone, minor sandstone, limestone, hornfels, dacitic ignimbrite, and volcaniclastic sediments.

**3 Pavement Investigation**

To establish the subsurface conditions, a 3.5T excavator with a 300mm diameter auger was used to drill 2 boreholes (designated BH1 to BH2) to 1.5m below ground level (mbgl) or prior refusal. The subsurface profiles were logged general accordance with AS1726-2017. The locations of the boreholes are shown on Figure 1, and the detailed logs are attached to this letter. BH1 was located within an area of failed pavement, while

BH2 was located to the west of the failed section of pavement, where the pavement was showing no visible signs of deterioration.

Representative samples of the subgrade soils from were sampled and tested in a NATA laboratory for standard compaction and soaked CBR, and a sample of the pavement base course tested for Atterberg Limits and Particle Size Distribution. The test certificates are attached to this letter.

#### 4 Results of Pavement Investigation

##### 4.1 Subsurface Conditions

The following tables summarise the subsurface conditions encountered. The logs should be referred to for more detail, and are attached to this report.

The boreholes found the subsurface profile to comprise:

Geological Profile	Typical Depth Interval	Description
PAVEMENT	0m to 0.05m/0.12m	ASPHALT
	0.05m/0.12 to 0.32m	BASECOURSE; Gravelly SAND; fine to coarse, fine to medium gravel, grey, light brown-yellow, moist, very loose
FILL	0.32m to 0.6m/1.0m	Gravelly SAND, Gravelly Silty CLAY: fine to coarse sand, low plasticity clay, fine to medium sub angular gravel, with cobbles of siltstone, wet, very soft, very stiff
RESIDUAL SOIL	0.32m/0.6m to 1.5m/>1.7m	Sandy CLAY, Sandy Silty CLAY: low to high plasticity clay, grey brown, fine to medium sand, moist less than plastic limit to moist greater than plastic limit, very soft, to very stiff
BEDROCK	Below 1.5m	SILTSTONE: moderately weathered, grey. Only encountered in BH2

Groundwater was not encountered in BH2. Standing groundwater was recorded at 1.3m below pavement level in BH1 follow approximately 45 minutes following drilling and was rising at the time of backfilling. Water seepages within BH1 were recorded in BH1 at 0.32mbgl (base of pavement) and 0.9m (near base of fill).

##### 4.2 Laboratory Results

Subgrade materials were tested for Modified Compaction, California Bearing Ratio (CBR) (4-day soak), particle size distribution and Atterberg Limits. Results are summarized in Table 1 and 2 below. Certificates of Analysis are attached to this report.

**Table 1: Summary of Laboratory CBR Results**

Sample Reference	Unit	Field Moisture Content (%)	Optimum Moisture Content (%)	MDD (t/m <sup>3</sup> )	CBR Swell (%)	CBR @95%MMDD (%)
<b>BH1 0.4-0.8m</b>	Residual Soil	19.3	11.5	2.08	1.5	16

Table Notes:

OMC: Optimum Moisture Content    CBR: California Bearing Ratio

MDD: Maximum Dry Density

**Table 2: Summary of Grading and Atterberg Limit Results**

Sample Reference	Unit	LL (%)	PL(%)	PI(%)	Fines (%)	Sand(%)	Gravel (%)
<b>BH1 0.4-0.4m</b>	Residual Soil (Subgrade)	25	17	8	47	26	27
<b>BH2 0.1-0.3m</b>	Pavement (Basecourse)	17	12	5	12	45	43

Table Notes:

LL: Liquid Limit

PL: Plastic Limit

PI: Plasticity Index

Fines: Fraction Passing 0.075mm

Sand: Fraction between 2.36 & 0.075mm

Gravel: Fraction Retained above 2.36mm

### 4.3 Pavement Defects

Surface defects of the pavement were classified in accordance with AGPT05-12. The defect types and the inferred cases are summarised in Table 3 below. Photographic plates are attached to this report.

**Table 3: Surface Defect Assessment**

Defect Type	Possible causes	Photograph
<b>Crocodile Cracking</b>	Fatigue induced structural cracking Moisture in formation	Plate 1 & 2

Seepages were observed from the pot hole and two areas near the intersection of Tarra Place and Jabanungga Ave. Seepages are likely occurring due to pumping action from traffic driving over the cracked area forcing moisture within the base course and subgrade to the surface.

A review of the pavement condition was undertaken using aerial photography available from Nearmap and Google Earth to assess the history of the pavement condition in the area. Table 4 summarises the findings. Reference is made to three zones of pavement – Zone A to Zone C – where failures have been observed. Figure 2 shows the locations of these zones.



**Plate 1: Crocodile Cracking and seepage from pavement.**



**Plate 2: Major pavement failure.**

**Table 4: Aerial Photograph Summary**

Photograph Date	Observations
<b>December 2002</b>	Tarra Place, Iterra Grove and Jabanunga Ave have been constructed with residential dwellings on both sides. No development has occurred to the north of the dwellings on the northern side of Iterra Grove. Pavements appear to be in an adequate condition.
<b>November 2009</b>	Development to the west of Horse Park drive in Casey has commenced. Pavements appear to be in an adequate condition.
<b>September 2012</b>	Development of Ngunnawal to the north of Iterra Grove and east of Jabanungga Ave begins. Pavements appear to be in an adequate condition. Some dirt is present on the pavements, likely associated with construction traffic or erosion.
<b>April 2013</b>	Construction of the stormwater dam/wetland to the north begins. Development of Ngunnawal north continuing. Pavements appear to be in an adequate condition. Some dirt is present on the pavements, likely associated with construction traffic and works. Construction of dwellings to the east of Jabanungga Ave begins.
<b>July 2013</b>	Water begins accumulating in the stormwater dam. Pavements appear to be in an adequate condition.
<b>December 2013</b>	Construction of residential dwellings in Ngunnawal north is underway. Pavements appear to be in an adequate condition.
<b>February 2016</b>	Pavement failure in Zone A has occurred.
<b>August 2016</b>	Heavy patching of Zone A undertaken.
<b>October 2016</b>	Pavement failure in Zone B has occurred.
<b>December 2016</b>	Heavy patching of Zone B has been undertaken.
<b>March 2017</b>	Dilapidation of the patch in Zone B is occurring.
<b>April 2017</b>	Repatching of an area of Zone B has been undertaken.
<b>Novemebr 2018</b>	Some deterioration of the pavement in the north of Zone B appears.
<b>June 2020</b>	Minor deterioration of pavement in Zone C
<b>August 2020</b>	Major deterioration of pavement in Zone C
<b>December 2020</b>	Heavy patching of Zone C undertaken. Failures through the patches and to the east occurring. Seepages and failure in the south of Zone B appear.

Other pavements in the greater Ngunnawal area that were constructed at the same time as Tarra Place appear to be performing well.

## 5 Discussion & Recommendations

### 5.1 Subgrade Design CBR

The geotechnical investigation has identified that the site is underlain by residual soils, which are moderately reactive.

Based upon the laboratory results, the design CBR value of 5% has been adopted for the full depth pavements.

The design CBR value is based on the laboratory and in situ CBR tests and is based on a statistical review of the lab and field testing. It is not the lowest CBR value that was encountered but rather based on a statistical likelihood and engineering judgement based on the characteristics of the subgrade materials. There is potential that there are zones where the subgrade soils have an in situ CBR of less than the design CBR. Care will be required during construction to confirm that the design CBR has been achieved.

### 5.2 Existing Pavement Materials

The result of the particle size distribution of the existing base course has been plotted against the DGB20 grading limits given by TfNSW QA specification 3051- Granular Pavement Base and Subbase Materials, and is shown in Figure 3 below.

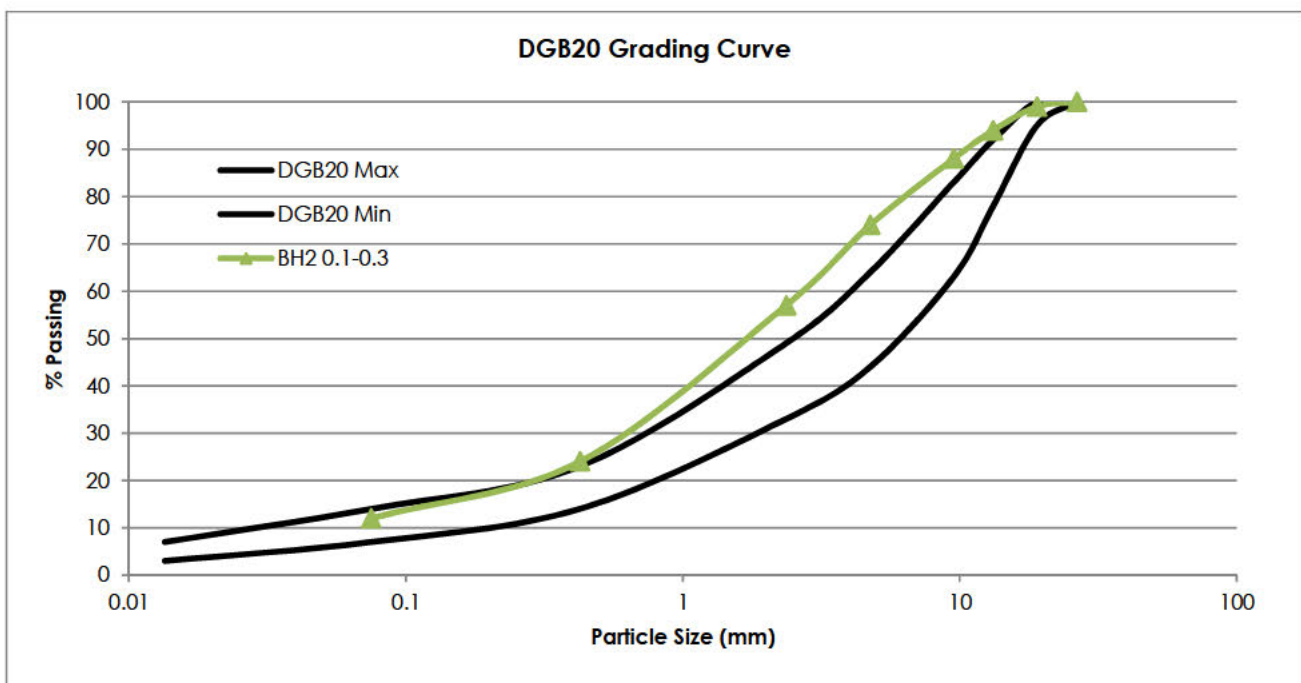


Figure 3: Base course Grading Curve

The grading curves indicate the sand fraction of the base course exceeds the grading requirement for DGB20, but is generally compliant with the fines requirement. The base course material meets the plasticity requirements.

### 5.3 Inferred Pavement Failure Modes

The pavement failures in the area are inferred to have been induced by excessive water in the subgrade. Prolonged saturation of the subgrades has significantly weakened the subgrade material, inducing pavement failure when trafficked.

The source of the water is unable to be determined give the scope of this investigation, however could be due to:

- Damaged utilities, including water, sewer or storm water pipes
- Migration of groundwater from upslope infiltration
- Leakage of the storm water detention dam to the north of the site.

Given that the pavement failures in the area started to occur shortly after the development to the north and east of the site, it is considered likely that water is naturally occurring seepage from an upslope source. Development may have changed the water infiltration and runoff pathways, and water may be migrating

along the interface between the natural soil and fill materials below the pavement. We also anecdotally understand that groundwater seepages have previously been an issue at the residential units immediately to the south of Tarra Place.

#### 5.4 Recommendations

Based on the review of the aerial photographs, water saturating the pavement inducing failures in the area (beyond the Tarra Place failure which was the scope of this investigation) appears to have been occurring over the past 5 years. The scope of works required to remediate the pavements in the area to a level requiring only routine maintenance may be significant. The following options for further works should be considered:

- **Undertake a utilities investigation**

A utilities investigation should be undertaken to eliminate the possibility of the source of the water being a leaking water, storm water or sewer pipe. While we understand that Icon Water have stated that water mains in the area do not have any leakages. Given the rate and persistence of water flows over time we consider that without a CCTV investigation (or similar inspection method) and/or exposure of assets, the water source being a service pipe cannot be discounted. Given the observed sheen on the standing water in BH1 indicate the presence of hydrocarbons in the water, the water may be from runoff from the pavements. This suggests storm water would be the most likely utility source.

The possibility of blocked subsoil drains should also be considered.

- **Heavy Patching**

Heavy patching of the pavement in Zone A has been previously undertaken, and to date appears to have largely remediated the issue in this zone. Heavy patching should comprise the milling of the existing wearing course and placement of a minimum asphalt thickness of 200mm. We note however that the performance such patches cannot be guaranteed, as shown by the post-patching failures in Zone B & C. It may also cause the failure of pavements elsewhere in the vicinity due to the sealing in of water in the patched area, causing further migration of the water to other areas.

- **Full Pavement Reconstruction including a Drainage Layer**

The water causing the saturation of the subgrade may be from upslope infiltration or the nearby storm water detention basin. Given the seepages were observed to be occurring near the interface of the fill and natural soil, this interface may be a preferential pathway for seepages, with the down-slope migration retarded by clogged subsoil drains on the southern side of Tarra Place.

Full pavement reconstruction would require, at a minimum, the following procedure:

1. Milling of existing wearing course;
2. Excavation of existing granular base course. This material would likely be suitable for reuse in the new pavement layers, but confirmation of suitability for use as base course would be required following laboratory testing of the stockpiled materials;
3. Excavation and offsite disposal of water effected subgrade soils. Based on the profile in BH1, this is likely up to 900mm below surface level. Wet soils (moisture content above optimum moisture content (OMC)) would not be suitable for reuse without air drying. Any soils with an in situ moisture content less than OMC may be suitable for reuse with approval from a suitability qualified geotechnical engineer;
4. Inspection of the subgrade by a suitability qualified geotechnical engineer to confirm the subgrade is firm and unyielding (proof roll or similar test);
5. Placement of a drainage layer. The drainage layer shall comply with the requirements of TfNSW R44 Treatment Type C5 – Drainage Layer. The drainage layer must be tied into the subsoil drainage system with a cross fall greater than the longitudinal fall of the road. The drainage layer broadly comprises an aggregate wrapped in a separation geotextile;
6. Placement of a Select Material Zone (SMZ) with a thickness of 300mm. It is recommended that the SMZ material be lime-treated (2%) to minimise its susceptibility to moisture changes; and,
7. Reconstruct pavement to tie in with the existing pavement. Alternatively a full depth asphalt (deep lift) pavement could be considered if a thinner pavement is required for level correction purposes.

Figure 3 shows the details of this option. Detailed design would require review of the existing subsoil drainage details.

- **Localised Pavement Reinforcement**

Localised pavement reinforcement would require full depth reconstruction of the pavement locally where the pavement failures are occurring. Pavement reinforcement would comprise the following procedure:

1. Milling of existing wearing course;
2. Excavation of existing granular base course. This material would likely be suitable for reuse in the new pavement layers, but confirmation of acceptability for use as base course would be required following laboratory testing of the stockpiled materials;
3. Excavation of water impacted soils to a minimum depth of 300mm below pavement subgrade level (approx. 600mm below surface level). Excavation a minimum of 1m in plan distance from the water impacted area would be required. The extent of the treatment area would be required to be confirmed by a geotechnical engineer following exposure of the existing subgrade;
4. Placement of a triaxial geonet drainage layer (separation geotextile both sides (Bidim A24 or equivalent)). The geonet would need extend a minimum plan distance of 1.0m beyond the water impacted subgrade soils and be tied into the subsoil drainage system on the downslope side of the effected pavement. The geonet should be graded such that water flows into the existing subsoil drains rather than longitudinally down the pavement;
5. Construction of a bridging layer, comprising a geogrid (Tensar Triax TX170 or equivalent).The bridging layer would need to extend a minimum plan distance of 1.0m beyond the water impacted subgrade soils, as confirmed by a geotechnical engineer following exposure of the subgrade;
6. Placement of a Select Material Zone (SMZ) with a thickness of 300mm. It is recommended that the SMZ material be lime-treated (2%) to minimize its susceptibility to moisture changed; and,
7. Reconstruct pavement to tie in with the existing pavement. Alternatively a full depth asphalt (deep lift) pavement could be considered.

Figure 4 shows the details of this option. Detailed design would require review of the existing subsoil drainage details and confirmation installation and performance. Adoption of this option may result in pavement failures in other areas.

- **Herring Bone Subsoil Drains**

Installation of subsoil drains within the pavement subgrade could allow for moisture within the formation to be collected prior to saturating the subgrade within 300mm of the pavement.

1. Excavate subsoil trenches within the failed pavement area to a minimum depth of 300mm below subgrade level (approx. 600mm) at 2m longitudinal spacing in the configuration shown on Figure 5;
2. Install subsoil drains and tie into existing subsoil drains in accordance with MITS03;
3. Backfill trenches in accordance with MITS03;
4. Undertake deep lift patching of the failed pavement areas;
5. Patch trench excavations;
6. Monitor performance of pavement for 12 months; and,
7. If the pavement is performing adequately, mill and resheet wearing course of entire treated area.

Figure 5 shows the details of this option. Detailed design would require review of the existing subsoil drainage details and confirmation installation and performance. This option risks continued saturation of the subgrade below the level of the installed subsoil drains, which could continue to impact pavement performance.

## 6 Closure

Should you require any further information regarding this report, please do not hesitate to contact our office.

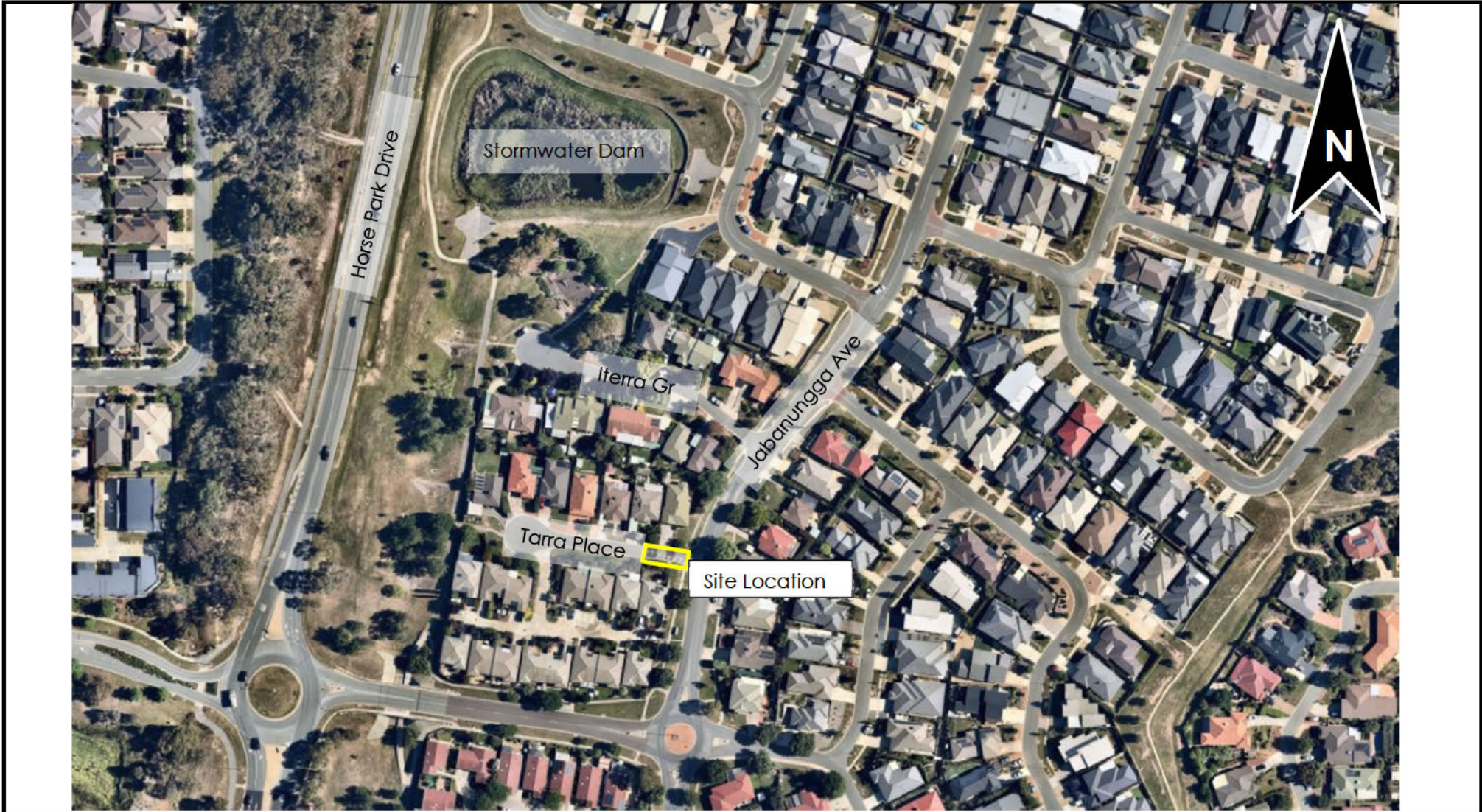
Yours faithfully

**ACT Geotechnical Engineers Pty Ltd**



### **Attachments:**

- Figure 1: Site Location Plan
- Figure 2: Borehole Location Plan
- Figure 3: Historic Pavement Failures
- Figure 4: Full Depth Reconstruction
- Figure 5: Localised Pavement Reinforcement
- Figure 6: Herring Bone Subsoil Drains
- Borehole Logs
- Laboratory Certificates
- Limitation of Geotechnical Reports



**ROADS ACT  
TARRA PLACE, NGUNNAWAL  
SITE LOCATION PLAN**



**ROADS ACT  
TARRA PLACE, NGUNNAWAL  
BOREHOLE LOCATION PLAN**

ACT Geotechnical Engineers Pty Ltd

C11493

FIGURE 2

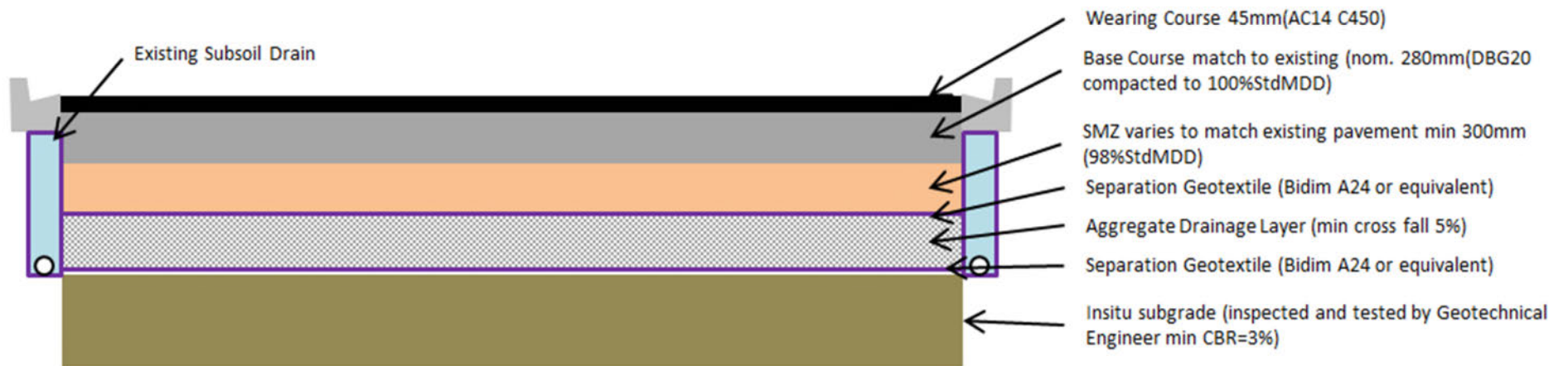


**ROADS ACT  
TARRA PLACE, NGUNNAWAL  
HISTORIC PAVEMENT FAILURES**

ACT Geotechnical Engineers Pty Ltd

C11493

FIGURE 3

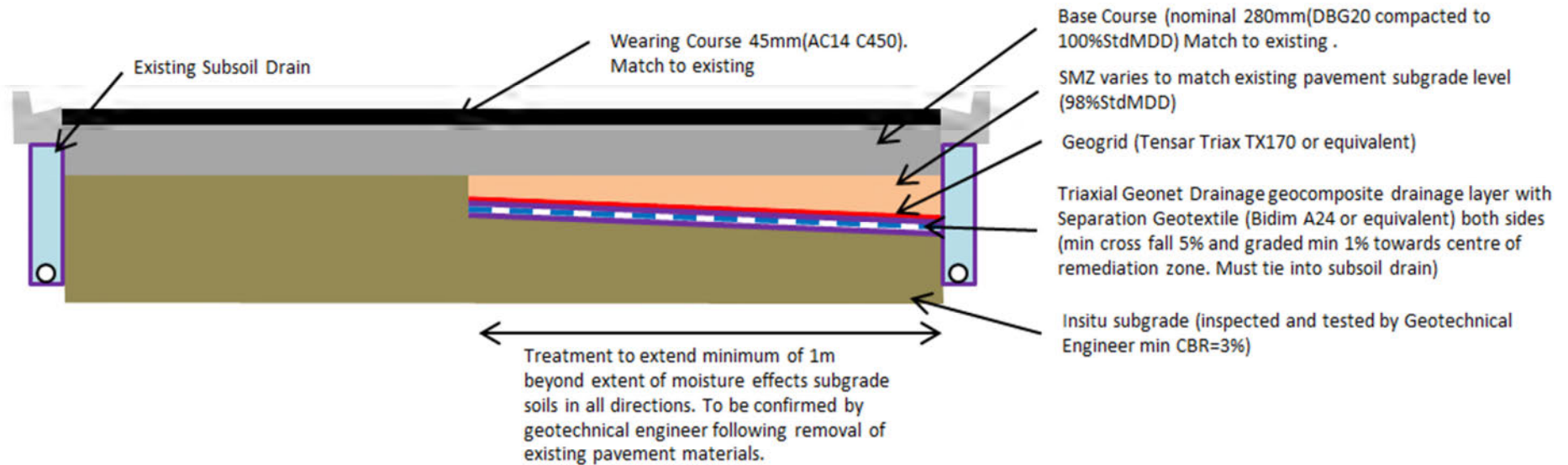


ROADS ACT  
TARRA PLACE, NGUNNAWAL  
FULL DEPTH RECONSTRUCTION

ACT Geotechnical Engineers Pty Ltd

C11493

FIGURE 4

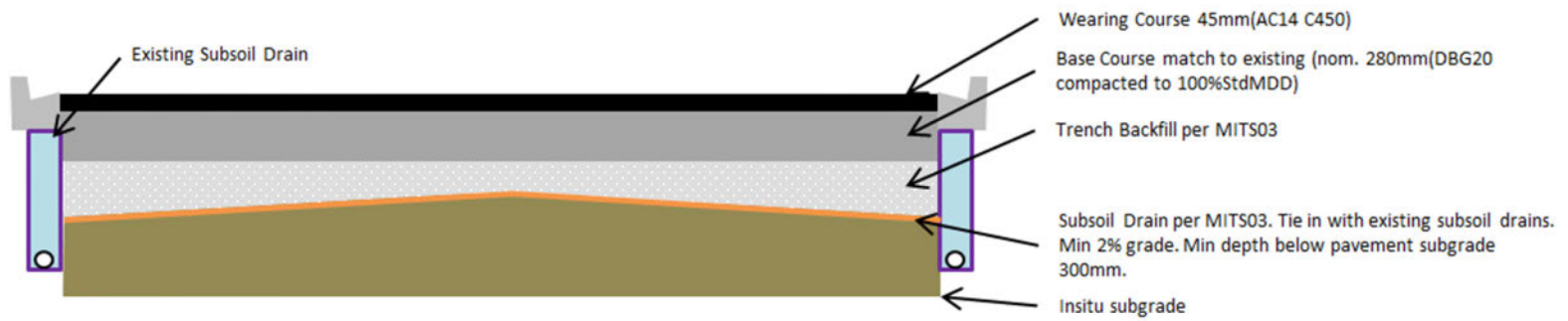


**ROADS ACT  
TARRA PLACE, NGUNNAWAL  
LOCAL PAVEMENT REINFORCEMENT**

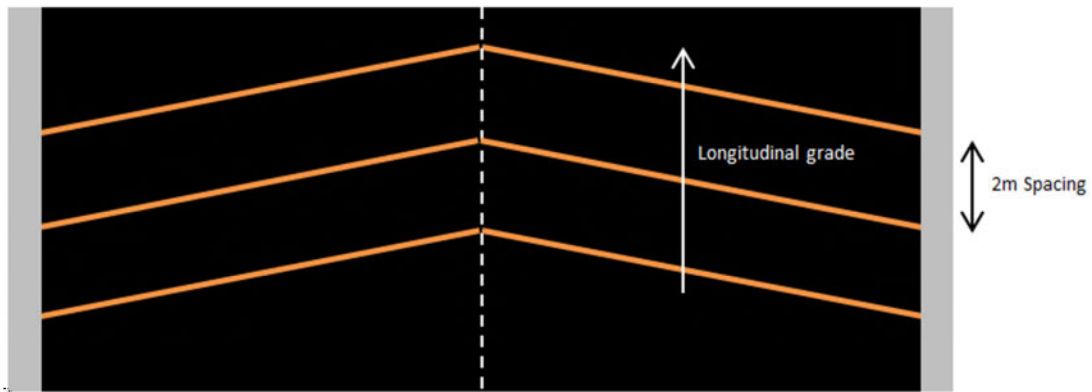
ACT Geotechnical Engineers Pty Ltd

C11493

FIGURE 5



Section



Plan

**ROADS ACT  
TARRA PLACE, NGUNNAWAL  
HERRING BONE SUBSOIL DRAINS**

ACT Geotechnical Engineers Pty Ltd

C11493

FIGURE 6

# Borehole Log

Borehole No.	<b>BH01</b>
Sheet	1 of 1
Job No.	C11493
Location	: See Report
Collar Level	: Not Known
Angle From Vertical	: 0°
Bearing	: N.A.

CLIENT:	Roads ACT
PROJECT	Pavement Failure Investigation Tarra Place, Ngunnawal, ACT
Equipment Type	: EZ36
Hole Diameter	: 300mm

Samples	Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure <small>Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure</small>	Consistency or Relative Density	Field Test Results		Geological Profile
							DCP	Dynamic Cone Penetrometer Test Results in Blows per 100mm	
		0.12			ASPHALT		1	Dynamic Cone Penetrometer Test Results in Blows per 100mm	PAVEMENT
				SP	ROADBASE Gravelly SAND; fine to coarse sand, grey, fine gravel, moist.	Very loose	0		
							0		
		0.32		CH	Sandy Silty CLAY; medium to high plasticity clay, grey-brown, fine to coarse sand, approximately at the liquid limit. On the north-east side from 0.32m to 0.7m FILL Gravelly SAND; fine to coarse sand, fine to medium sub angular gravel, with cobbles of siltstone, wet.	Very soft	0		
							0		
							0		
							0		
							0		
							0		
							5		
		1.0		CL	Sandy CLAY; low to medium plasticity clay, light brown, colour becomes light grey at 1.5m, fine sand, moist less than plastic limit. Slight sheen on water.	Very stiff to hard	8		
							7		
							13		
							12		
							13		
							16		
							19		
		1.7			BOREHOLE TERMINATED AT 1.7m		16		
							18		
		2.0							

Water Seepage

Water Seepage

SWL after 45 minutes

BOREHOLE/EXCAVATION LOG C11493 - LOG.GPJ ACT GEO.GDT 2/2/21

Logged By : MT	Date : 2/2/21	Checked By : JM	Date : 3/2/21
----------------	---------------	-----------------	---------------

# Borehole Log

Borehole No.	<b>BH02</b>
Sheet	1 of 1
Job No.	C11493
Location	: See Report
Collar Level	: Not Known
Angle From Vertical	: 0°
Bearing	: N.A.

CLIENT:	Roads ACT
PROJECT	Pavement Failure Investigation Tarra Place, Ngunnawal, ACT
Equipment Type	: EZ36
Hole Diameter	: 300mm

Samples	Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure <small>Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure</small>	Consistency or Relative Density	Field Test Results		Geological Profile	
							DCP	Dynamic Cone Penetrometer Test Results in Blows per 100mm		
		0.05		SP	ASPHALT				PAVEMENT	
					ROADBASE Gravelly SAND; fine to coarse sand, grey, fine gravel, moist.					
		0.32		CL	Gravelly Silty CLAY; low plasticity clay, brown, fine to coarse sub angular siltstone gravel, moist approximately at plastic limit.	Very stiff	15	Dynamic Cone Penetrometer Test Results in Blows per 100mm	FLL	
							9			
							7			
		0.6		CL	Sandy CLAY; low to medium plasticity clay, grey-brown, fine to medium sand, moist less than plastic limit.	Very stiff to hard	13			RES DUAL
							8			
							9			
		1.0					15			
							17			
							17			
							16			
							23			
		1.5			SILTSTONE; moderately weathered, grey.				BEDROCK	
		1.8								
					BOREHOLE TERM NATED AT 1.8m REFUSAL					
		2.0								

BOREHOLE/EXCAVATION LOG C11493 - LOG.GPJ ACT GEO.GDT 2/2/21

Logged By : MT	Date : 2/2/21	Checked By : JM	Date : 3/2/21
----------------	---------------	-----------------	---------------

# Material Test Report

**Report Number:** CP21436-1  
**Issue Number:** 1  
**Date Issued:** 11/02/2021  
**Client:** ACT Geotechnical Engineers Pty Ltd  
 Unit 5/9 Beaconsfield St, Fyshwick ACT 2609

**Contact:** [REDACTED]  
**Project Number:** CP21436  
**Project Name:** Site Investigation  
**Project Location:** Tarra Place Ngunnawal ACT  
**Client Reference:** [REDACTED]  
**Work Request:** 1946  
**Sample Number:** CS1946A  
**Date Sampled:** 02/02/2021  
**Dates Tested:** 02/02/2021 - 04/02/2021  
**Sampling Method:** Sampled by Client

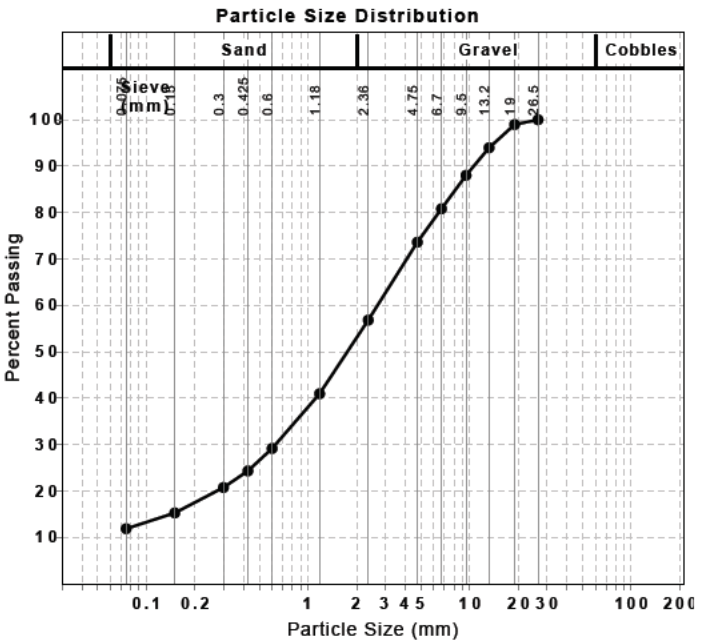
*The results apply to the sample as received*

**Preparation Method:** AS 1289.1.1 - Sampling and preparation of soils  
**Site Selection:** Selected by Local Authority  
**Sample Location:** BH2, Depth: 0.1-0.3m

Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
26.5 mm	100	
19 mm	99	
13.2 mm	94	
9.5 mm	88	
6.7 mm	81	
4.75 mm	74	
2.36 mm	57	
1.18 mm	41	
0.6 mm	29	
0.425 mm	24	
0.3 mm	21	
0.15 mm	15	
0.075 mm	12	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	17		
Plastic Limit (%)	12		
<b>Plasticity Index (%)</b>	<b>5</b>		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	2.5		
Cracking Crumbling Curling	Cracking		



# Material Test Report

**Report Number:** CP21436-1  
**Issue Number:** 1  
**Date Issued:** 11/02/2021  
**Client:** ACT Geotechnical Engineers Pty Ltd  
 Unit 5/9 Beaconsfield St, Fyshwick ACT 2609

**Contact:** [REDACTED]  
**Project Number:** CP21436  
**Project Name:** Site Investigation  
**Project Location:** Tarra Place Ngunnawal ACT  
**Client Reference:** C11493  
**Work Request:** 1946  
**Sample Number:** CS1946B  
**Date Sampled:** 02/02/2021  
**Dates Tested:** 02/02/2021 - 10/02/2021  
**Sampling Method:** Sampled by Client

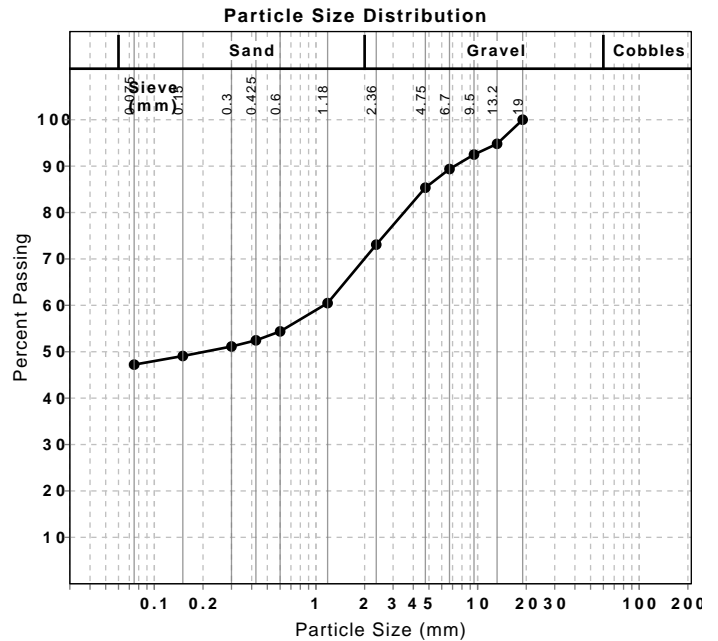
*The results apply to the sample as received*

**Preparation Method:** AS 1289.1.1 - Sampling and preparation of soils  
**Site Selection:** Selected by Local Authority  
**Sample Location:** BH1, Depth: 0.4-0.8m

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	16		
Method of Compactive Effort	Modified		
Method used to Determine MDD	AS 1289 5.2.1 & 2.1.1		
Method used to Determine Plasticity	visual		
Maximum Dry Density (t/m <sup>3</sup> )	2.08		
Optimum Moisture Content (%)	11.5		
Laboratory Density Ratio (%)	95.5		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m <sup>3</sup> )	1.96		
Field Moisture Content (%)	19.3		
Moisture Content at Placement (%)	11.5		
Moisture Content Top 30mm (%)	15.0		
Moisture Content Rest of Sample (%)	13.1		
Mass Surcharge (kg)	9.0		
Soaking Period (days)	4		
Curing Hours	24.2		
Swell (%)	1.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	25		
Plastic Limit (%)	17		
<b>Plasticity Index (%)</b>	<b>8</b>		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	4.0		
Cracking Crumbling Curling	Cracking		



Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	95	
9.5 mm	92	
6.7 mm	89	
4.75 mm	85	
2.36 mm	73	
1.18 mm	60	
0.6 mm	54	
0.425 mm	52	
0.3 mm	51	
0.15 mm	49	
0.075 mm	47	

## DESCRIPTION AND CLASSIFICATION OF SOILS

The methods of description and classification of soils used in this report are based on the Australian Standard 1726 – 1993, Geotechnical site investigations. In general, descriptions cover the following properties – soil type, colour, secondary grain size, structure, inclusions, strength or density and geological description.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (e.g. sandy clay) on the following basis:

Classification	Particle Size
Clay	Less than 0.002mm
Silt	0.002mm to 0.06mm
Sand	0.06mm to 2.00mm
Gravel	2.00mm to 60.00mm
Cobbles	60mm (63mm) to 200mm
Boulders	>200mm

Soils are also classified according to the Unified Soil Classifications System which is included in this Appendix. Rock types are classified by their geological names.

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The terms are defined as follows:

Consistency	Shear Strength $s_u$ (kPa) (Representative Undrained Shear)	
	Very soft	< 12
Soft	12 - 25	2-4
Firm	25 - 50	4-8
Stiff	50 – 100	8-15
Very Stiff	100 – 200	15-30
Hard	> 200	>30

Non-cohesive soils are classified on the basis of relative density, generally from the results of in-situ standard penetration tests as below:

Term	Relative Density (%)	SPT Blows/300mm 'N'
Very loose	< 15	<4
Loose	15-35	4-10
Medium dense	35-65	10-30
Dense	65-85	30-50
Very Dense	>85	>50

## SAMPLING

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are generally taken by one of two methods:

1. Driving or pushing a thin walled sample tube into the soil and withdrawing with a sample of soil in a relatively undisturbed state.
2. Core drilling using a retractable inner tube (R.I.T.) core barrel.

Such samples yield information on structure and strength in additions to that obtained from disturbed samples and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

## PENETRATION TESTING

The relative density of non-cohesive soils is generally assessed by in-situ penetration tests, the most common of which is the standard penetration test. The test procedure is described in Australian Standard 1289 "Testing Soils for Engineering Purposes" Testing Soils for Engineering Purposes" – Test No. F3.1.

The standard penetration test is carried out by driving a 50mm diameter split tube penetrometer of standard dimensions under the impact of a 63 kg hammer having a free fall of 750mm.

The "N" value is determined as the number of blows to achieve 300mm of penetration (generally after disregarding the first 150mm penetration through possibly disturbed material). The results of these tests can be related empirically to the engineering properties of the soil.

The test is also used to provide useful information in cohesive soils under certain conditions, a good quality disturbed sample being recovered with each test. Other forms of in situ testing are used under certain conditions and where this occurs, details are given in the report.

## DEFINITIONS OF ROCK, SOIL, AND DEGREES OF CHEMICAL WEATHERING

### GENERAL DEFINITIONS – ROCK AND SOIL

**ROCK** In engineering usage, rock is a natural aggregate of minerals connected by strong and permanent cohesive forces.

Note: Since “strong” and “permanent” are subject to different interpretations, the boundary between rock and soil is necessarily an arbitrary one.

**SOIL** In engineering usage, soil is a natural aggregate of mineral grains which can be separated by such gentle mechanical means as agitation in water, can be remoulded and can be classified according to the Unified Soil Classification System. Three principal classes of soil recognized are:

**Residual soils:** soils which have been formed in-situ by the chemical weathering of parent rock. Residual soil may retain evidence of the original rock texture or fabric or, when mature, the original rock texture may be destroyed.

**Transported soils:** soils which have been moved from their places of origin and deposited elsewhere. The principal agents of erosion, transport and deposition are water, wind and gravity. Two important types of transported soil in engineering geology and materials investigations are:

**Colluvium** – a soil, often including angular rock fragments and boulders, which has been transported downslope predominantly under the action of gravity assisted by water. The principle forming process is that of soil creep in which the soil moves after it has been weakened by saturation. It may be water borne for short distances.

**Alluvium** – a soil which has been transported and deposited by running water. The larger particles (sand and gravel size) are water worn.

**Lateritic soils:** soils which have formed in situ under the effects of tropical weathering include all reddish residual and non residual soils which genetically form a chain of material ranging from decomposed rock through clay to sesqui-oxide rich crusts. The term does not necessarily imply any compositional, textural or morphological definition; all distinctions useful for engineering purposes are based on the differences in geotechnical characteristics.

### ROCK WEATHERING DEFINITIONS

Extremely Weathered (EW)	Rock substance affected by weathering to the extent that the rock exhibits soil properties, i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered (HW)	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of the chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered (MW)	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Slightly Weathered (SW)	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance, usually by limonite, has taken place. The colour and texture of the fresh rock is recognisable.
Fresh (Fr)	Rock substance unaffected by weathering.

The degrees of rock weathering may be gradational. Intermediate stages are described by dual symbols with the prominent degree of weathering first (e.g. EW-HW).

The various degrees of weathering do not necessarily define strength parameters as some rocks are weak, even when fresh, to the extent that they can be broken by hand across the fabric, and some rocks may increase in strength during the weathering process.

Fresh drill cores of some rock types, such as basalt and shale may disintegrate after exposure to the atmosphere due to slaking, desiccation, expansion or contraction, stress relief or a combination of any of these factors.

## AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS

This classification system provides a standardised terminology for the engineering description of the sandstone and shales in the Sydney area, but the terms and definitions may be used elsewhere when applicable. Where other rock types are encountered, such as in dykes, standard geological descriptions are used for rock types and the same descriptions as below are used for strength, fracturing and weathering.

Under this system rocks are classified by Rock Type, Strength, Stratification Spacing, Degree of Fracturing and Degree of Weathering. These terms do not cover the full range of engineering properties. Descriptions of rock may also need to refer to other properties (e.g. durability, abrasiveness, etc) where these are relevant.

## ROCK TYPE DEFINITIONS

ROCK TYPE	DEFINITION
Conglomerate:	More than 50% of the rock consists of gravel sized (greater than 2mm) fragments.
Sandstone:	More than 50% of the rock consists of sand sized (0.06 to 2mm) grains.
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06mm) granular particles and the rock is not laminated.
Claystone:	More than 50% of the rock consists of silt or clay sized particles and the rock is not laminated.
Shale:	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated.

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g. clayey sandstone, sandy shale.

## STRATIFICATION SPACING

Term	Separation of Stratification Planes
Thinly Laminated	< 6mm
Laminated	6mm to 20mm
Very thinly bedded	20mm to 60mm
Thinly bedded	60mm to 0.2m
Medium bedded	0.2m to 0.6m
Thickly bedded	0.6m to 2m
Very thickly bedded	> 2m

## DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude known artificial fractures such as drilling breaks.

Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20mm, and mostly of width less than the core diameter
Highly Fractured:	Core lengths are generally less than 20mm – 40mm with occasional fragments.
Fractured:	Core lengths are mainly 30mm – 100mm with occasional shorter and longer section.
Slightly Fractured:	Core lengths are generally 300mm – 1000mm with occasional longer sections and occasional sections of 100mm – 300mm.
Unbroken:	The core does not contain any fracture.

## ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Society of Rock Mechanics.

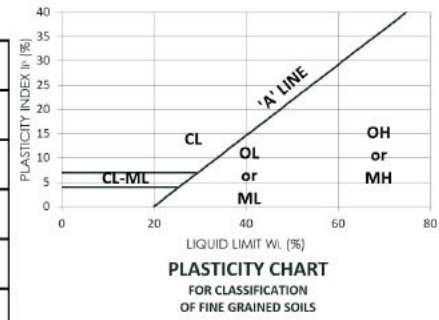
Term	Point Load Index Is(50) MPa	Field Guide	Approx qu MPa*
Extremely Weak:	0.03	Easily remoulded by hand to a material with soil properties.	0.7
Very Weak:	0.1	May be crumbled in the hand. Sandstone is “sugary” and friable.	2.4
Weak:	0.3	A piece of core 150mm long x 50mm dia. May be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	7
Medium Strong:	1	A piece of core 150mm long x 50mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.	24
Strong: (SW)	3	A piece of core 150mm long x 50mm dia. core cannot be broken by unaided hands, can be slightly scratched or scored with knife.	70
Very Strong (SW)	10	A piece of core 150mm long x 50mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.	240
Extremely Strong (Fr)	>10	A piece of core 150mm long x 50mm dia. is difficult to break with hand held hammer. Rings when struck with a hammer.	>240

The approximate unconfined compressive strength (qu) shown in the table is based on an assumed ratio to the point load index of 24:1. This ratio may vary widely.

## Unified Soil Classification System (Metricated)

### Data for Description Identification and Classification of Soils

MAJOR DIVISIONS	DESCRIPTION				FIELD IDENTIFICATION				LABORATORY CLASSIFICATION							
	Group Symbol	Graphic Symbol	TYPICAL NAME	DESCRIPTIVE DATA	GRAVELS AND SANDS			Group Symbol	% (Z) < 0.06mm	PLASTICITY OF FINE FRACTION			NOTES			
					GRADATIONS	NATURE OF FINES	DRY STRENGTH									
COARSE GRAINED SOILS	More than 50% by dry mass less than 60mm & greater than 0.06mm.	GRAVELS SOILS	GW	Well graded gravels and gravel-sand mixtures little or no fines	Give typical name indicate approximate percentages of sand and gravel maximum size angularity surface condition and hardness of the coarse grains local or geological name and other pertinent descriptive information symbols in parenthesis.	GOOD	Wide range in grain size	Clean materials (not enough fines to band coarse grains)	None	GW	0-5	-	>4	Between 1 and 3	1. Identify Fines by the method given for fine grained soils. 2. Borderline classifications occur when the percentage of fines (fraction smaller than 0.06mm size) is greater than 5% and less than 12%. Borderline classifications require the use of dual symbols eg SP-SM GW-GC	
			GP	Poorly graded gravels and gravel-sand mixtures little or no fines		POOR	Predominantly one size or range of sizes				GM	12-50	-	-		-
		GRAVELLY SOILS	GM	Silty gravels gravel-sand-silt mixtures	For undisturbed soils add information on stratification degree of compactness cementation moisture conditions and drainage characteristics.  EXAMPLE Silty Sand gravelly about 20% hard angular gravel particles 10mm maximum size rounded and sub angular sand grains coarse to fine about 15% non-plastic fines with low dry strength well compacted and moist in place light brown alluvial sand (SM)	GOOD TO FAIR	Dirty materials (Excess of fines)	None to medium	GM	12-50						
			GC	Clayey gravels gravel-sand-clay mixtures		GOOD	Wide range in grain size				SW	0-5	-	-		-
	SANDY SOILS	SANDS	SW	Well graded sands and gravelly sands little or no fines	EXAMPLE Silty Sand gravelly about 20% hard angular gravel particles 10mm maximum size rounded and sub angular sand grains coarse to fine about 15% non-plastic fines with low dry strength well compacted and moist in place light brown alluvial sand (SM)	GOOD	Wide range in grain size	Clean materials (not enough fines to band coarse grains)	None	SW						
			SP	Poorly graded sands and gravelly sands little or no fines		POOR	Predominantly one size or range of sizes				SM	12-50	-	-		-
		SANDY SOILS	SANDY SOILS	SM	Silty sand sand-silt mixtures	EXAMPLE Silty Sand gravelly about 20% hard angular gravel particles 10mm maximum size rounded and sub angular sand grains coarse to fine about 15% non-plastic fines with low dry strength well compacted and moist in place light brown alluvial sand (SM)	GOOD TO FAIR	Dirty materials (Excess of fines)	None to medium	SM						
				SC	Clayey sands sand-clay mixtures		GOOD TO FAIR	Dirty materials (Excess of fines)			None to medium	SC	12-50	-		-
			SILT AND CLAY FRACTION													
			Fraction smaller than 0.20mm AS sieve size													
FINE GRAINED SOILS	More than 50% by dry mass less than 60mm in less than 0.06mm	Liquid limit less than 50%	ML	Inorganic silts very fine sands rock flour silty or clayey fine sands.	Give typical name indicate degree and character of plasticity amount and maximum size of coarse grains colour in wet condition odour if any local or geological name and other pertinent descriptive information symbols in parenthesis.	None to low	Quick to slow	None	ML	Below 'A' line	5	-	-	-	Use the gradation curve of material passing 60mm for classification of fractions according to criteria given under Major Division.	
																CL
			OL	Organic silts and organic silty clays of low plasticity	For undisturbed soil add information on structure stratification consistency undisturbed and remoulded states moisture and drainage conditions.  EXAMPLE Clayey Silt brown low plasticity small percentage of fine sand numerous vertical root-holes firm and dry in place fill (ML).	Low to medium	Slow	Low	OL	Below 'A' line	10	-	-	-		-
			CH	Inorganic clays of high plasticity fat clays.	EXAMPLE Clayey Silt brown low plasticity small percentage of fine sand numerous vertical root-holes firm and dry in place fill (ML).	High to very high	None	High	CH	Above 'A' line	15	-	-	-		-
			PI	Peat muck and other highly organic soils.	Readily identified by colour odour spongy feel and generally by fibrous texture	PI*	*Effervescence with H2O2									



## **Limitations in the Use and Interpretation of this Geotechnical Report**

Our Professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

The geotechnical report was prepared for the use of the Owner in the design of the subject development and should be made available to potential contractors and/or the Contractor for information on factual data only. This report should not be used for contractual purposes as a warranty of interpreted subsurface conditions such as those indicated by the interpretive borehole and test pit logs, cross-sections, or discussion of subsurface conditions contained herein.

The analyses, conclusions and recommendations contained in the report are based on site conditions as they presently exist and assume that the exploratory bore holes, test pits, and/or probes are representative of the subsurface conditions of the site. If, during construction, subsurface conditions are found which are significantly different from those observed in the exploratory bore holes and test pits, or assumed to exist in the excavations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between conducting this investigation and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, this report should be reviewed to determine the applicability of the conclusions and the recommendations considering the changed conditions and time lapse.

The summary bore hole and test pit logs are our opinion of the subsurface conditions revealed by periodic sampling of the ground as the test holes progressed. The soil descriptions and interfaces between strata are interpretive and actual changes may be gradual.

The bore hole and test pit logs and related information depict subsurface conditions only at the specific locations and at the particular time designated on the logs. Soil conditions at the other locations may differ from conditions occurring at these bore hole and test pit locations. Also, the passage of time may result in a change in the soil conditions at these test locations.

Groundwater levels often vary seasonally. Groundwater levels reported on the boring logs or in the body of the report are factual data only for the dates shown.

Unanticipated soil conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking soil samples, bore holes or test pits. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. It is recommended that the Owner consider providing a contingency fund to accommodate such potential extra costs.

This firm cannot be responsible for any deviation from the intent of this report including, but not restricted to, any changes to the scheduled time of construction, the nature of the project or the specific construction methods or means indicated in this report: nor can our company be responsible for any construction activity on sites other than the specific site referred to in this report.