martens
consulting engineers since 1989

| | | |
|---|---|---|
| Posted | | |
| Faxed | | |
| Emailed | X | karla@richardcolearchitecture.com.au |
| Courier | | |
| By Hand | | |
| Contact: | | Gray Taylor |
| Our Ref: | | P1907237JC02V01 |
| Pages: | | 2 + 3 Attachment |
| cc. | | - |

22 July, 2019

Richard Cole Architecture
Karla Wilford
By email

Dear Karla,

**RE: DEVELOPMENT APPLICATION- GEOTECHNICAL ADVICE: ALTERATIONS AND ADDITIONS AT 13 BRUCE ST, WARRIEWOOD, NSW**

## 1.0 INTRODUCTION

This letter summarises the results of a review of previous geotechnical investigations at the site, review of proposed development plans and a site inspection to provide geotechnical advice for the proposed DA application.

We have reviewed the development application plans by Richard Cole Architecture (Project No. 1803 dated February 2019) for the proposed alterations and additions to the existing dwelling at the site.

We understand that the proposed works include the extension of the lower ground level, an additional level consisting of a study and internal works. We note that there are no modifications to the existing footprint (i.e. roof area) of the dwelling.

## 2.0 PREVIOUS WORKS

A previous geotechnical investigation was conducted by Martens and Associates (REF: P0601550JR01V01, 2008) as part of a previous development application for the proposed dwelling. The geotechnical assessment was undertaken in accordance with Pittwater Council's Interim Geotechnical Risk Management Policy (June 2003) to assess a range of issues most notably site stability; the strength of soil materials; excavation requirements; footing and foundation design; site risk assessment; and construction management. The geotechnical recommendations within P061550JR01V01 were again confirmed by Martens and Associates (REF: P1404185JC01V01) in 2014 as part of a Section 96 application for the excavation of the lower ground level. Refer to Attachment A and B for details.

## 3.0 SITE INSPECTION

A site inspection by a senior engineer from Martens and Associates was undertaken on the 5th June, 2019 to visually assess the existing condition of the dwelling foundations, the area of the proposed excavation required as part of the lower ground floor level excavation and the existing stormwater system.



**Head Office**
Suite 201, Level 2, 20 George Street
Hornsby NSW 2077, Australia
**Ph** 02 9476 9999 **Fax** 02 9476 8767

> mail@martens.com.au
www.martens.com.au
MARTENS & ASSOCIATES P/L
ABN 85 070 240 890 ACN 070 240 890

The following geotechnical observations were made during the site inspection:

- The existing piers appeared to be stable showing no signs of movement.
- The approximate area of excavation (as marked on the plan in Attachment C) is to be excavated up to 1.0m deep. Based on the site inspection, the material is likely to be clay soil with some floaters. Several piers will need to be removed.

## 4.0 RECOMMENDATIONS

With regards to the lower ground floor excavation, due care is to be taken to ensure excavation works do not undermine any existing footings. Where the excavation cannot be excavated with a temporary batter slope of 1(V):2(H) without undermining any existing footings, shoring is to be utilised during excavation with the post excavation support provided by an engineered retaining wall and/or new pier.

## 5.0 CONCLUSION

Based on our site inspection and review of all associated information, we confirm that our geotechnical recommendations within our previous geotechnical assessment report (REF P0601550JR01V01, 2008) and confirmation letter (REF: P1404185JC01V01, 2014) are applicable to the proposed development and no further geotechnical risk assessment is required.

If you require any further information, please do not hesitate to contact the writer.

**For and on behalf of**

**MARTENS & ASSOCIATES PTY LTD**

**GRAY TAYLOR**

BE Engineering

Senior Engineer / Project Manager

Attachments:

1. Geotechnical Assessment Report (REF P0601550JR01V01, 2008)
2. Geotechnical Recommendation Letter (REF P1404185JC01V01, 2014)
3. Approximate Area of Excavation

## Attachment A – Geotechnical Assessment Report (REF P0601550JR01V01, 2008)

Michael King

# Geotechnical and Stormwater Assessment: 13 Bruce Street, Warriewood, NSW

P0601550JR01_v1
January 2008

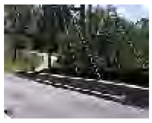
ENVIRONMENTAL

WATER

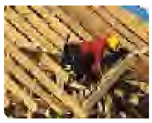
WASTEWATER

GEOTECHNICAL

CIVIL



PROJECT MANAGEMENT



**Limitations Statement**

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to provide a geotechnical and stormwater assessment in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and Michael King (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which may include for example site inspections, correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Martens & Associates Pty Ltd may have relied upon and presumed accurate certain information (or absence thereof) relative to the site. Except as otherwise stated in the report, Martens & Associates Pty Ltd has not attempted to verify the accuracy of completeness of any such information (including for example survey data supplied by others).

The findings, observations and conclusions expressed by Martens & Associates Pty Ltd in this report are not, and should not be considered an opinion concerning the completeness and accuracy of information supplied by others. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings and conclusions are based solely upon site conditions, information and drawings supplied by the Client *etc*. in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Martens & Associates Pty Ltd and the Client. Martens & Associates Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

**Head Office**
Unit 6/37 Leighton Place
Hornsby, 2077, NSW
ACN 070 240 890 ABN 85 070 240 890
**Phone: +61-2-9476 8777**
Fax: +61-2-9476 8767
Email: mail@martens.com.au
Web: www.martens.com.au

**Document and Distribution Status**

| Author(s) | Reviewer(s) | Project Manager | Signature |
|---|---|---|---|
| Mr Gray Taylor | Mr Andrew Norris<br>Dr Daniel Martens | Mr Andrew Norris | |

| Revision No. | Status | Release Date | Document Location | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | File Copy | MA Library | Michael King | Jim Koopman | - | - |
| 1 | Draft | 24/01/08 | 1H, 1P, 1E | - | 1P | 1P | - | - |
| 2 | Final | 31/01/08 | 1H, 1P, 1E | 1H | 1P | 1P | | |
| | | | | | | | | |

Distribution Types: F = Fax, H = hard copy, P = PDF document, E = Other electronic format. Digits indicate number of document copies.

**All enquiries regarding this project are to be directed to the Project Manager.**

# Contents

# 1 Overview

## 1.1 Background

The purpose of this report is to provide a revised geotechnical and stormwater assessment to support a development application (DA) for proposed dwelling modifications at 13 Bruce Street, Warriewood, NSW. The assessment for the alterations determines geotechnical parameters for structural design and geotechnical risk for the proposed development and stormwater and OSD design based on observed site, soil and environmental conditions.

The geotechnical assessment contained in this report has been undertaken in accordance with Pittwater Council's *Interim Geotechnical Risk Management Policy* (June 2003). A range of issues have been reviewed as part of this study, most notably site stability, strength of soil materials, nature of rock, likely requirements for excavations, footings and foundations and site risk assessment and management. The geotechnical assessment is in accordance with AS1726 (1993) and AS1289.F3.2 (1984).

The stormwater aspects of this report have been prepared in accordance with Pittwater Council's *Pittwater 21 Development Control Plan* (December 2003) *Section B5 Water Management*. As part of this study existing site stormwater drainage infrastructure been reviewed, as well as soil type, local catchment, surrounding lands and relevant features of the proposed development.

This report has been prepared in conjunction with Martens and Associates previous report geotechnical and stormwater assessment report REF:P0400994JR01_v1.

## 1.2 Proposed Development

It is our understanding that the development proposal includes the following:

- External works: It is proposed to remove the existing 'Weldmesh' boundary fence and one tree within the boundaries of the site. A new concrete entry path is to be constructed from Bruce Street to a new side entry position. New lap pool in the south eastern corner and site landscaping.

- Lower Ground Floor Level: New external opening is proposed to convert the existing storage area to habitable space.

- Garage: Extension to existing garage.

The development will also include cut and fill earthworks and several retaining walls. A site plan showing the proposed dwelling modifications is provided in the 'plan set' Attachment A with locations of geotechnical and stormwater related testing.

# 2 Site Description

## 2.1 Field Investigations

Field investigations were undertaken on the 24th September 2004, 16th October 2006, 12th October 2007 and 15th January 2008 and included the following:

- Walkover inspection of the site to assess existing site conditions and determine any geotechnical hazards that have potential to impact on the proposed development and or neighbouring properties.
- Inspection of the conditions of structures such as foundations, pavements and buildings.
- Penetration testing at five locations to determine depth to rock and estimates of preliminary soil strength properties in accordance with AS 1289.6.3.2 (1997).
- Inspection of soil exposures on the site and in the local area to determine the nature of sub-surface materials.
- Inspection of works already undertaken including removal of chimney, new concrete and metal piers and repairs made to existing retaining walls.
- Excavation of two test pits using a spade to allow for the characterisation of underlying soils and geology.

DCP and test pit locations can be found in Sheet 2 of the 'plan set'. Test pit logs are provided in Attachment B.

## 2.2 Location and Existing Land-use

The allotment is located on a west-east aligned hill-slope overlooking Warriewood Beach. The allotment is approximately rectangular in shape, with street frontage to Bruce Street (western boundary). The eastern boundary adjoins the public foreshore reserve on a steep, heavily vegetated slope rising up from Warriewood Beach. Residential properties adjoin the site to the north and south. The allotment encloses a total area of approximately 526 m$^2$.

The site is presently occupied by a predominantly timber weatherboard cottage with a tiled roof located in the centre of the allotment (Figure 1). A brick and weatherboard garage is located in the north-western corner. Both the cottage and garage are founded on brick piers. Other prominent site features include a concrete paved area and stairs on the western side of the cottage, a concrete footpath and stairs on the southern side, one large and one medium-sized palm tree in the front yard and a large Norfolk pine in the north-east corner.

*Figure 1:* Existing allotment showing front of weatherboard cottage and palm tree to the front of the dwelling. Photograph taken looking south-west

## 2.3 Condition of Existing Site Structures

On the 16th October 2006 and 15th January 2008 a site inspection was made of the existing dwelling and associated site structures including the repairing of retaining walls, pavements and drainage measures. The following observations were made:

- There were no visible signs of soil erosion, movement or slope failure evident on undeveloped ground surfaces.
- New brick and metal piers supporting the cottage were generally in serviceable condition as shown in Attachment C Plates 4, 5 and 6.
- Concrete pathway at the front of the cottage has been removed.
- New brick piers supporting the garage showed no signs of movement and all retaining walls were repaired and in serviceable condition (Attachment C Plates 1 and 2).
- The rear and side brick walls enclosing the lower ground floor of the cottage had been repaired and showed no signs of displacement or cracking (Plate 3).

- Preliminary drainage measures for the cottage, garage and proposed paved areas appeared to be functioning adequately.

### 2.4 Site Geological and Topographic Setting

Reference to the Sydney Soil Landscape Series Sheet 9130 (1989) describes the bedrock geology for the soil landscape at the site as the Narrabeen Group of sediments comprising sandstone with occasional layers of shale and siltstone (Chapman *et al.*, 1989).

The study site presented few opportunities to inspect *in-situ* bedrock due to a lack of outcrops or scarps within the allotment. Exposures of sandstone, shale and siltstone are evident on nearby coastal cliffs to the north and south of the site. The type and strength of bedrock was unable to be determined through site inspection, however it is expected to comprise varying thickness layers of interbedded sandstone, siltstone and shale.

Site elevation rises from approximately 23 mAHD adjacent to the eastern boundary to approximately 29 mAHD along Bruce Street. The grade within the allotment is approximately 21 % in the vicinity of the existing cottage and rear yard, rising to 30 % in the front yard area between the dwelling and Bruce Street.

### 2.5 Soil Profile and Depth to Bedrock

An exposed soil profile in the road embankment upslope of the site was inspected. The profile consisted of silty fine sands and sandy clays. No exposed soil profiles were evident on the site. Surface soils comprised silty fine sands at the front of the cottage and sandy clay in the cottage sub-floor area.

The rear of the cottage (eastern portion of the site) contains temporary clay fill approximately 0.4m to 0.6m in depth overlying natural clays in the vicinity of the proposed lap pool.

*Table 1*: Summary of *in situ* ground conditions on eastern portion of site based on two test pits and three DCP tests.

| **Depth** | **Classification** | **Description** |
|---|---|---|
| 0 – 0.4/0.6 | CL/FILL | CLAY FILL – dark brown, gravels/builders rubble approximately 10% |
| 0.4/0.6 – 1.8 | CL | CLAY – orange brown, medium grained sands (20%), with sandstone floaters (50 – 100mm, approx 15%), moist, stiff. |
| > 1.8 | EW | Extremely weathered grading to moderately weathered sandstone. |

DCP investigations indicate that the depth to bedrock is approximately 1.70 – 2.00 m towards the front of the site, 2.80 – 3.00 m at the centre and 1.80 – 2.00 m towards the rear. DCP's 3, 4 and 5 were conducted within or close to the proposed lap pool, and provide a consistent indication that the depth to bedrock in this area is between 1.8 – 2.0 m b.g.l.

*Table 2:* Summary of DCP N-Counts

| **Depth (m)** | **DCP "n" Counts** | | | | |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** |
| 0.15 | 4 | 2 | 3 | 3 | 3 |
| 0.3 | 6 | 5 | 8 | 4 | 7 |
| 0.45 | 6 | 5 | 5 | 4 | 4 |
| 0.6 | 5 | 4 | 6 | 4 | 7 |
| 0.75 | 6 | 5 | 5 | 4 | 8 |
| 0.9 | 5 | 5 | 5 | 3 | 6 |
| 1.05 | 4 | 5 | 5 | 4 | 6 |
| 1.2 | 4 | 8 | 10 | 6 | 6 |
| 1.35 | 5 | 10 | 25 | 10 | 8 |
| 1.5 | 16 | 10 | 25 | 15 | 8 |
| 1.65 | 15 | 8 | 25 | 26 | 10 |
| 1.8 | ***1.70***[1] | 18 | 45 | 28 | 10 |
| 1.95 | | 18 | ***1.80***[1] | 36 | 12 |
| 2.10 | | 17 | | 46 | 36 |
| 2.25 | | 21 | | ***2.12***[1] | 48 |
| 2.4 | | 15 | | | ***2.26***[1] |
| 2.55 | | 15 | | | |
| 2.7 | | 27 | | | |
| 2.85 | | ***2.80***[1] | | | |

NOTES: [1] DCP termination depth(m).

Soil strength properties were estimated using *in-situ* testing results and are summarised in Table 3.

*Table 3:* Summary of estimated soil strength parameters.

| Depth (m) | Estimate of Dry Unit Weight (kN/m³) | $C_u$[1] | Preliminary Allowable Bearing Capacity[2] (kPa) |
|---|---|---|---|
| 0.5 – 1.0 | 16 | 35 | 80 |
| 1.0 – 1.8 | 20 | 60 | 120 |
| > 1.8 | 22 | 100 | 200 |

Note: [1] Undrained shear strength. [2] Assuming square footing with $D_f/B < 0.5$.

Locations of the DCP and borehole test sites are provided on the site plan in Attachment A. Full borehole logs are provided as Attachment B.

## 2.6 Site Drainage

No natural streams or drainage easements were noted to cross the allotment. The piped roof drainage and overland flow path from the allotment discharge to the public foreshore reserve to the east.

Natural soil materials at the allotment were observed to be highly permeable suggesting that little runoff would occur from pervious surfaces except during moderate to high intensity and/or extended duration rainfall events.

## 2.7 Site Vegetation Coverage

The site yard areas to the front and rear of the existing cottage maintain an established cover of grass and herbaceous weedy species. Several large trees were also noted within the allotment, both up- and down-slope of the existing dwelling. Inspection of the mature trees at the site showed no evidence of significant soil creep or gross slope instability.

## 2.8 Groundwater

Given the elevated topography of the allotment and surrounding area, as well as the close proximity to Warriewood Beach, we consider it reasonable to suggest that permanent groundwater levels are expected to be in excess of 5 m below the existing ground level. Temporary groundwater above the bedrock is likely to be limited to a thin layer of flow at the soil/bedrock interface. Further investigations would be required to confirm accurate groundwater depth.

## 2.9 Site Stability

New brick piers supporting the existing garage show no signs of movement or structural damage (Plates 1 and 2).

It was noted that on recent site investigations (October 2006 and 2007) that the new brick and steel piers beneath the cottage showed no signs of movement. Major external foundations and brick walls are in reasonable condition, exhibiting no significant signs of movement or failure.

# 3 Geotechnical Assessment

## 3.1 Geotechnical Risk Management Guidelines

The geotechnical risk assessment for the proposed development has been conducted in accordance with the principles outlined in Pittwater Council's (2003) Interim Geotechnical Risk Management Policy. The assessment uses qualitative risk analysis matrices in Appendix A of the Council's (2003) Interim Geotechnical Risk Management Policy to determine the level of risk to life and property arising from the proposed development.

### *3.1.1 Pittwater Council Interim Geotechnical Risk Management Policy Objectives*

The objectives of the Council's (2003) Interim Geotechnical Risk Management Policy relevant to the proposed development include assurances of the following:

- That geotechnical and related structural matters are adequately investigated and documented by applicants or proponents of activities, prior to the lodgement of any development application or Part V activities to carry out any development subject to the guidelines.
- Establishment of whether or not the proposed development activity is appropriate to be carried out, and the conditions that should be applied if it is to be carried out, having regard to the results of the geotechnical and related structural investigations.
- That, in the event that a proposed development activity is only appropriate to be carried out subject to geotechnical and related structural engineering conditions, those conditions are able to be met and are identified by the applicants prior to the lodgement of the development application, including all appropriate constraints and remedial maintenance actions required prior to, during, and after the carrying out of the development.
- To ensure that effective controls exist to guarantee that a development is carried out in accordance with the policy.
- That developments are only carried out if geotechnical and related structural engineering risks, and, where appropriate, coastal process risks, are identified and can be effectively addressed and managed for the life of the development.

In order to satisfy the above objectives, this risk assessment has reviewed the following site features in determining site geotechnical risk classification:

- Site topographical and geological setting.
- Site surface and sub-surface stormwater drainage.
- Sub-surface profiles and strength properties of soil materials.
- Site gradients and slope instability.
- Site vegetation coverage.
- Site groundwater conditions.

These site features are described in section 2 and the following sections.

## 3.2 Geotechnical Risk Assessment

We consider that there are three potential forms of slope instability on the site: (1) Soil creep; (2) Shallow rotational slide; and (3) General slope instability (e.g. landslide). The likely risk of occurrence of each of these events has been qualitatively assessed by utilising Attachment A of the *Interim Geotechnical Risk Management Policy for Pittwater,* June 2003. A summary of the slope instability risk assessment for the site is shown in Table 4.

*Table 4:* Summary of slope instability risk assessment based on Pittwater Council (2003) for proposed site re-development at 13 Bruce Street, NSW.

| Risk | Likelihood | Consequence | | Risk Level adopted | |
|---|---|---|---|---|---|
| | | Life | Property | Life | Property |
| Risk A:<br>Soil creep | Likely | Insignificant<br>(Rare Fatality) | Insignificant<br>(Little damage) | Low | Low |
| Risk B:<br>Shallow rotational slide | Rare | Insignificant<br>(Rare Fatality) | Minor<br>(Limited Damage to part of the structure) | Very low | Very low |
| Risk C:<br>Deep seated slide | Barely credible | Major<br>(Likely Fatality) | Major<br>(Extensive damage to most of structure) | Very low | Very low |

On the basis of the qualitative risk assessment shown above, we consider the site to have a <u>Low risk to life and property from slope instability</u> arising from the proposed site works based on site physical features. In general no major signs of gross slope instability were noted on the allotment. Minor signs of structural failure, noted in the site investigation undertaken in September 2004, in the <u>front portion</u> of the site may indicate minor soil creep, although this may be due to poor construction methods, in particular foundation design, used at the time of construction. The identified site risks are shown on the site topographic and geological section (Attachment A).

Despite the Very Low risk classification, we recommend that good hill-slope engineering practices, as indicated in Attachment D, be employed at this site in conjunction with the proposed site works.

## 3.3 Recommendations

### *3.3.1 General Recommendations*

The likely risks of landslide and soil creep on the site are considered low to very low. No specific site stabilisation works are necessary prior to development. All site works should be completed in accordance with the AGS Hill Slope Construction Guidelines (2007) provided in Attachment D.

### *3.3.2 Soil Strength and Foundation Class*

An allowable bearing capacity as per Table 3.

Strength testing of bedrock was not conducted due to the nature of the site inspection. However, based on visual inspection of exposed bedrock from the neighbouring dwelling excavations we consider that the sandstone bedrock at the site may be conservatively assumed to be Class III, classified in accordance with Bertuzzi and Pells (2002). Based on this assessment and the general properties of the local sandstone, it is assumed that fresh bedrock would have an unconfined compressive strength of at least 3 MPa and a serviceable bearing capacity of 1 MPa. Further investigation of underlying bedrock is required to determine accurate rock strength properties.

### *3.3.3 Excavations*

The proposed alterations will require significant excavation works for the lap pool up to depths of approximately 2.0 m below current ground level. From our investigations, we expect that this will involve excavation of soil overburden and possibly some rock.

We recommend that surface soils and sub-soils be stock piled separately so that topsoils can be re-used on site. Excavation of bedrock should be inspected by a geotechnical engineer. Suitable sediment and erosion control measures will be required during site works.

We anticipate that the permanent groundwater table is likely to be below the level of the proposed excavation works. Groundwater may be higher during extended rainfall. If site excavations are required to extend to bedrock, temporary groundwater flows at the soil / rock interface are likely to be affected. If this is the case, adequate groundwater drainage systems should be installed, as described in Section 3.3.5.

Excavations near site boundaries (< 3 m) and / or below the footing depth of adjacent buildings are to be adequately shored during excavation and supported by engineer designed retaining walls post-construction to ensure excavation works do not impact on neighbouring structures. We recommend the excavation be supported by contiguous concrete piles founded in bedrock.

Given the site topography, all excavations into loose soil materials exceeding 0.75 m in depth for the construction of foundations, should be supported by shoring in the form of suitably designed and installed retaining structures. Where feasible, soil overburden may be excavated at a temporary batter slope of 1:2 with no retaining structures.

### *3.3.4 Footings and Foundations*

All new piers and foundations of the proposed alterations as well as foundations for the lap pool are to be designed by a suitably qualified and experienced geotechnical/structural engineer and inspected by same prior to placement of footings.

If any sandstone "floaters" are encountered during excavation works for foundations, these will need to be trimmed or relocated where they overlap the footprint of proposed foundations and /or intersect footing locations.

### *3.3.5 Retaining Structures*

All retaining structures proposed to be built in conjunction with the alterations and additions are to be backfilled with free-draining aggregate with suitable drainage measures included. A geosynthetic fabric is to be placed between *in-situ* soils and aggregate to prevent the ingress of fine materials into the aggregate. A minimum 100 mm diameter agricultural drainage pipe(s) installed within the aggregate is considered to be sufficient to collect sub-surface seepage that may occur behind retaining structures.

All retaining structures are to be constructed such that excessive surface flows do not cause scouring of backfilled materials.

All retaining structures greater than 0.75 m high should be designed and inspected by a suitably qualified engineer. Placement of fill to depths of greater than 0.75 m should be certified and inspected by the same.

#### 3.3.6 *Soil Erosion Control*

Suitable sediment and erosion control measures should be installed around all areas of disturbed soil and vegetation to ensure that soil erosion and losses do not occur as a result of any site excavation works. These are to be maintained until site vegetation cover is replaced or a similarly non-erosive surface finish applied.

#### 3.3.7 *Vibrations*

Vibrations created during rock excavation works are to be minimised to reduce potential impacts on the neighbouring properties. Recommended maximum levels of ground vibration (as per AS 2187.2, 1993, Appendix J) are 10 mm/s PPV (peak particle velocity) at the site boundary or at closer site structures (e.g. existing dwelling foundations).

We recommend, for rock excavation to within 1 m of existing dwelling foundations, that a rock hammer with a maximum mass of 250 kg or a ripper or rock saw be utilised. This will minimise the impact that excavation works will have on any neighbouring dwelling. A rock saw and rock ripper may also be used an alternative to a rock hammer.

#### 3.3.8 *Stormwater and Drainage*

During construction, all surface flows should be diverted downslope and away from excavations so as to prevent water accumulating in areas surrounding retaining structures or footings.

All seepage water from new retaining walls or footings is to be directed to the proposed stormwater drainage network at the site. Gravity drainage of all structures and areas of the site is readily achievable. Details of the general site stormwater drainage requirements are provided in Section 4.

All drainage works should be constructed in accordance with the guidelines provided in Attachment D.

### 3.4 Monitoring Program

To ensure site stability, prevent any adverse geotechnical impacts and reduce the risk of sediment transport off-site due to erosion during site works, we recommend the following be monitored regularly:

- Seepage rates from any soil/ rock interface;
- Impacts of the excavations on the existing neighbouring buildings;
- Sedimentation downslope of excavated areas during and after rainfall events; and
- All sediment erosion control structures – for functioning condition and removal of built-up spoil.

### 3.5 Contingency Plan

In the event that the proposed development works cause an adverse impact on overall site stability or on neighbouring properties, works shall cease immediately. The nature of the impact shall be documented and the reason(s) for the adverse impact investigated. This might require site inspection by a qualified geotechnical or structural engineer.

### 3.6 Inspection Programme

We recommend inspection by a suitably qualified geotechnical engineer:

- After excavations of proposed lap pool prior to placement of concrete footings and backfilling.

- At 1 m rock depth increments during excavation.

### 3.7 Recommendations for Ongoing Management of Site Structures

We recommend that the following ongoing maintenance should be conducted to ensure no adverse changes to the site instability classification over the design life of the development:

- Any site instability or indicators of site instability (e.g. tension cracking, settlement, erosion, *etc*) is to be immediately reported to a geotechnical engineer, who should then assess the existing conditions and recommend remedial works where required.

### 3.8 Required Works Prior to Issue of Construction Certificate

All designs of proposed foundations, supports, retaining walls, and drainage measures should be referred to a suitably qualified geotechnical engineer for review and certification that proposed structures have been designed in accordance with Council's (2003) Interim Geotechnical Risk Management Policy and the recommendations given in this report.

Written certification or documentation acceptable to Council should be provided by the geotechnical engineer to Council, clearly displaying that proposed site works designs comply with requirements.

# 4 Stormwater Assessment

## 4.1 Existing Stormwater Drainage

Stormwater drainage at the site is presently directed from the roof to sub-surface drains. Although the point of discharge was not located it is expected to follow the site topography and drain to the public foreshore reserve to the east. Runoff from paved areas is not collected by a formal drainage system and infiltrates into site soils or runs off as sheet flow to the foreshore reserve.

No stormwater easements were identified on the site. It was observed that there was no kerb and gutter system for road drainage on the east side of Bruce Street, adjacent to the western site boundary. There is, however, a kerb and gutter on the western side of the street. The slope of Bruce Street is predominantly from south to north at approximately 5% and surface runoff would generally be conveyed in this direction past the site (Figure 2). The street pavement falls from the centreline to either side and it is expected that a small area of the road (up to approximately 50 $m^2$) drains via sheet flow to the site with runoff infiltrating to subsoils in the grass verge.

*Figure 2:* View of Bruce Street towards the south.

## 4.2 Soil Type

Investigations in the western portion of the site, indicated that soils are likely to provide good infiltration capacity for stormwater. The eastern portion of the site contains clay fill approximately 0.4m to 0.6m in depth. The underlying soil material consists of shallow clays and extremely weathered sandstone.

## 4.3 Local Catchment and Surrounding Lands

Upslope areas on the western side of Bruce Street drain to the existing kerb and gutter system. During major rainfall events, stormwater runoff from these areas may result in increased flows onto the western boundary of the site from an area of approximately 50m$^2$ of the road.

The new driveway and garage entrance is raised above Bruce Street and therefore sheet flow from the road will be prevented from entering the site's drainage system as shown in Plates 7 and 8.

The site is located on an easterly facing hill slope. Local topography indicates that stormwater runoff from neighbouring allotments to the north and south would also be conveyed to the public foreshore reserve to the east.

## 4.4 Stormwater Management for Proposed Development

### *4.4.1 Overview*

It is understood that the existing dwelling never had an infiltration system. The proposed alterations create an additional 29 m$^2$ of hardstand area and therefore do not require a rainwater tank or an On-Site Detention (OSD) system in accordance with Pittwater Council DCP21 Section B5 (2004). However runoff from the existing dwelling, garage and hard stand areas is to be diverted into an infiltration trench/basin.

### *4.4.2 Catchment Area*

The catchment draining to the infiltration trench has an area of approximately 270 m$^2$. This combined area consists of a 41 m$^2$ garage roof, 169m$^2$ existing dwelling and 59m$^2$ from the courtyard and hardstand areas.

### *4.4.3 Soil Permeability*

Permeability testing in the eastern portion of the site (Test Pit 1) using the Constant Head Method (results sheet provided in Attachment F) and subsequent $K_{sat}$ analysis indicates the site has a $K_{sat}$ value of approximately 0.18 m/day or approximately 0.0075 m/hour. The site's soil profile in the vicinity of the proposed infiltration trench/basin was characterised as clay fill to approximately 300mm depth overlying silty sandy/clay subsoil.

### 4.4.4 *Infiltration Trench Capacity*

According to Australian Rainfall and Run-off (AR&R) data and the probabilistic Rational Method, design storage volume for the trench in a 1:20 year 5 minute rainfall event equates to a capacity of 4524.8L (270 x 201.1/12). Infiltration trench size was calculated to accommodate this capacity.

*Table 5*: Calculated discharge and rainfall intensity for the 1:5 - 5 minute, 1:20 - 5 minute and 1:100 - 5 minute rainfall event on the proposed carport/garage at 13 Bruce Street, Mona Vale, NSW

| ARI/Duration | Rainfall Intensity (mm/hr) | Discharge ($m^3/s$) | Discharge (L/s) |
|---|---|---|---|
| 5 year – 5 min | 157.7 | 0.007 | 7.3 |
| 20 year – 5 min[1] | 201.1 | 0.011 | 11.8 |
| 100 year – 5 min | 257.6 | 0.019 | 19.1 |

Note: [1] Design discharge applicable to the infiltration trench.

## 4.5 Stormwater Disposal Requirements

To accommodate and subsequently absorb the overflow generated from a 1:20 year ARI rainfall event with duration of 5 minutes the infiltration trench will require a total storage capacity of 7541.3 litres ((1/0.6) x 4524.8 = 7541.3). This figure was calculated based on a trench porosity of 60%. To achieve this, the infiltration trench requires dimensions of 15000 mm x 600 mm x 660 mm. These dimensions are a minimum and have been derived assuming all hardstand flows go to the infiltration trench/basin. Refer to Attachment A ‘Plan Set’ for plan and section drawings of the site and proposed infiltration trench.

Surcharges from the infiltration trench may be directed to the foreshore reserve through an appropriately designed outlet structure, ensuring that the flow rate and velocity of stormwater overflow are minimised. It is considered that this method of disposal will not contribute to slope instability, erosion, sedimentation, water quality impacts or visual impact on the foreshore reserve.

Stormwater runoff from all hard surfaces must be managed appropriately. Runoff from the roof is to be collected with a standard roof gutter system and conveyed to the infiltration trench. Paved footpaths and stairs should be designed and constructed in such a way that infiltration of stormwater runoff to garden areas is maximised.

### 4.6 Inspection Programme

We recommend inspection by a suitably qualified engineer prior to backfilling of infiltration trenches.

### 4.7 Stormwater Management Controls

It is considered that the proposed method of stormwater disposal will not contribute to slope instability, erosion, sedimentation or water quality impacts on the public foreshore reserve to the east. The proposed site stormwater controls comply with the requirements of Pittwater DCP 21 (2003).

Final stormwater invert levels of all pits and pipes and final position of trenches to be determined at CC stage.

## 5 References


Australian Geomechanics Society (March 2007), *Landslide Risk Management*, Australian Geomechanics 42 (1).

Australian Standard 2419 (1994), *Fire hydrant installations.*

Australian Standard 2870 (1996) *Residential Slabs and Footings*

Australian Standard (1984) 1289.F3.2 *Determination of the Penetration Resistance of a Soil using the 9 kg Dynamic Cone Penetrometer*

Pittwater Council (2003), *Interim Geotechnical Risk Management Policy for Pittwater.*

Pittwater Council (2004), *Pittwater 21 Development Control Plan*

# 6 Attachment A – Plan Set

Sheet 1: Cover Sheet
Sheet 2: Stormwater Management and Site Plan
Sheet 3: Geological Section
Sheet 4: Surcharge Pit and Infiltration Trench Detail

# GECOTECHNICAL AND STORMWATER ASSESSMENT PLAN SET

## 13 BRUCE STREET, WARRIEWOOD, NSW






martens

6/37 Leighton Place
Hornsby, NSW 2077 Australia
Phone: (02) 9476 8777
Fax: (02) 9476 8767
Email: mail@martens.com.au
Internet: http://www.martens.com.au

**MARTENS & ASSOCIATES PTY LTD**
**Sustainable Solutions**
Environmental - Geotechnical - Civil
Hydraulic - Wastewater Engineers


CLIENT/ ADDRESS
MICHAEL KING
13 BRUCE STREET WARRIEWOOD

THIS PLAN MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED BY PRINCIPAL CERTIFYING AUTHORITY
All measurements in mm unless otherwise specified.

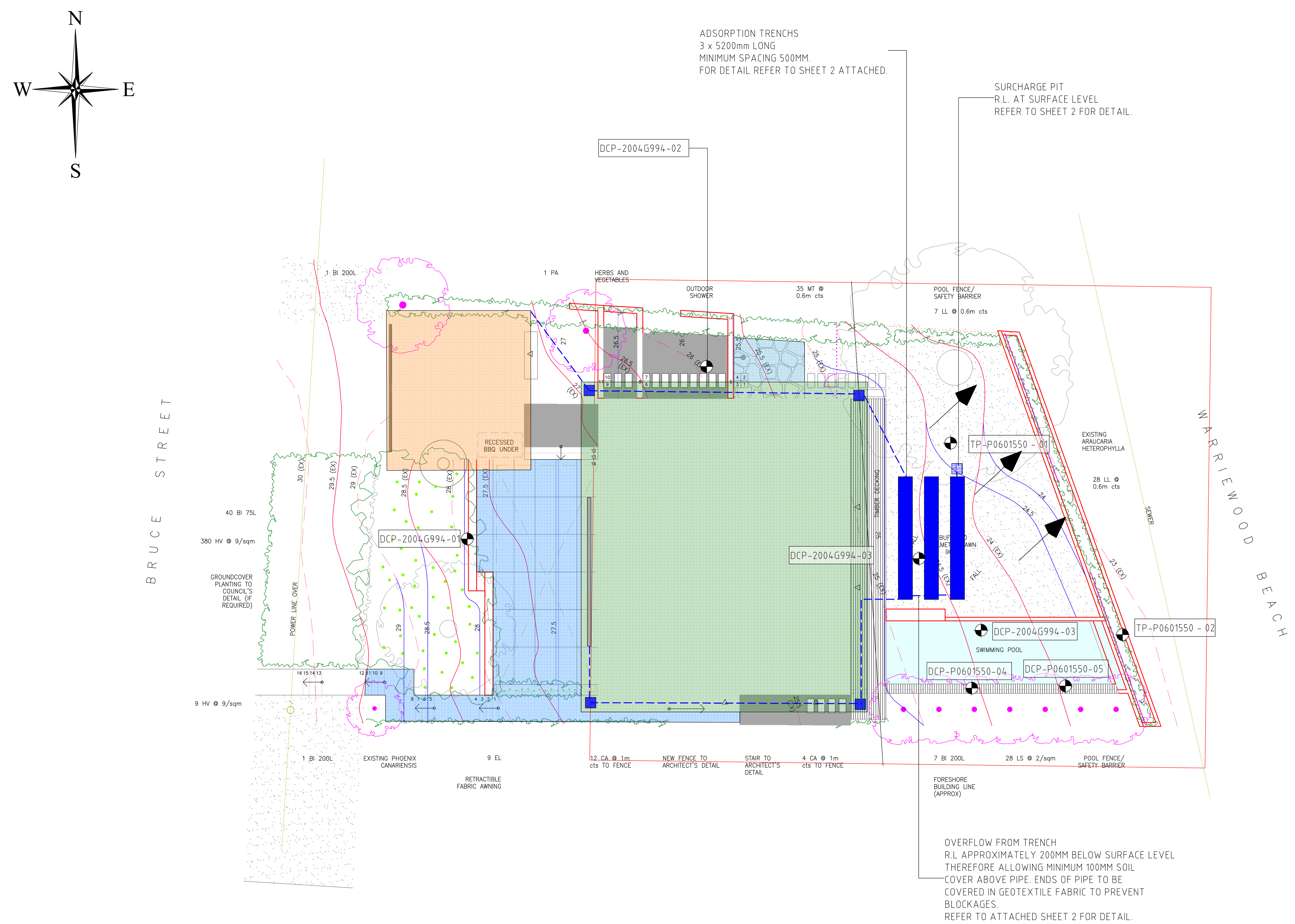
TITLE: COVER SHEET

PROJECT MANAGER: MR ANDREW NORRIS

DRAWING NUMBER: P0601550JD01_V2

| | | |
|---|---|---|
| DESIGNED: GT | DATUM: NR | SHEET 1 OF 4 SHEETS |
| DRAWN: GT | HORIZONTAL RATIO: NR | |
| REVIEWED: AN | VERTICAL RATIO: NR | PAPER SIZE: A1 / A3 |

| REV. | DESCRIPTION | DATE | ISSUED |
|---|---|---|---|
| 1 | GEOTECHNICAL AND STORMWATER ASSESSMENT | 09.01.2008 | GT |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |




LEGEND:

- DRAINAGE AREA FROM GARAGE= 41.3M2
- DRAINAGE AREA FROM HARDSTAND= 59.19M2
- DRAINAGE AREA FROM ROOF = 169.24M2
- DCP AND TEST PIT SOIL TESTING LOCATION
- PROPOSED LOCATION OF INFILTRATION TRENCH/BASINS
- SLOPE DIRECTION
- 150MM X 200MM BOX DRAIN
- 450MM X 450MM STORMNWATER PIT
- 450MM X 450MM SURCHARGE PIT
- 100MM DIAMETER STORMWATER PIPE

PAGE BAR SCALE
0 2 4 6 8 10
UNITS - METRES
SCALE - 1:100 @ A1 1:200 @ A3

NOTES:
ALL PITS AND PIPE INVERT LEVELS TO BE CONFIRMED AT CC STAGE.

NOTE: SITE SURVEY PROVIDED BY CLIENT.



martens
6/37 Leighton Place
Hornsby, NSW 2077 Australia
Phone: (02) 9476 8777
Fax: (02) 9476 8767
Email: mail@martens.com.au
Internet: http://www.martens.com.au

MARTENS & ASSOCIATES PTY LTD
Sustainable Solutions
Environmental - Geotechnical - Civil
Hydraulic - Wastewater Engineers

CLIENT/ ADDRESS: MICHAEL KING, 13 BRUCE STREET WARRIEWOOD

THIS PLAN MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED BY PRINCIPAL CERTIFYING AUTHORITY
All measurements in mm unless otherwise specified.

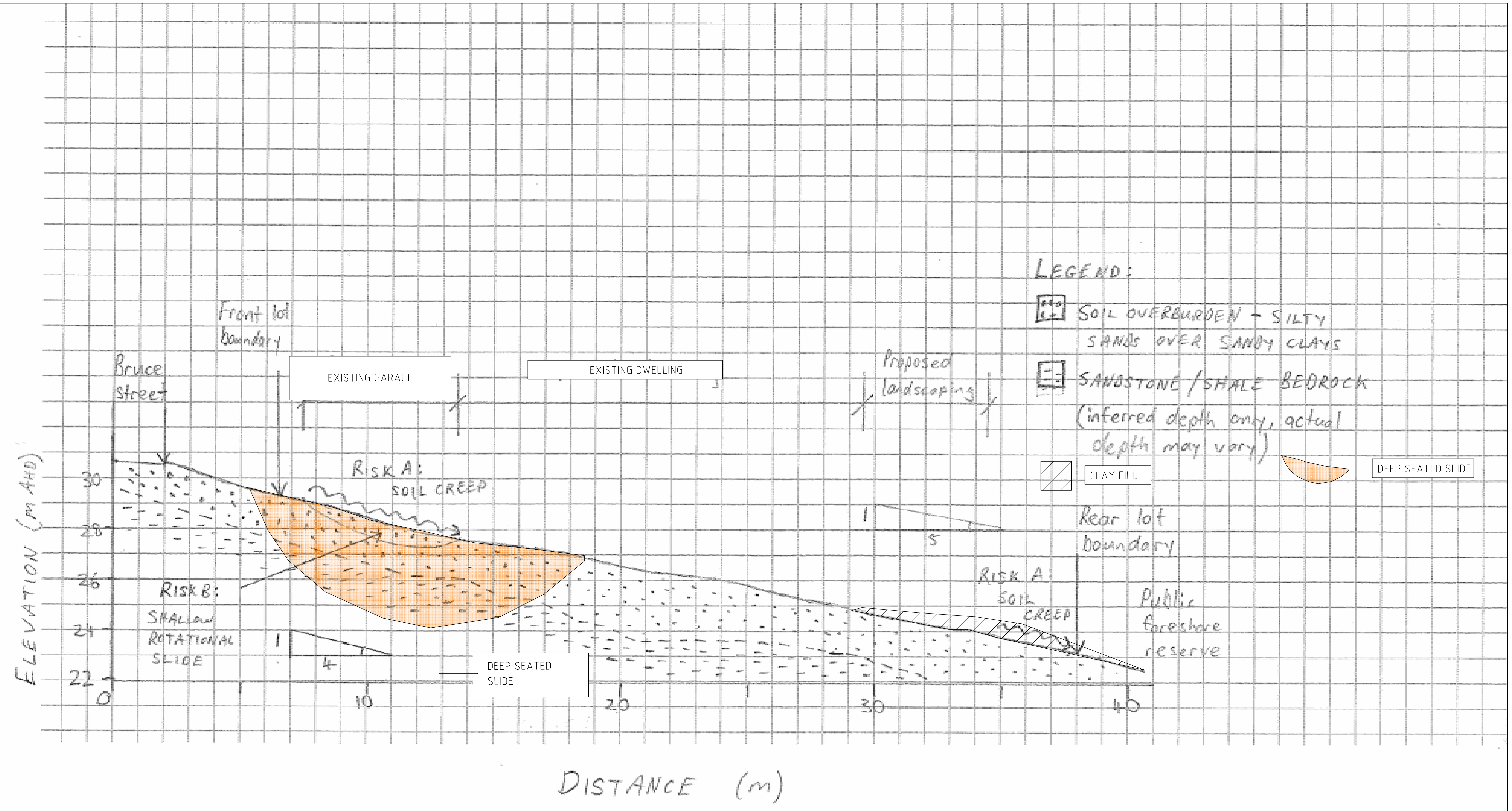
TITLE: STORMWATER MANAGEMENT AND SITE PLAN

PROJECT MANAGER: MR ANDREW NORRIS

DRAWING NUMBER: P0601550JD01_V2

| DESIGNED: | DATUM: | SHEET |
|---|---|---|
| GT | AHD | 2 |
| DRAWN: GT | HORIZONTAL RATIO: 1:100 @ A1 1:200 @ A3 | OF 4 SHEETS |
| REVIEWED: AN | VERTICAL RATIO: 1:100 @ A1 1:200 @ A3 | PAPER SIZE: A1 / A3 |

| REV. | DESCRIPTION | DATE | ISSUED |
|---|---|---|---|
| 1 | INFILTRATION TRENCH DESIGN | 22.10.2007 | GT |
| 2 | GEOTECHNICAL AND STORMWATER ASSESSMENT | 09.01.2008 | GT |






martens
6/37 Leighton Place
Hornsby, NSW 2077 Australia
Phone: (02) 9476 8777
Fax: (02) 9476 8767
Email: mail@martens.com.au
Internet: http://www.martens.com.au

MARTENS & ASSOCIATES PTY LTD
Sustainable Solutions
Environmental - Geotechnical - Civil
Hydraulic - Wastewater Engineers

CLIENT/ ADDRESS
MICHAEL KING
13 BRUCE STREET WARRIEWOOD



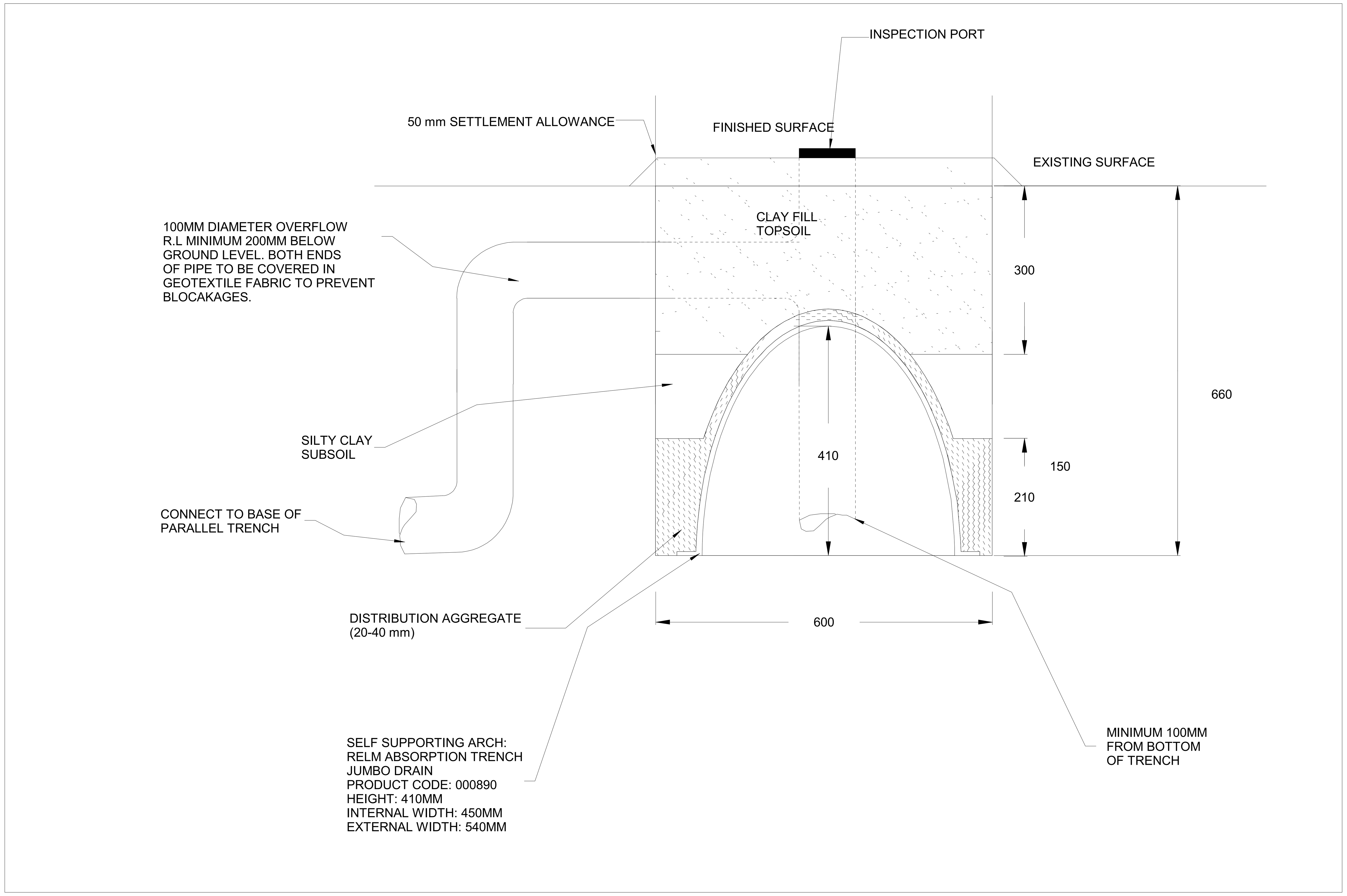
TITLE
GEOLOGICAL SECTION

PROJECT MANAGER: MR ANDREW NORRIS

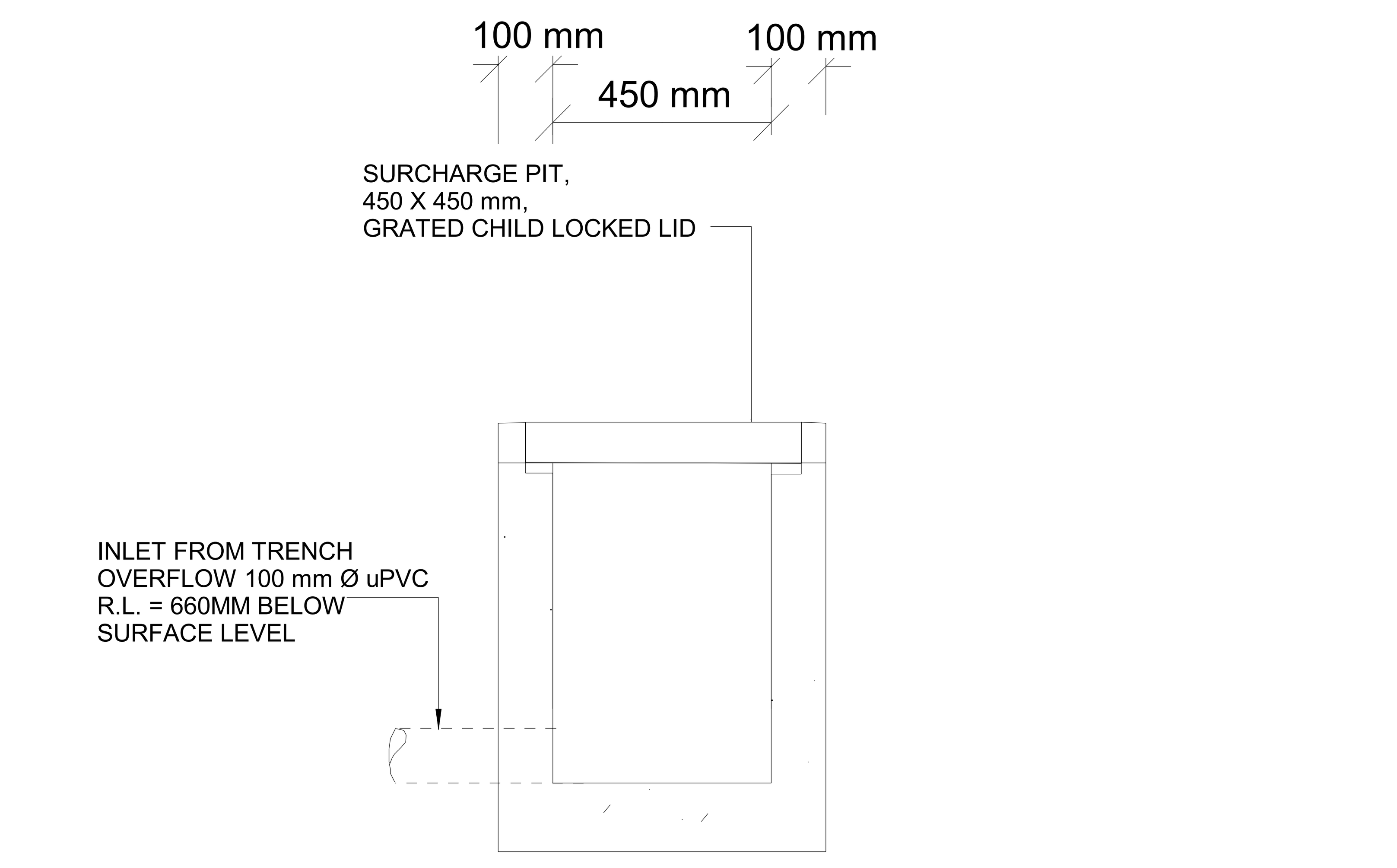
DRAWING NUMBER: P0601550JD01_V2

| DESIGNED: | GT |
|---|---|
| DRAWN: | GT |
| REVIEWED: | AN |
| DATUM: | AHD |
| HORIZONTAL RATIO: | 1:100 @ A1<br>1:200 @ A3 |
| VERTICAL RATIO: | 1:100 @ A1<br>1:200 @ A3 |
| SHEET | 3 OF 4 SHEETS |
| PAPER SIZE: | A1 / A3 |

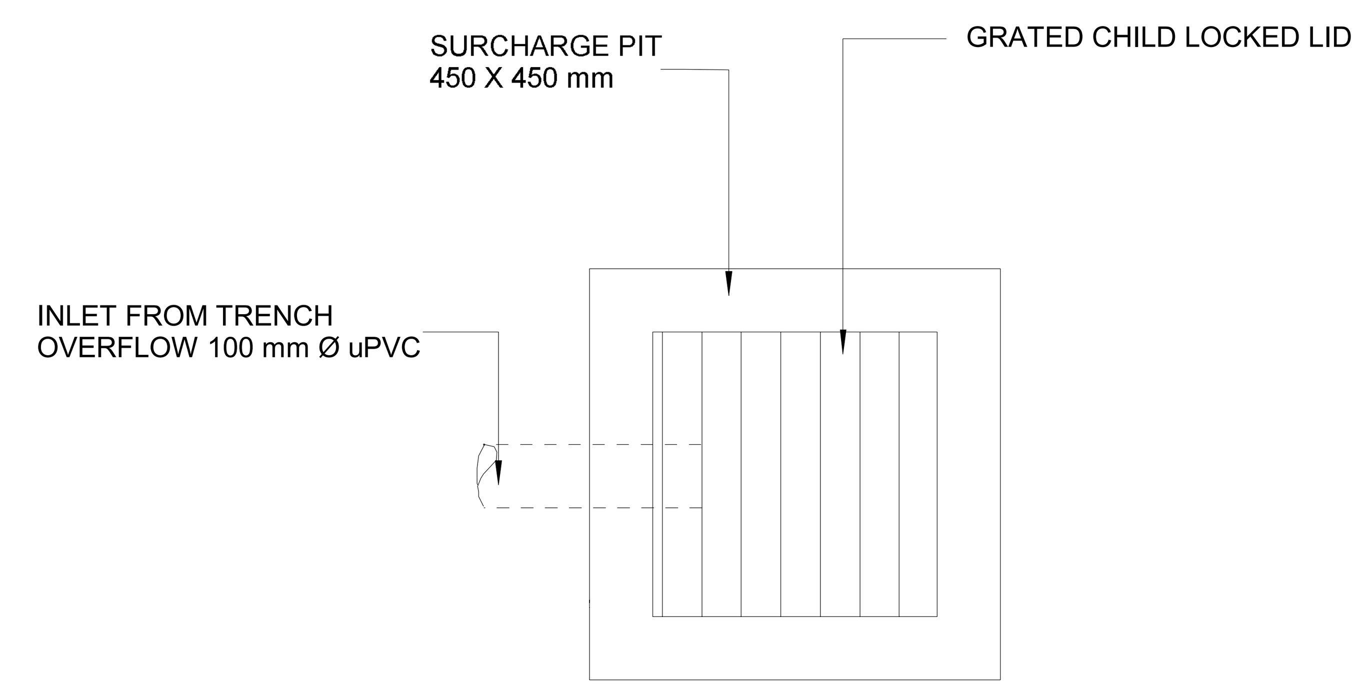
| REV. | DESCRIPTION | DATE | ISSUED |
|---|---|---|---|
| 1 | GEOTECHNICAL AND STORMWATER ASSESSMENT | 09.01.2008 | GT |




TRENCH SECTION
SCALE 1:10 @ A1 AND 1:20 @A3




SECTION OF SURCHARGE PIT




SURCHARGE PIT DETAIL

TRENCH SECTION
SCALE 1:10 @ A1 AND 1:20 @A3



martens
6/37 Leighton Place
Hornsby, NSW 2077 Australia
Phone: (02) 9476 8777
Fax: (02) 9476 8767
Email: mail@martens.com.au
Internet: http://www.martens.com.au

MARTENS & ASSOCIATES PTY LTD
Sustainable Solutions
Environmental - Geotechnical - Civil
Hydraulic - Wastewater Engineers

CLIENT/ ADDRESS
MICHAEL KING
13 BRUCE STREET WARRIEWOOD

THIS PLAN MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED BY PRINCIPAL CERTIFYING AUTHORITY
All measurements in mm unless otherwise specified.

TITLE
SURCHARGE PIT AND INFILTRATION TRENCH DETAIL

PROJECT MANAGER:
MR ANDREW NORRIS

DRAWING NUMBER:
P0601550JD02_V2

DESIGNED: GT
DRAWN: GT
REVIEWED: AN
DATUM: AHD
HORIZONTAL RATIO: 1:10 @ A1, 1:20 @ A3
VERTICAL RATIO: 1:10 @ A1, 1:20 @ A3
SHEET 4 OF 4 SHEETS
PAPER SIZE: A1 / A3

| REV. | DESCRIPTION | DATE | ISSUED |
|---|---|---|---|
| 1 | INFILTRATION TRENCH DESIGN | 22.10.2007 | GT |
| 2 | GEOTECHNICAL AND STORMWATER ASSESSMENT | 09.01.2008 | GT |

**Attachment B – Geotechnical Recommendation Confirmation Letter (REF: P1404185JC01V01)**

martens
consulting engineers since 1989

| | | |
|---|---|---|
| Posted | | |
| Faxed | | |
| Emailed | X | ian@campbellsbuilding.com.au |
| Courier | | |
| By Hand | | |
| Contact: | | Ben Rose/ Gray Taylor |
| Our Ref: | | P1404185JC01V01 |
| Pages: | | 1 |
| cc. | | - |

2 April, 2014

Campbells Building Company
Ian Campbell
By email

Dear Ian,

**RE: SECTION 96 APPLICATION: 13 BRUCE ST, WARRIEWOOD, NSW**

We have reviewed the Section 96 application plans by Campbells Building Company (revision C, 7 page plan set, 10.03.2014) and with the exception of the proposed lower ground floor excavation, confirm geotechnical recommendations within our previous site geotechnical assessment report (REF: P0601550JR01V1, 2008) remain unchanged.

With regards to the lower ground floor excavation, due care is to be taken to ensure excavation works do not undermine any existing footings. Where the excavation cannot be excavated with a temporary batter slope of 1(V):2(H) without undermining any existing footings, shoring is to be utilised during excavation with the post excavation support provided by an engineered retaining wall.

If you require any further information, please do not hesitate to contact the writer.

**For and on behalf of**

**MARTENS & ASSOCIATES PTY LTD**

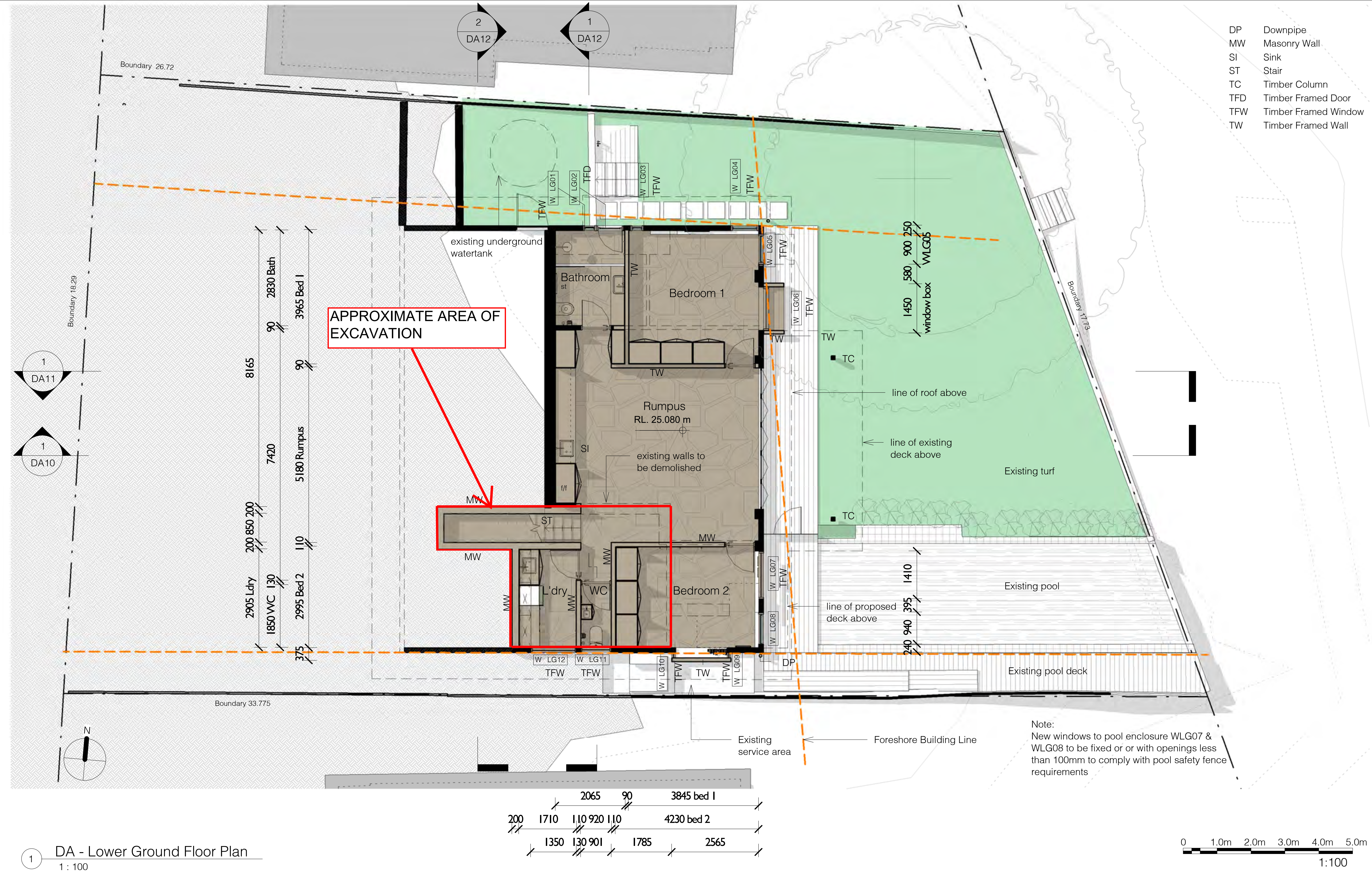
**BEN ROSE**
BEnvMgt
Environmental Engineer




**Head Office**
Unit 6 / 37 Leighton Place
Hornsby NSW 2077, Australia
**Ph** 02 9476 9999 **Fax** 02 9476 8767

> mail@martens.com.au
www.martens.com.au
MARTENS & ASSOCIATES P/L
ABN 85 070 240 890 ACN 070 240 890

**Attachment C – Approximate Area of Excavation**




1 DA - Lower Ground Floor Plan
1 : 100


richard cole architecture
139 PALMGROVE ROAD
AVALON BEACH NSW 2107
t: 02 9918 3843
f: 02 9918 3492
m: 0418 627 024
richard@richardcolearchitecture.com.au
www.richardcolearchitecture.com.au


| No. | Revision Description | Date |
|---|---|---|
| A | Pre DA | 25.01.19 |

KENNETT RESIDENCE
DEVELOPMENT APPLICATION
Lot 10 DP15764
13 Bruce Street Mona Vale 2103
for
Jason Kennett & Mandy Eilbeck

Lower Ground Floor Plan

| | | | |
|---|---|---|---|
| Project number | 1803 | Checked by | Checker |
| Date | February 2019 | Scale | 1 : 100 |
| Drawn by | Author | | DA03 |