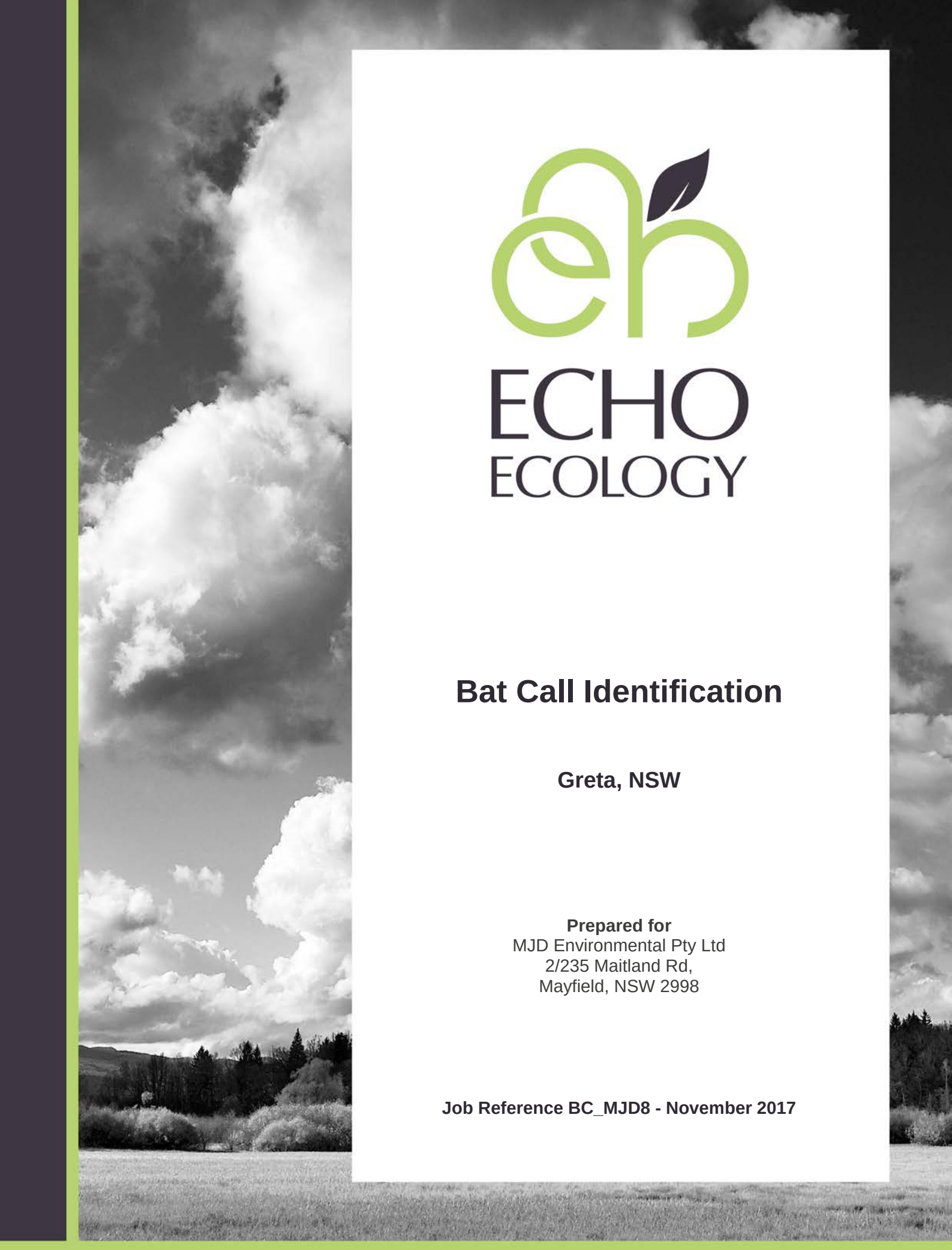

ECHO ECOLOGY

Bat Call Identification

Greta, NSW

Prepared for
MJD Environmental Pty Ltd
2/235 Maitland Rd,
Mayfield, NSW 2998

Job Reference BC_MJD8 - November 2017

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This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

Dr Anna McConville
PhD, B.Env.Sc.

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1.0 INTRODUCTION

This report has been commissioned by MJD Environmental to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Greta, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Chris Corben, Version 4.2n) software. The calls appeared to have been recorded using Div Ratio 8. The identification of calls was undertaken with reference to Pennay et al. (2004) and through the comparison of recorded reference calls from the Sydney Basin. Reference calls were obtained from the NSW database and from the authors personal collection.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Activity levels should not be compared among species as different species have different detectability due to factors such as call loudness, foraging strategy and call identifying features. Activity comparisons among sites are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

Nomenclature follows the Australian Chiroptera taxonomic list described by Reardon et al. (2015).

2.1 Characteristics Used to Differentiate Species

Miniopterus australis was differentiated from *Vespadelus pumilus*, by characteristic frequency or the presence of a down-sweeping tail on pulses.

Calls from *Miniopterus orianae oceanensis* were differentiated from *Vespadelus* spp. by a combination of uneven consecutive pulses and the presence of down-sweeping tails.

Calls from *Mormopterus* spp. were differentiated by the presence of mainly flat pulses. Calls from *Mormopterus planiceps* were distinguished from *Mormopterus ridei* only where they do not overlap in characteristic frequency.

Chalinolobus gouldii was differentiated from other species by the presence of curved, alternating call pulses.

Scotorepens balstoni was differentiated in long call sequences at lower frequencies by lack of alternation.

Scotorepens orion, *Scoteanax rueppellii* and *Falsistrellus tasmaniensis* were unable to be differentiated from one another. *Falsistrellus tasmaniensis* is most frequently recorded from more elevated locations in the region and so its occurrence within the study area is unlikely. However, some records exist from coastal lowlands and so we have included it in our species groups as a precautionary measure.

Austronomus australis was differentiated from other bat species on the basis of characteristic frequency.

3.0 RESULTS

A total of 302 call sequences were recorded, of which 159 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 37 call sequences (23 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Austronomus australis* (White-striped Free-tailed Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Mormopterus planiceps* (Southern Free-tailed Bat)
- *Scotorepens balstoni* (Inland Broad-nosed Bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Chalinolobus morio* (Chocolate Wattled Bat)
- *Falsistrellus tasmaniensis* (Eastern Falsistrelle)
- *Mormopterus norfolkensis* (Eastern coastal Free-tailed Bat)
- *Mormopterus ridei* (Ride's Free-tailed Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Scotorepens orion* (Eastern Broad-nosed Bat)
- *Vespadelus darlingtoni* (Large Forest Bat)
- *Vespadelus pumilus* (Eastern Forest Bat)
- *Vespadelus regulus* (Southern Forest Bat)
- *Vespadelus troughtoni* (Eastern cave bat)
- *Vespadelus vulturnus* (Little Forest Bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors (or are difficult to identify by bat call) and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

Table 3-1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	Anabat 30/10/2017	Anabat 31/10/2017	Anabat 1/11/2017	Anabat 2/11/2017
DEFINITE				
Austronomus australis	4	1	-	-
Chalinolobus gouldii	1	3	-	1
Miniopterus australis	-	1	1	-
Mormopterus planiceps	-	-	3	1
PROBABLE				
Chalinolobus gouldii	2	2	1	-
Miniopterus orianae oceanensis	5	2	6	1
Mormopterus planiceps	-	-	1	-
Scotorepens balstoni	-	-	-	1
POSSIBLE				
Miniopterus orianae oceanensis	-	-	-	1
SPECIES GROUPS				
Chalinolobus gouldii / Mormopterus norfolkensis / Mormopterus ridei / Scotorepens balstoni	2	-	1	-
Chalinolobus gouldii / Mormopterus ridei / Mormopterus planiceps / Scotorepens balstoni	2	-	-	2
Chalinolobus gouldii / Scotorepens balstoni	3	1	2	-
Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	2	-	-	-
Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	1	-	1	-
Miniopterus orianae oceanensis / Vespadelus darlingtoni / Vespadelus regulus	36	16	20	15
Mormopterus norfolkensis / Mormopterus ridei	3	-	4	-
Mormopterus ridei / Mormopterus planiceps	2	1	4	3
UNKNOWN				

IDENTIFICATION	Anabat 30/10/2017	Anabat 31/10/2017	Anabat 1/11/2017	Anabat 2/11/2017
'Noise' files	63	1	2	2
Unknown	22	16	27	10
TOTAL	**148**	**44**	**73**	**37**

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

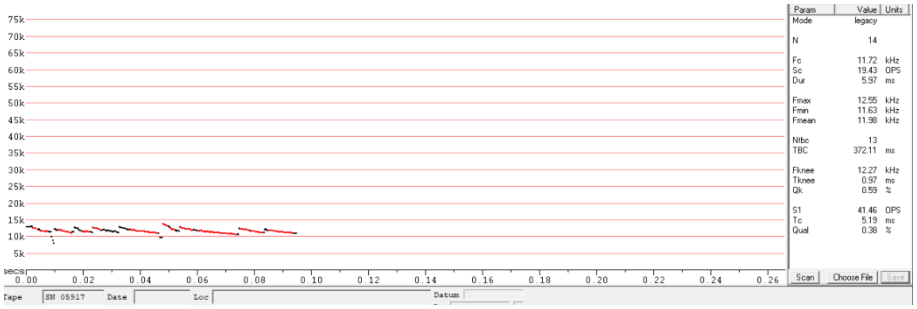

Figure 4-1: *Austronomus australis* definite call

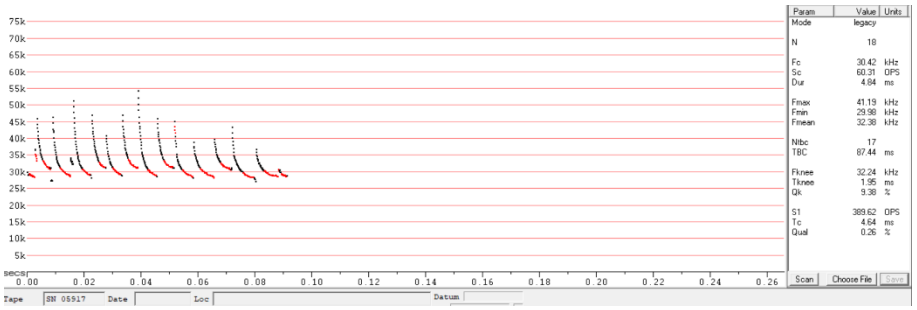

Figure 4-2: *Chalinolobus gouldii* definite call

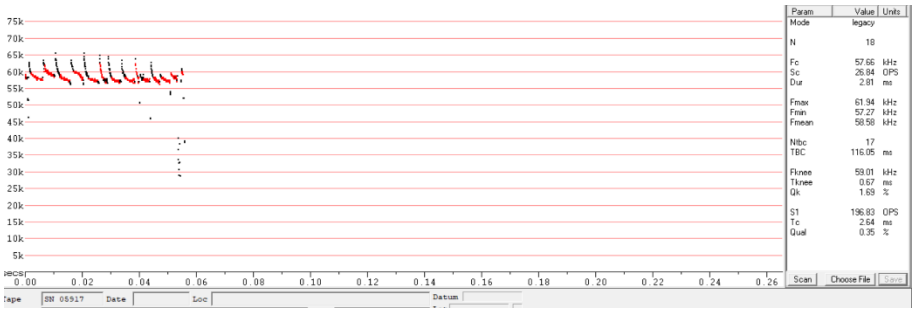

Figure 4-3: *Miniopterus australis* definite call

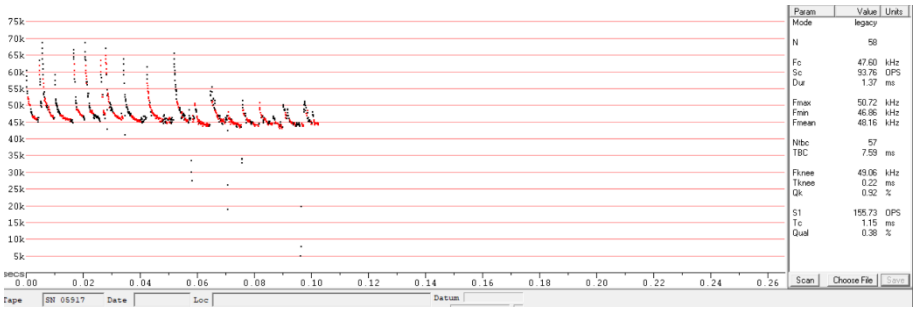

Figure 4-4: *Miniopterus orianae oceanensis* probable call

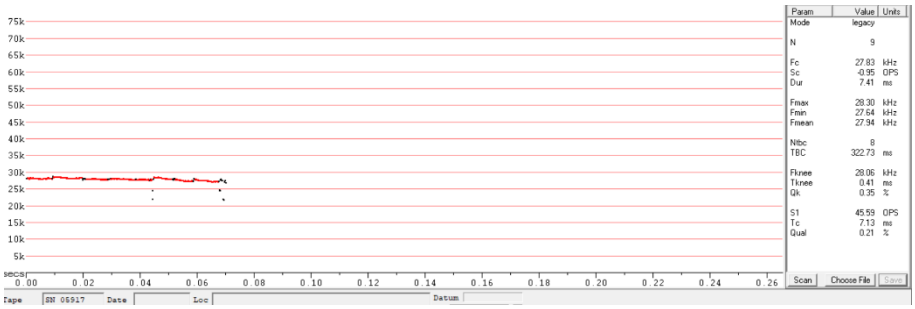

Figure 4-5: *Mormopterus planiceps* definite call

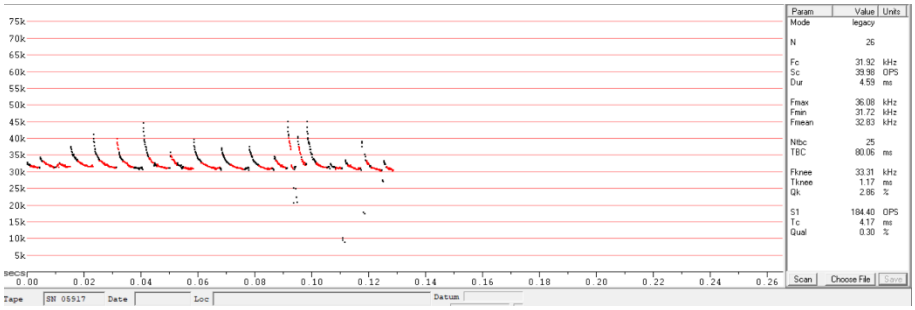

Figure 4-6: *Scotorepens balstoni* probable call

5.0 REFERENCES

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ATTACHMENT 4

STATE ENVIRONMENTAL PLANNING POLICY COMPLIANCE TABLE

State Environmental Planning Policy	Apply	Requirements	Comment
State Environmental Planning Policy No 1—Development Standards	YES	NO	Not applicable
State Environmental Planning Policy No 14—Coastal Wetlands	NO	NO	Not applicable
State Environmental Planning Policy No 15—Rural Landsharing Communities	YES	NO	Not applicable
State Environmental Planning Policy No 19—Bushland in Urban Areas	NO	NO	Not applicable
State Environmental Planning Policy No 21—Caravan Parks	YES	NO	Not applicable
State Environmental Planning Policy No 26—Littoral Rainforests	NO	NO	Not applicable
State Environmental Planning Policy No 29—Western Sydney Recreation Area	NO	NO	Not applicable
State Environmental Planning Policy No 30—Intensive Agriculture	NO	NO	Not applicable
State Environmental Planning Policy No 32—Urban Consolidation (Redevelopment of Urban Land)	NO	NO	Not applicable
State Environmental Planning Policy No 33—Hazardous and Offensive Development	NO	NO	Not applicable
State Environmental Planning Policy No 36—Manufactured Home Estates	NO	NO	Not applicable
State Environmental Planning Policy No 39—Spit Island Bird Habitat	NO	NO	Not applicable
State Environmental Planning Policy No 44—Koala Habitat Protection	YES	YES	The ecological assessment indicates that the vegetation on the property is not potential koala habitat. There this policy is not applicable to the proposal.
State Environmental Planning Policy No 47—Moore Park Showground	NO	NO	Not applicable
State Environmental Planning Policy No 50—Canal Estate Development	NO	NO	Not applicable
State Environmental Planning Policy No 52—Farm Dams and Other Works in Land and Water Management Plan Areas	NO	NO	Not applicable
State Environmental Planning Policy No 55—Remediation of Land	YES	YES	A contaminated land assessment is recommended post gateway determination prior to the making of the plan.
State Environmental Planning Policy No 59—Central Western Sydney Regional Open Space and Residential	NO	NO	Not applicable
State Environmental Planning Policy No 62—Sustainable Aquaculture	NO	NO	Not applicable
State Environmental Planning Policy No 64—Advertising and Signage	YES	NO	Not applicable
State Environmental Planning Policy No 65—Design Quality of Residential Flat Development	YES	NO	Not applicable
State Environmental Planning Policy No 70—Affordable Housing (Revised Schemes)	NO	NO	Not applicable
State Environmental Planning Policy No 71—Coastal Protection	NO	NO	Not applicable

State Environmental Planning Policy (Affordable Rental Housing) 2009	YES	NO	Not applicable
State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004	YES	NO	Not applicable
State Environmental Planning Policy (Exempt and Complying Development Codes) 2008	YES	NO	Not applicable
State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004	YES	NO	Not applicable
State Environmental Planning Policy (Infrastructure) 2007	YES	NO	Not applicable
State Environmental Planning Policy (Kosciuszko National Park—Alpine Resorts) 2007	NO	NO	Not applicable
State Environmental Planning Policy (Kurnell Peninsula) 1989	NO	NO	Not applicable
State Environmental Planning Policy (Major Development) 2005	NO	NO	Not applicable
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007	YES	NO	No impact as the subject site is within 2km of an existing residential area as such it falls within the exclusion buffer area
State Environmental Planning Policy (Miscellaneous Consent Provisions) 2007	YES	NO	Not applicable
State Environmental Planning Policy (Penrith Lakes Scheme) 1989	NO	NO	Not applicable
State Environmental Planning Policy (Rural Lands) 2008	NO	NO	Not applicable
State Environmental Planning Policy (SEPP 53 Transitional Provisions) 2011	NO	NO	Not applicable
State Environmental Planning Policy (State and Regional Development) 2011	YES	NO	Not applicable
State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011	NO	NO	Not applicable
State Environmental Planning Policy (Sydney Region Growth Centres) 2006	NO	NO	Not applicable
State Environmental Planning Policy (Three Ports) 2013	NO	NO	Not applicable
State Environmental Planning Policy (Urban Renewal) 2010	NO	NO	Not applicable
State Environmental Planning Policy (Western Sydney Employment Area) 2009	NO	NO	Not applicable
State Environmental Planning Policy (Western Sydney Parklands) 2009	NO	NO	Not applicable

ATTACHMENT 5

S117 MINISTERIAL DIRECTIONS COMPLIANCE TABLE

	Applicable	Consistent	Comments
1.1 - Business and Industrial Zones	NO	-	
1.2 - Rural Zones	YES	NO	This s117 direction refers to the need to protect the agricultural production value of rural land. Given the location and size of the subject site it is considered that the proposal is justifiably inconsistent. The subject site is less then 6ha in area and has not had any form of agricultural production value for the past several decades. The existing zoning does not reflect the use of the site. The current use of the property more closely represents a large lot resident zone then a rural production zone. As such it is considered that the proposal would be justifiably inconsistent due to lack of agricultural production capacity and its minor nature.
1.3 - Mining, Petroleum Production and Extractive Industries	NO	-	
1.4 - Oyster Aquaculture	NO	-	
1.5 - Rural Lands	YES	NO	This s117 direction refers to the need to protect the agricultural production value of rural land and facilitate the orderly and economic development of rural lands for rural and related purposes. Given the location and size of the subject site it is considered that the proposal is justifiably inconsistent due to lack of agricultural production capacity and its minor nature.
2.1 - Environment Protection Zones	YES	YES	The site as a whole is classified *environmentally sensitive land* by Cessnock Council. The proposal has an ability to protect/offset any potential impacts. It is therefore considered that the proposal can be consistent with the s117 direction.
2.2 - Coastal Protection	NO	-	
2.3 - Heritage Conservation	NO	-	
2.4 - Recreation Vehicle Areas	NO	-	
3.1 - Residential Zones	YES	YES	Nil
3.2 - Caravan Parks and Manufactured Home Estates	NO	-	
3.3 - Home Occupations	YES	YES	Nil
3.4 - Integrating Land Use and Transport	YES	YES	Nil

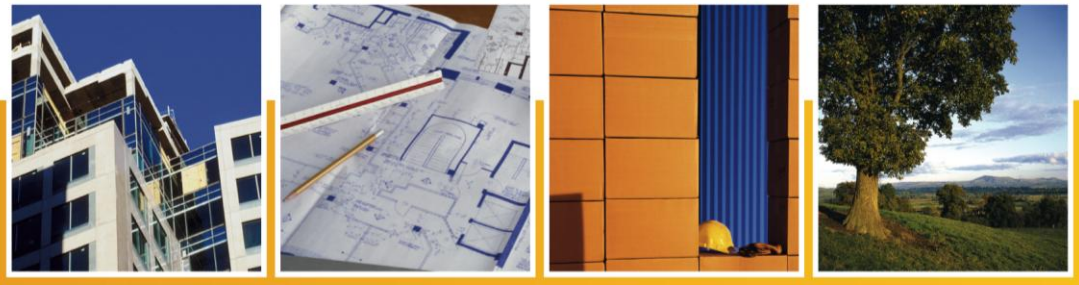
3.5 - Development Near Licensed Aerodromes	NO	-	
3.6 - Shooting Ranges	NO	-	
4.1 - Acid Sulfate Soils	NO	-	
4.2 - Mine Subsidence and Unstable Land	YES	NO	The subject site has not been identified as being located within a proclaimed Mine Subsidence District. However, the site has been identified as containing shallow mine workings. A full geotechnical investigation has been undertaken to determine areas of the site which would be at risk to future development. The assessment concludes that the site can be developed provided future investigations are undertaken as recommended in the report.
4.3 - Flood Prone Land	YES	NO	The subject site is subject to some flooding. The subdivision has been designed to mitigate this risk and as such is considered consistent.
4.4 - Planning for Bushfire Protection	YES	YES	Having regard to this direction the proposal put forward would have regard to *Planning for Bushfire Protection 2006*, introduce controls that avoid placing inappropriate developments in hazardous areas, and ensure that bushfire hazard reduction is not prohibited within the APZ. It is therefore considered that the proposal can be consistent with the s117 direction.
5.1 - Implementation of Regional Strategies	YES	YES	There is nothing in the proposal that is inconsistent with the directions for housing in the Hunter Regional Plan.
5.2 - Sydney Drinking Water Catchments	NO	-	
5.3 - Farmland of State and Regional Significance on the NSW Far North Coast	NO	-	
5.4 - Commercial and Retail Development along the Pacific Highway, North Coast	NO	-	
5.5 - Development in the vicinity of Ellalong, Paxton and Millfield (Cessnock LGA) (Revoked 18 June 2010)	N/A	-	
5.6 - Sydney to Canberra Corridor (Revoked 10 July 2008. See amended Direction 5.1)	N/A	-	
5.7 - Central Coast (Revoked 10 July 2008. See amended Direction 5.1)	N/A	-	

5.8 - Second Sydney Airport: Badgerys Creek	NO	-	
5.9 - North West Rail Link Corridor Strategy	NO	-	
6.1 - Approval and Referral Requirements	YES	YES	Nil
6.2 - Reserving Land for Public Purposes	YES	YES	Nil
6.3 - Site Specific Provisions	YES	YES	Nil
7.1 - Implementation of the Metropolitan Plan for Sydney 2036	NO	-	

ATTACHMENT 6

PRELIMINARY STORMWATER MANAGEMENT PLAN

STORMWATER MANAGEMENT PLAN



For

PROPOSED REZONING AND SUBDIVISION

At

LOT 1 DP873220

71 BRANXTON STREET, GRETA

Prepared for

KARL WAEGER

November 2017

Report No: 17/015/2 Rev2

Prepared by

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Applicant:	Karl Waeger
HDB Project Manager:	Tony O'Beirne
HDB Reference Number:	17/015

Project Manager  ***Date*** 23/10/17

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APPENDICES

FIGURES

TABLES

1.0 INTRODUCTION

HDB Town Planning & Design have been engaged by Karl Waeger to prepare a Stormwater Management Plan (SMP) for the proposed subdivision and associated rezoning of Lot 1 DP 873220 located at 71 Branxton Street, Greta. The subdivision site is located less than 1km north of Greta's commercial centre. The site is approximately 5.8ha in area and is currently zoned RU2 - Rural Landscape.

The rezoning is for the purpose of residential development.

1.1 PURPOSE OF THIS PLAN

The purpose of this document is to demonstrate that rezoning and subsequent subdivision of the site can effectively satisfy all applicable legislative requirements and best practice guidelines with regard to flood impact and stormwater management. Design has been undertaken with regard to flood impact and stormwater management, including appropriate control measures, in which the proposal will meet regulatory requirements. Where we require significantly greater data and detailed analysis in order to identify controls, the expected information has been broadly summarised for analysis within consequent stages of the application process, should that option be further pursued.

The site been designed in such a manner as to ensure:

- All proposed new lots have adequate flood free building envelopes for up to, and including, the 100yr ARI flood event (as identified by Peter Sullivan and Associates 1995 report) from the existing watercourse;
- Attenuation of peak stormwater runoff from the post-development catchment to be comparable to the pre-development (existing) catchment runoff for the 10yr and 100yr ARI design event; and
- Potential water quality issues are considered and recommended treatment measures to reduce urban water pollutants resulting from the increased hardstand areas.

It is intended that this document will provide guidance to both the developer and contractors as to their obligations to ensure that potential impacts regarding stormwater issues are minimised.

The design strategy is conceptual in nature and does not include detailed design or detailed stormwater modelling, however, for the purpose of recognising overall implications and management, the strategy provides broad quantities and recommendations.

1.2 GUIDING DOCUMENTS

The design strategy has been undertaken using recent best practice guidelines and documentation. The following documents have provided key inputs into this SMP:

- *National Water Quality Management Strategy* (ANZECC, 2000);
- *Australian Runoff Quality* (Engineers Australia, 2006);
- *Australian Rainfall and Runoff: A guide to flood estimation* (Engineers Australia, 2001);
- *NSW Floodplain Development Manual* (DIPNR, 2005);
- *Landcom's Water Sensitive Urban Design Guidelines;*
- *WSUD Technical Design Guidelines for South East Queensland* (Healthy Waterways, 2006); and
- *The City of Cessnock's Engineering Requirements for Development (1995).*
- *Lake Macquarie City Council (LMCC) MUSIC Line Guideline*

While some details in the above documentation vary somewhat, the broad objectives of all of these documents have been used to guide this SMP. The strategy has prioritised the locally focussed documentation above national and regional.

2.0 EXISTING SURFACE WATER ENVIRONMENT

The site is bounded to the south-east, south-west and north-west by West Street, Branxton Street, and Hollingshed Street, respectively. West Street is currently unformed. North-east of the development is rural land zoned RU2. An unnamed 2nd Order (Strahler ordering) watercourse bisects the north-eastern corner of the land parcel, meanders south onto adjacent land, where a separate 1st Order tributary is collected, prior to bisected the most southern corner of the land parcel and conveying flow under Branxton Street, eventually discharging in Anvil Creek. The watercourse also drains through an on-line farm dam in the north-eastern corner of the property.

The area has previously been the subject of flooding investigations in association with the Greta Drainage Study undertaken by Peter Sullivan and Associates (1995). Cessnock City Council have advised the 100yr ARI flood level resulting from these investigations varies from 51.2m AHD in the north-east corner and 47.1m AHD in the southern corner of the property. Council has identified these flood levels, in addition to the standard 500mm freeboard, as appropriate for flood planning restrictions relating to the site.

The site falls to the east draining to the watercourse with typical grades of between 4% and 8%. Detailed survey information has not been obtained for the purpose of this planning proposal, rather interpolation of LPI topographical mapping analysed in conjunction with known flood levels at the site and assumed bed levels. The typical bed grade in the creek was adopted and an assumed depth from bed to the 100yr flood level adopted at 1.2m in the downstream (south-western) boundary and 0.7m depth at the upstream (north-eastern) boundary. The LPI data indicated higher RL levels than what was in the Peter Sullivan and Associates 1995 report. As a result, the 100 yr ARI flood extents have been transferred to the plan; however the LPI RL height data has been used in the design.

Limited site specific geotechnical information has been made available for the purpose of this report, however, regional mapping information has been considered. Soil mapping information obtained from eSPADE (NSW Environment and Heritage) indicated topsoils of sandy loam to loams, and subsoils of light to medium clays, typically occur in the area. For the purpose of surfacewater infiltration characteristics, soils have been assumed to have slow infiltration rates and layer, which may impede the downward movement of water.

At present the site contains a residential dwelling, associated sheds and ancillary structures, along with an access drive.

Figure 1 demonstrates the existing land parcel.

3.0 PROPOSED SUBDIVISION

The planning proposal includes consists of 44 lots accessed by a circuit road, cul-de-sac and directly off West Street. Intersections with Hollingshed Street and West Street will be introduced. Of the 44 proposed lots, 3 lots are located on land affected by the 100yr ARI design flood (as identified by Peter Sullivan and Associates); however minor controlled filling in this area will lift these lots out of the flood zone. Vehicle access / egress would be maintained in the 100 yr ARI event.

The cumulative impact of development in the floodplain and potential increase in flood levels and velocities will require consideration; however these impacts are considered to be negligible for this study. Additional survey information would be necessary in order to carry out this analysis and the effect of the construction of West Street on the flood extents.

This proposal is shown in ***Figure 2***.

4.0 SURFACE WATER MODELLING ASSUMPTIONS AND METHODOLOGY

4.1 WATER QUANTITY - DRAINS

Investigation of the existing surfacewater flow across the proposed development site has occurred through the creation of a hydrological model using DRAINS modelling software. DRAINS is an event-base hydrologic and hydraulic software package which adopts ILSAX hydrological routing to derive catchment flow hydrographs. On-site detention requirements were estimated based upon the 10yr and 100yr ARI design events.

The pre-development and post-development hydrological parameters used within the DRAINS modelling are detailed in ***Table 1***.

Hydrological DRAINS modelling parameter	Parameter description and value used
Antecedent Moisture Condition (Ranges 1-4 Dry to Saturated)	Rather Wet - 3
Soil type (Ranges 1-4, sand and gravels to clays with permanent high water table)	Between soil types with slow infiltration rates (may have layers that impeded downward movement of water) and soil types with high runoff potential and very slow infiltration rates – 3.5
Paved Depression Storage (mm)	1
Grassed Depression Storage (mm)	5
Manning's Pervious Overland Roughness *n	0.15
Manning's Impervious Overland Roughness *n	0.014

Table 1: Hydrological modelling parameters

Rainfall Intensity-Frequency-Duration (IFD) information was obtained using the Bureau of Meteorology's IFD program for co-ordinates identified at the site. The design rainfall hyetographs have then been identified by the software package using the temporal pattern appropriate to the area and in accordance with Book 2 of AR&R 1987. The IFD data used for the purpose of the surfacewater modelling is demonstrated in ***Appendix A***.

The primary purpose of this report is to identify stormwater mitigation measures to ensure the development does not increase peak flow rates or impact upon existing surfacewater flow regimes. Therefore, the catchment area modelled has been limited to the site area that will be impacted by the proposed development. Diversion drains were assumed on the development boundaries, and runoff from Hollingshed Street was assumed to be conveyed by road side swales to the water

course below the site. Flow from the site currently discharges as sheet flow to the watercourse.

The existing site was modelled in two catchments draining to the existing watercourse and negating flow external to the site. The existing site was conservatively assumed to be completely pervious.

The proposed subdivision assumed each new lot would include 500m^2 of hardstand impervious area and a 6m road pavement within the proposed road reserve areas. Piped street drainage and inter-allotment drainage was assumed. Direct discharge from lots into the creek was stopped by introducing inter-allotment drainage in Catchment B, in order to address water quality. Instead all site water would be directed to the offline basin. Road grades and lot slopes were assumed to remain consistent with natural grades. The existing catchment and developed catchments are demonstrated in ***Figure 1***, ***Figure 2***.

The modelled basin as shown in ***Figure 3***, used 1 (vertical) to 6 (horizontal) basin side slopes. Peak flow attenuation was dependent on a storage-elevation (or in a similar fashion, height-discharge) relationship which is demonstrated in ***Appendix B*** and the inflow / outflow hydrographs in ***Appendix C***.

4.2 WATER QUALITY - MUSIC

Investigation of the effect of the development on water quality and the required level of mitigation was analysed in MUSIC modelling software. In the absence of water quality guidelines for Cessnock City Council, load based targets sourced from Lake Macquarie City Council (LMCC) MUSIC Guidelines have been used. These are shown below in ***Table 2***.

Pollutant	Minimum Load Reduction Target (%)
Total Suspended Solids (TSS)	80
Total Phosphorus (TP)	45
Total Nitrogen (TN)	45
Gross Pollutants (GP)	70

Table 2: Load based targets

It was decided that the development would use an offline bio-retention basin integrated into the detention basin in order to improve water quality. The bio-retention basin has the properties shown in ***Table 3***.

Bio-retention Basin	Value
Filtration Area	450m2
Extended Detention Depth	300mm
Depth of filter material	400mm

Table 3: Bio - retention basin

5.0 MODELLING RESULTS

5.1 WATER QUANTITY- DRAINS

Hydrological modelling for the 10yr and 100yr ARI design event was conducted.

Table 4 demonstrates the resulting peak discharge rates with/without mitigation and the existing site at the downstream subdivision boundary.

Subdivision Option	10yr ARI Peak Catchment Discharge (m^3/s)	100yr ARI Peak Catchment Discharge (m^3/s)
Existing Site	0.59	1.15
Developed Site- No Mitigation	1.10	1.72
Developed Site- w/ Mitigation	0.50	1.19

Table 4: Results of the post-development modelling with / without mitigation

Using the previously discussed storage and discharge assumptions (refer to ***Section 4***), the required basin storages to attenuate peak flow to be comparable for the 10yr and 100yr ARI design events, have been calculated. ***Table 5*** demonstrates the results of such, as well as the maximum water level, peak discharge, and elevation associated with each area. A low flow pipe of 450mm diameter was placed with its invert at RL49.8m (300mm above the basin base). A 5m weir with crest at RL50.5m was also modelled.

Subdivision Option	Basin Elevation (m AHD)	Basin Area (m^2)	Maximum Water Level	Peak Outflow (m3/s)
Developed Site- w/ Mitigation (450mm low flow pipe, 5m weir)	49.5	450	50.7	1.19
	51.2	1800		

Table 5: Basin properties

5.2 WATER QUALITY - MUSIC

In order to achieve the water quality targets, all developed lots were designed to discharge into the offline basin in order to limit direct discharge into the creek. The results are shown below in ***Table 6***.

Pollutant	Load Based Reduction Target (%)	Modelled Reduction (%)
Total Suspended Solids (TSS)	80	89.5
Total Phosphorus (TP)	45	46.3
Total Nitrogen (TN)	45	58.6
Gross Pollutants (GP)	70	100

Table 6: Water quality pollutant reduction

6.0 THE PROPOSED DESIGN

The proposed option has the following features:

- Low density residential development with minimal intrusion into the 100yr ARI design event for the watercourse (as identified by Peter Sullivan and Associates);
- Probable safe vehicular access to all lots (this however should be confirmed within further stages from site survey);
- Flood free lots up to the 100yr ARI design event from the watercourse, with minor filling in the flood zone;
- On-site detention to ensure the subdivision does not increase peak flow for the 10yr and 100yr design storm event;
- Design of the road drainage to ensure piped conveyance of the 5yr ARI is required at later stages in the development application process, in accordance with the City of Cessnock's *Engineering Requirements for Development*; and
- Minimal disturbance of the natural watercourse.

In order to attenuate post-development peak flow to be comparable to that of the pre-development site (running a multi-storm analysis); the detention basin design was found to require the following elements:

- A base area of 450m^2 at RL 49.5m AHD and a total footprint of 1,800m^2 (using 1 vertical to 6 horizontal embankment side slopes). This allowed for 500mm of freeboard and a maximum ponding depth of 1.2m in the 100 yr ARI design event;
- A low flow outlet pipe of 450mm diameter with invert at RL49.8m (300mm above the basin base); and
- A designed overflow weir modelled using a 5m base width set to an elevation of RL 50.5m AHD, to allow for safe discharge of flows up to the 100yr ARI design storm.

Scour protection and detailed outlet design will be required during the later stages of the development application process.

The primary aim of this Stormwater Management Plan is to ensure that stormwater can be effectively managed with the implementation of detention facilities and overland flow paths. In conjunction with the buffer zone to the creek, the detention basin will also provide water quality treatment in the form of a bio-retention basin. This bio-retention basin has the following elements:

- A filtration area of 450m^2;
- An extended detention depth of 300mm (to the low flow pipe); and

- A filter material depth of 400mm.

The proposed low density residential subdivision utilises buffer zones which will assist in nutrient and pollutant removal. BASIX requirements for rainwater tanks will also provide additional treatment benefits.

In summary of the water quality treatment; pollutant and nutrient removal can effectively be provided for using:

- Rainwater tanks as per BASIX requirements for each lot;
- Buffer zones from impervious areas; and
- Discharge to an offline bio-retention basin.

6.1 PROPOSED WATER MANAGEMENT SUMMARY

The proposed water management system has been designed in such a manner that:

- Post-development flow rates are comparable to pre-development flows for up to and including the 100yr ARI design event at the downstream boundary of the site;
- Allocation of flood free new lots for up to and including the 100yr ARI flood event from the unnamed 2nd Order watercourse;
- Minimalistic development and minimal potential impact on natural flow regimes; and
- The provision of water quality treatment measures through the use of rainwater tanks, buffers, and a bio-retention basin.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The planning proposal has broadly identified the storage requirements in order to attenuate post-development peak flow to be comparable to pre-development flow. Allocation of basin location has been undertaken.

In the event that this proposal is pursued, consideration should be given to further investigation prior to issue of a subdivision certificate. It is recommended that the following further data be provided as a condition of consent, at the subdivision certificate stage:

- Site survey information that will demonstrate levels and flood depths detailed at critical locations; and
- Assurance that safe vehicular access can be provided without significant impacts upon flow regimes, for up to the 100yr ARI design event.

The detailed design would include the following elements:

- Design for conveyance of flow from the roadway for the 5yr ARI design event;
- Attenuation of post-development peak flow comparable to that of the pre-development peak flow for up to the 100yr design event; and
- Water quality treatment through a variety of measures using the treatment train approach.

While the design is conceptual in nature, it is adequate to satisfy the objectives of Council's requirements.

Figure 1

Existing Catchments

Existing Catchments

Scale - 1:500 @ A3
Date - 23/10/2017
Revision - B
Drawn - AN

Lot 1 DP 873228
71 Branxton Street, Greta

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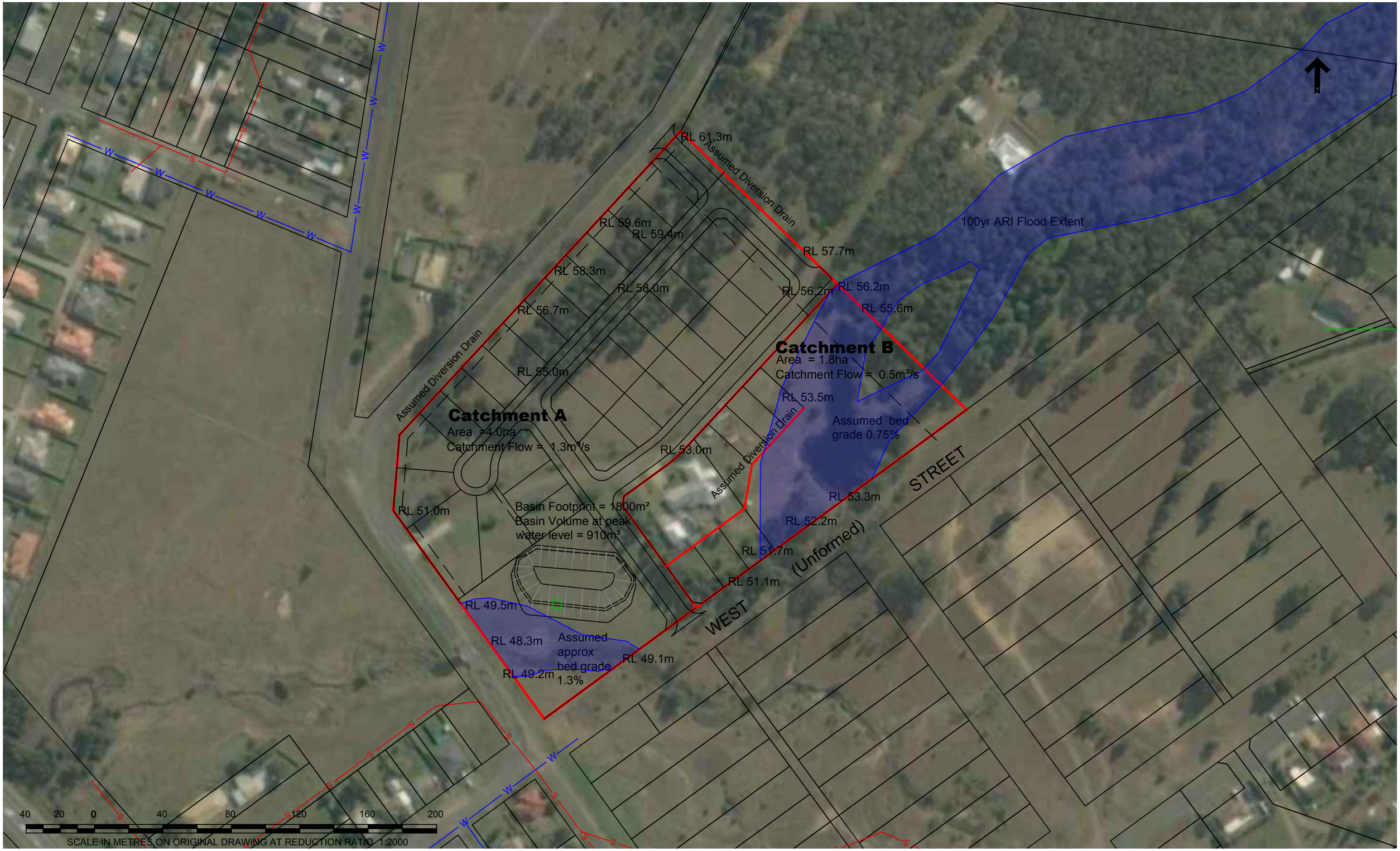
planning > design > development

Figure 2

Developed Catchments



PROPOSED DEVELOPED CATCHMENTS

Scale - 1:2000 @ A3
Date - 24/10/2017
Revision - A
Drawn - AN

Lot 1 DP 873228
71 Branxton Street, Greta

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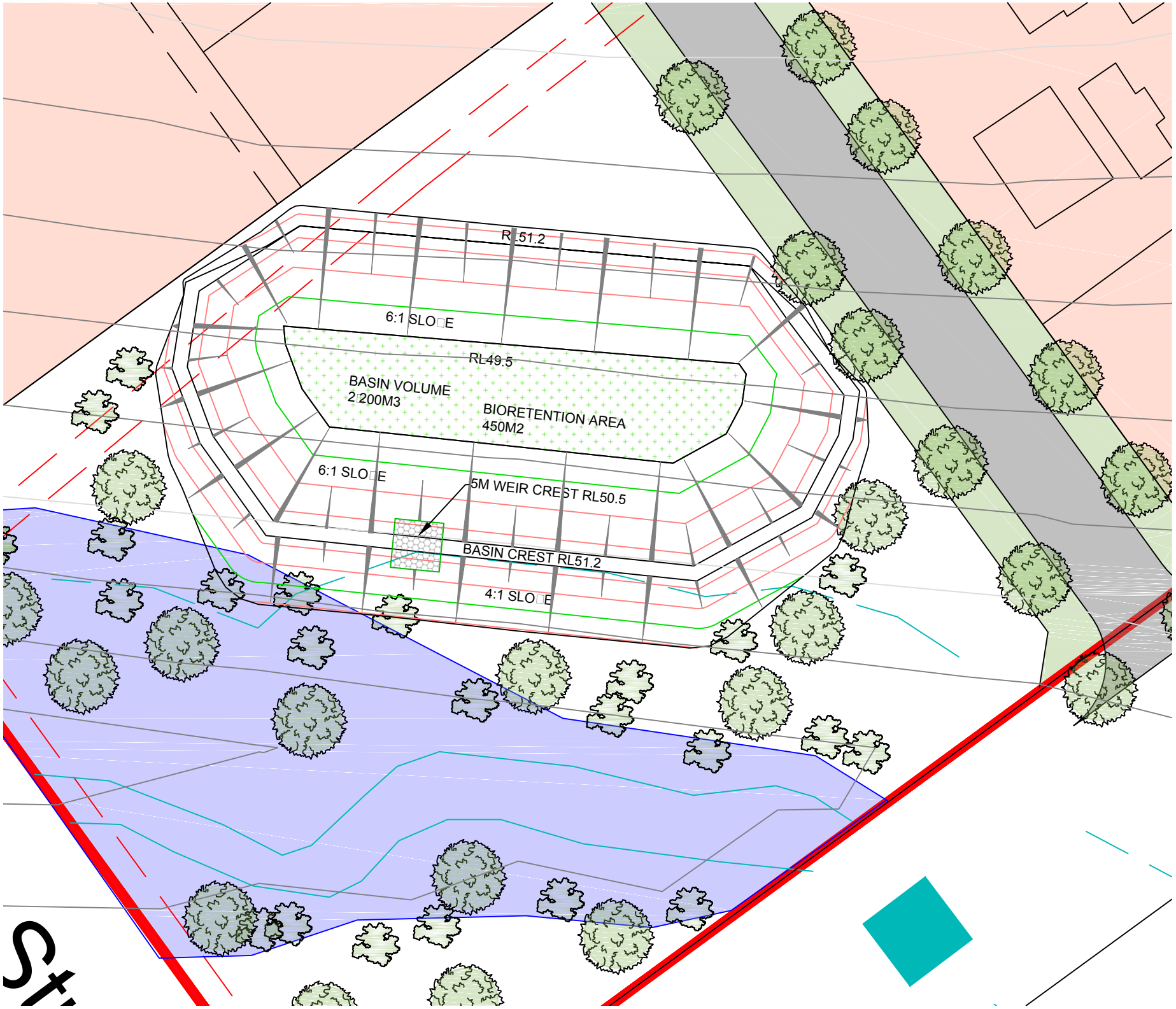
Figure 3

Basin Details


RL51.2
6:1 SLOPE
RL49.5
BASIN VOLUME
2200M3
BIORETENTION AREA
450M2
6:1 SLOPE
5M WEIR CREST RL50.5
BASIN CREST RL51.2
4:1 SLOPE

Appendix A

Intensity-Frequency-Duration (IFD) Data

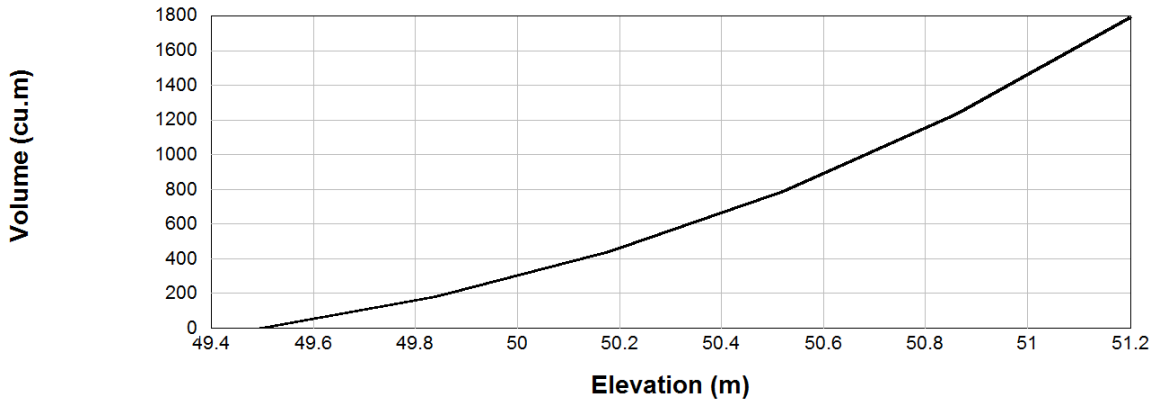
Longitude	151.3904	Latitude	-32.6734

Intensity-Frequency-Duration Table

DURATION	1 Year	2 years	5 years	10 years	20 years	50 years	100 years
5 Mins	70.4	91.2	119	135	157	187	209
6 Mins	65.9	85.3	111	127	147	174	196
10 Mins	53.7	69.5	90.2	103	119	141	158
20 Mins	39.1	50.4	64.9	73.4	84.8	99.9	112
30 Mins	31.8	40.9	52.3	59.1	68.1	80	89.2
1 Hr	21.3	27.5	35.1	39.5	45.5	53.4	59.5
2 Hrs	13.7	17.7	22.7	25.7	29.6	34.9	38.9
3 Hrs	10.4	13.5	17.4	19.8	22.9	27.1	30.3
6 Hrs	6.52	8.47	11.1	12.7	14.8	17.6	19.7
12 Hrs	4.16	5.41	7.15	8.21	9.6	11.5	12.9
24 Hrs	2.73	3.56	4.69	5.38	6.3	7.51	8.46
48 Hrs	1.8	2.34	3.06	3.49	4.06	4.82	5.42
72 Hrs	1.36	1.76	2.3	2.62	3.05	3.62	4.06

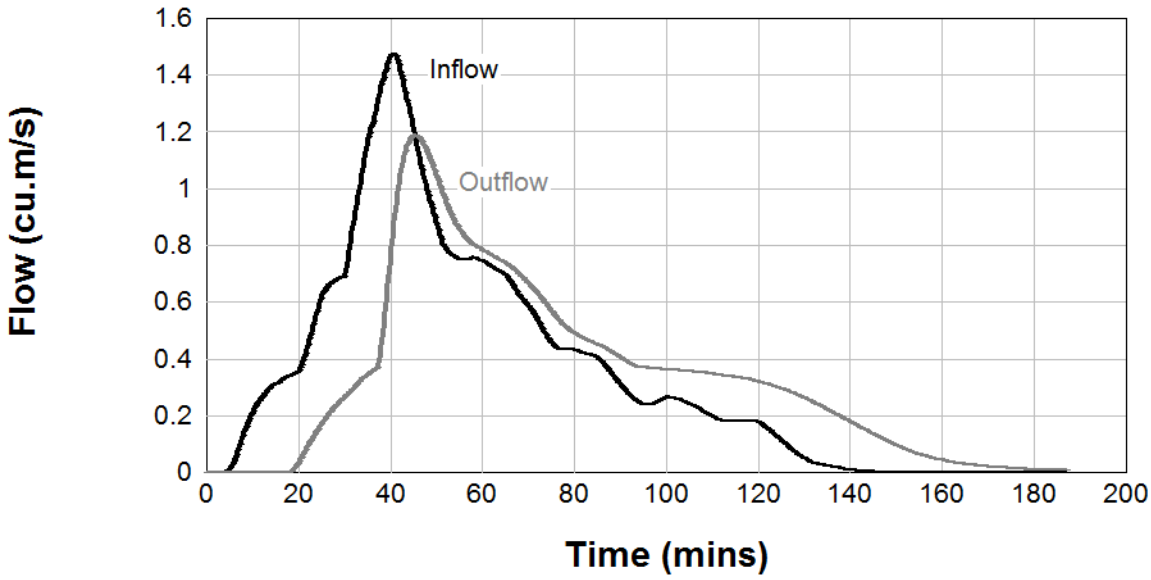
Appendix B

Storage-Elevation Relationships



Appendix C

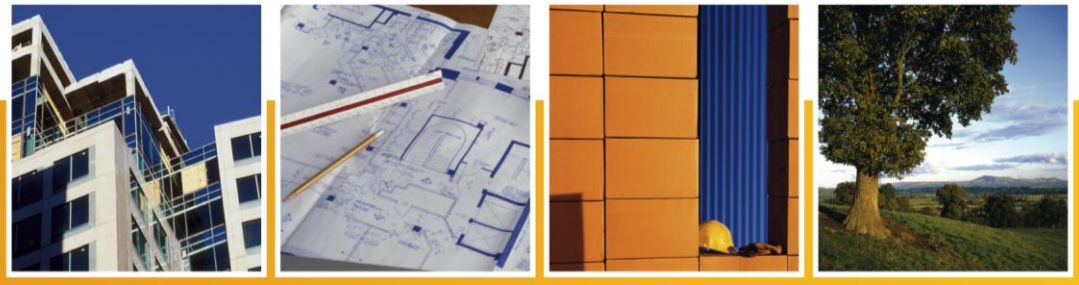
Basin Inflow / Outflow Hydrographs



ATTACHMENT 7

PRELIMINARY BUSHFIRE THREAT ASSESSMENT

BUSHFIRE THREAT ASSESSMENT



For

PROPOSED REZONING AND SUBDIVISION

At

LOT 1 DP873220

71 BRANXTON STREET, GRETA

Prepared for

KARL WAEGER

November 2017

Report No: 17/015/3

Prepared by

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Final	1	Client	1	17.11.17	LS	KN

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HDB Project Manager:	Leena Sebastian
HDB Reference Number:	17/015

Project Manager ***Date*** 17th November 2017

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APPENDICES

FIGURES

TABLES

1.0 INTRODUCTION

HDB Town Planning & Design (HDB) has been engaged by Mr Karl Waeger to undertake a Bushfire Threat Assessment to support a Planning Proposal for the property at Lot 1 DP 873228, 71 Branxton Street, Greta.

The site is currently zoned RU2 - Rural Landscape under Cessnock LEP 2011. The Cessnock Citywide Settlement Strategy 2010 identifies Greta and neighbouring settlements as being subject to significant change over the next 25 years due to their strategic location at the fringe of residential areas, alongside main infrastructure corridors providing easy access to full reticulated systems. The Strategy recommends an upgrade in the village status of Greta to 'Low Density Residential'. The site also meets the criteria for housing development in the recently adopted Branxton Subregion Land Use Strategy. Consequently a rezoning to R2 - Low Density Residential Zone is required to facilitate rezoning and development.

The property is identified as being bushfire prone in Council's Bushfire mapping; any future residential development on the site will therefore be subject to consideration under Section 100B of the Rural Fires Act and *Planning for Bush Fire Protection 2006*.

This Bushfire Threat Assessment identifies the bushfire hazards associated with the site and examines the ability of the future subdivision to accommodate bushfire protection measures in accordance with *Planning for Bushfire Protection 2006* (henceforth referred to as PBP 2006).

The following legislative requirements and guidelines have been the basis of this Bushfire Threat Assessment:

- Section 100B of the Rural Fires Act;
- Planning for Bushfire Protection 2006 (PBP 2006); and
- AS 3959 – 2009 Construction of buildings in bushfire prone areas.

2.0 SITE DETAILS

Address: 71 Branxton Street

Local Government: Cessnock City Council

Locality: Greta

Area: 5.84ha

Zone: RU2 - Rural Landscape

Figure 1 is the aerial photo of the site's location.

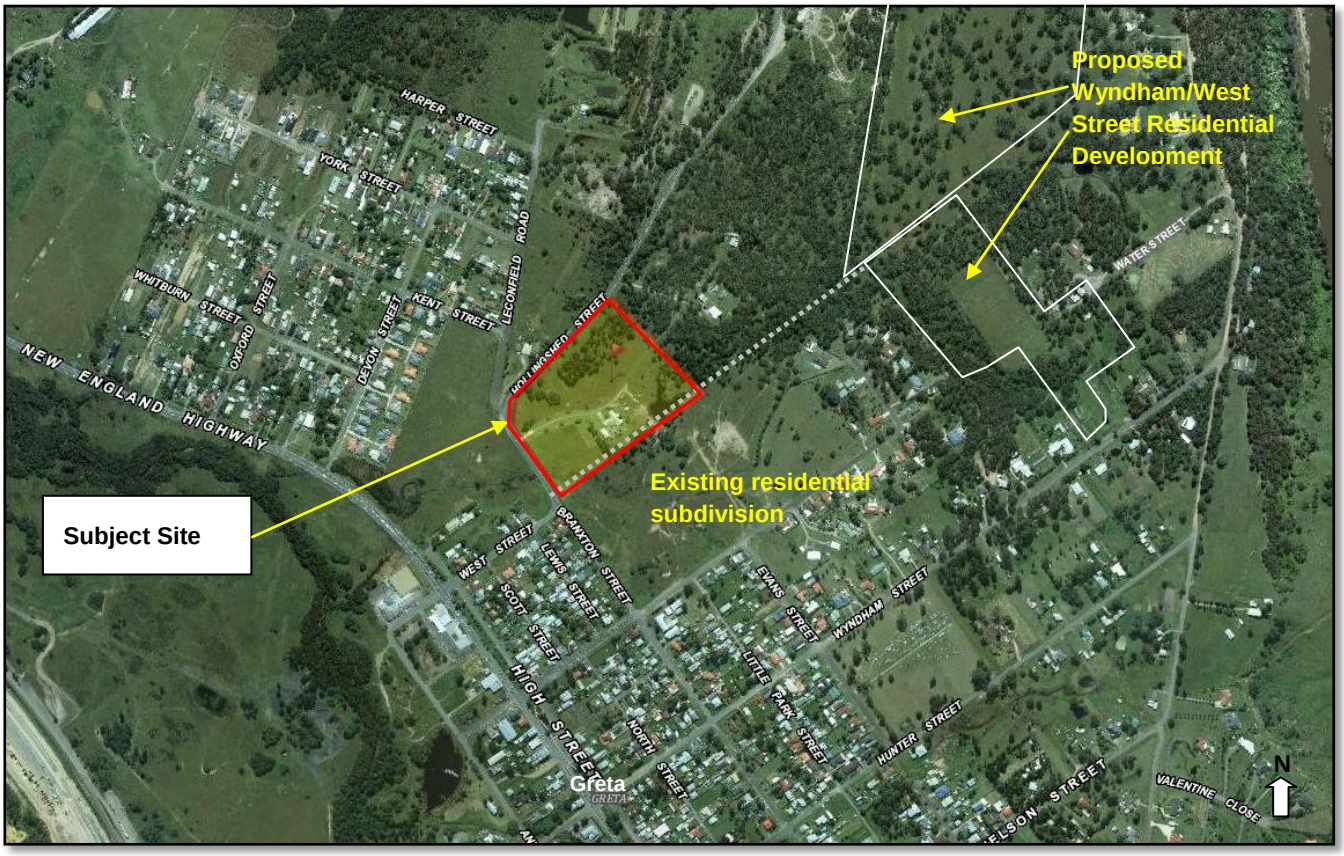

Figure 1: Location map

Source - Six Maps, Accessed August 2014

2.1 SITE DESCRIPTION AND SURROUNDING USES

The site is located approximately 550m to the north of Greta Town Centre at the intersection of Branxton Street and Hollingshed Street. The current site improvements include a dwelling with a detached carport, and ancillary sheds which are accessed through a driveway off Branxton Street (refer to ***Figure 2***).

The site is situated on the fringe of the rural landscape zone and is largely surrounded by established residential developments to the east, west and south. The proposed Wyndham Ridge Estate development and the associated extension of West Street

(along the eastern boundary of the site) will provide a third access option for the subject property (refer to ***Figure 1***). The surrounding residential developments are characterised by single dwelling units on 800m² to 1,000m² lots.

Easement for electricity transmission lines and water supply ranging from 3m to 15m in width exist on the site.

The following services were identified in Branxton Street and / or Hollingshed Street:

- Telecommunications - Telstra NSW, Central
- Electricity - Ausgrid (formally Energy Australia)

Gas services and water / sewer services are located within the Greta area and have the potential to be extended to the site.

Figure 2: Existing access to the property
Source - HDB Town Planning & Design

2.2 TOPOGRAPHY

A dam and a 2nd order drainage line are located in the north-east corner of the site, which drains in a westerly direction into Anvil Creek. The topography of the site is gently undulating towards the drainage line at slopes less than 5°.

The site vegetation largely consists of pine trees and a small cluster (approximately 500m^2) of potential Ecologically Endangered Communities (EECs) as shown in ***Figure 3***.

The "Hunter, Central and Lower North Coast Vegetation Classification and Mapping Project" identifies vegetation types located within the area to include; Red Ironbark / paperbark shrubby open forest; and Parramatta Red Gum / *Melaleuca Nodosa*

shrubby woodland in the Cessnock / Kurri Kurri area. These areas are considered *Endangered Ecological Communities* within the Kurri Sand Swamp Woodland in the Sydney Basin Bioregion. This will need to be confirmed by a Flora and Fauna Assessment as part of the preparation of the Development Application (DA).

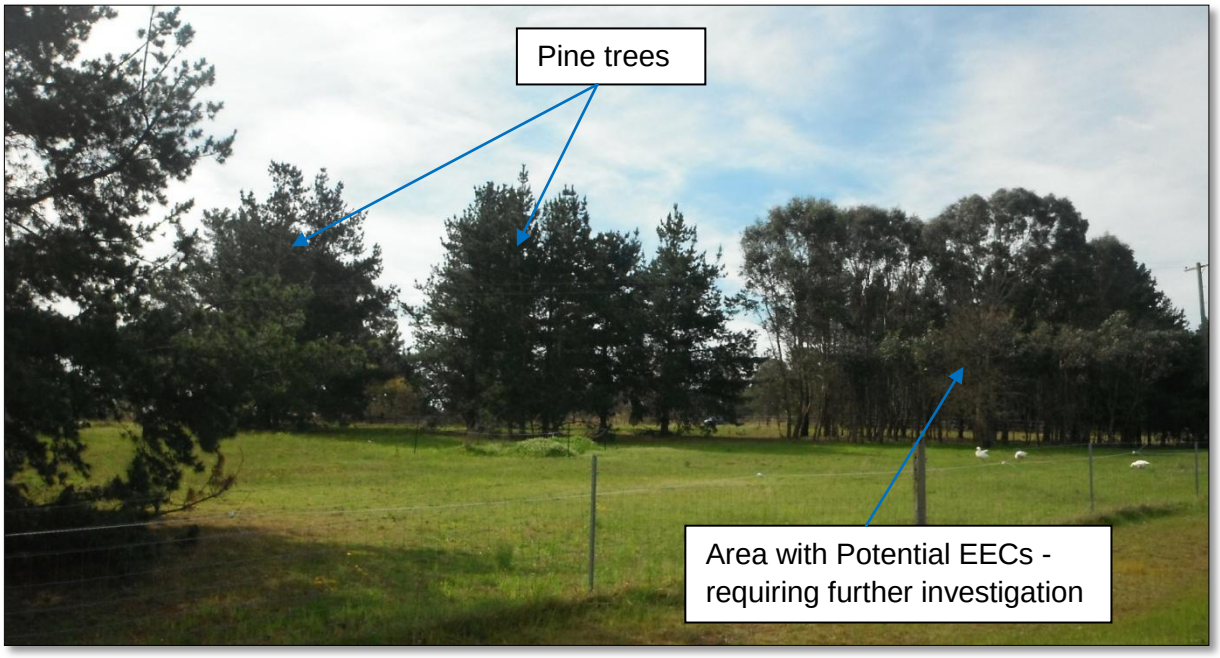

Figure 3: Site vegetation
Source - HDB Town Planning & Design

2.3 SITE CONSTRAINTS

2.3.1 ENVIRONMENTALLY SENSITIVE LAND

The subject site and surrounding areas have been identified as environmentally sensitive lands in Council's mapping, as shown in ***Figure 4***.

Figure 4: Environmentally sensitive land map
Source: Cessnock City Council

2.3.2 FLOODING

Council's flood mapping indicates that the north-east and south-east sections of the site are affected by the 1 in 100 year Average Recurrence Interval (ARI) flood event.

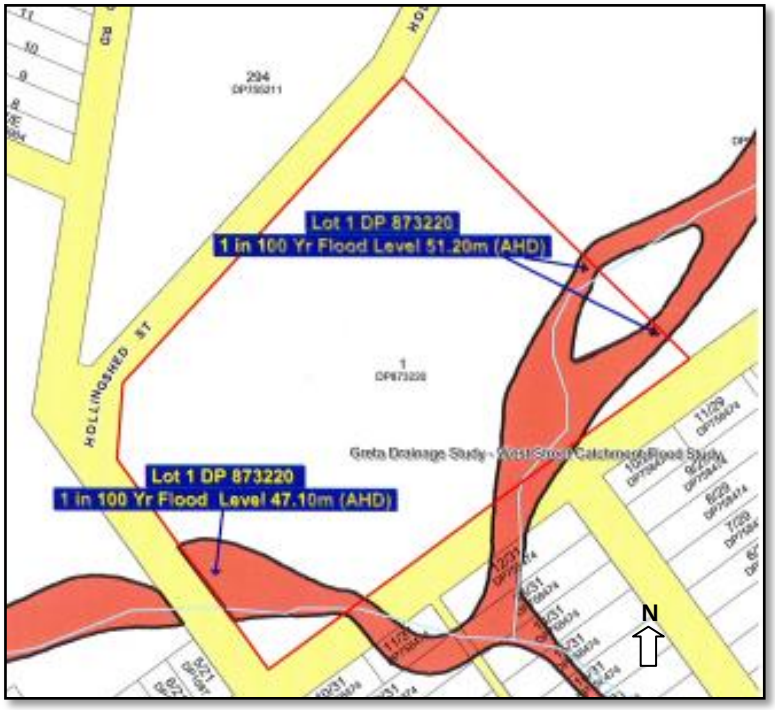

Figure 5: Flood map
Source: Cessnock City Council

2.3.3 BUSHFIRE

The Council's bushfire mapping identifies areas of category 1 bushfire vegetation and bushfire buffer areas on the site as shown in ***Figure 6***.

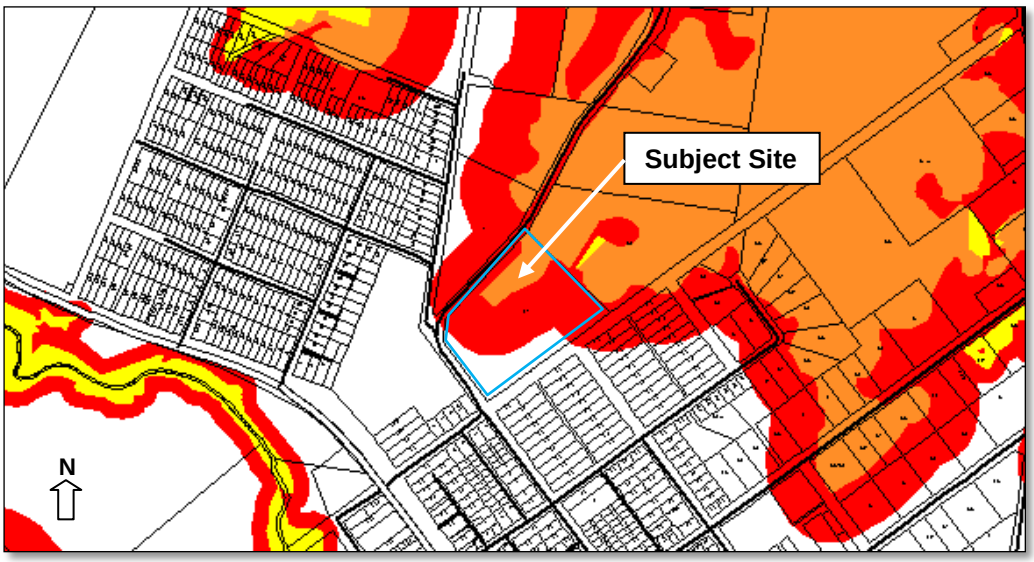

Figure 6: Bushfire prone land map
Source: Cessnock City Council

2.3.4 HERITAGE

The site does not contain, nor is it located in the vicinity of, any items of heritage significance. A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that there are no aboriginal sites, or places, recorded on the subject property.

3.0 PROPOSED DEVELOPMENT

The proposed rezoning from RU2 - Rural Landscape Zone to R2 - Low Density Residential Development aims to facilitate future residential subdivision on the property.

The proposal will require some vegetation removal on the development site. A Flora and Fauna Assessment undertaken for the site has concluded that the clearing is insignificant to have any adverse impacts.

The subdivision proposes a range of lot sizes between 520m^2 and 2,722m^2. The internal road system will connect to Hollingshed Street along the western boundary and West Street extension along the south-east, which is currently underway.

A copy of the concept plan is attached as ***Appendix A***.

4.0 BUSHFIRE THREAT ASSESSMENT

The methodology outlined in Appendix 3 of PBP 2006 forms the basis of this Bushfire Threat Assessment, which involves the following steps:

- Step 1 – Identify all vegetation assemblages within 140m of the site;
- Step 2 – Determine the effective slope under the vegetation;
- Step 3 – Determine the Fire Danger Index (FDI) for the area;
- Step 4 – Match the relevant FDI, appropriate vegetation, distance, and effective slope classes to determine the level of bushfire attack.

4.1 VEGETATION AND SLOPE ASSESSMENT

A site inspection was carried out to identify the type and extent of vegetation. Aerial photographs of the site were also used to determine the coverage. The results of the vegetation analysis are presented in ***Figure 7***.

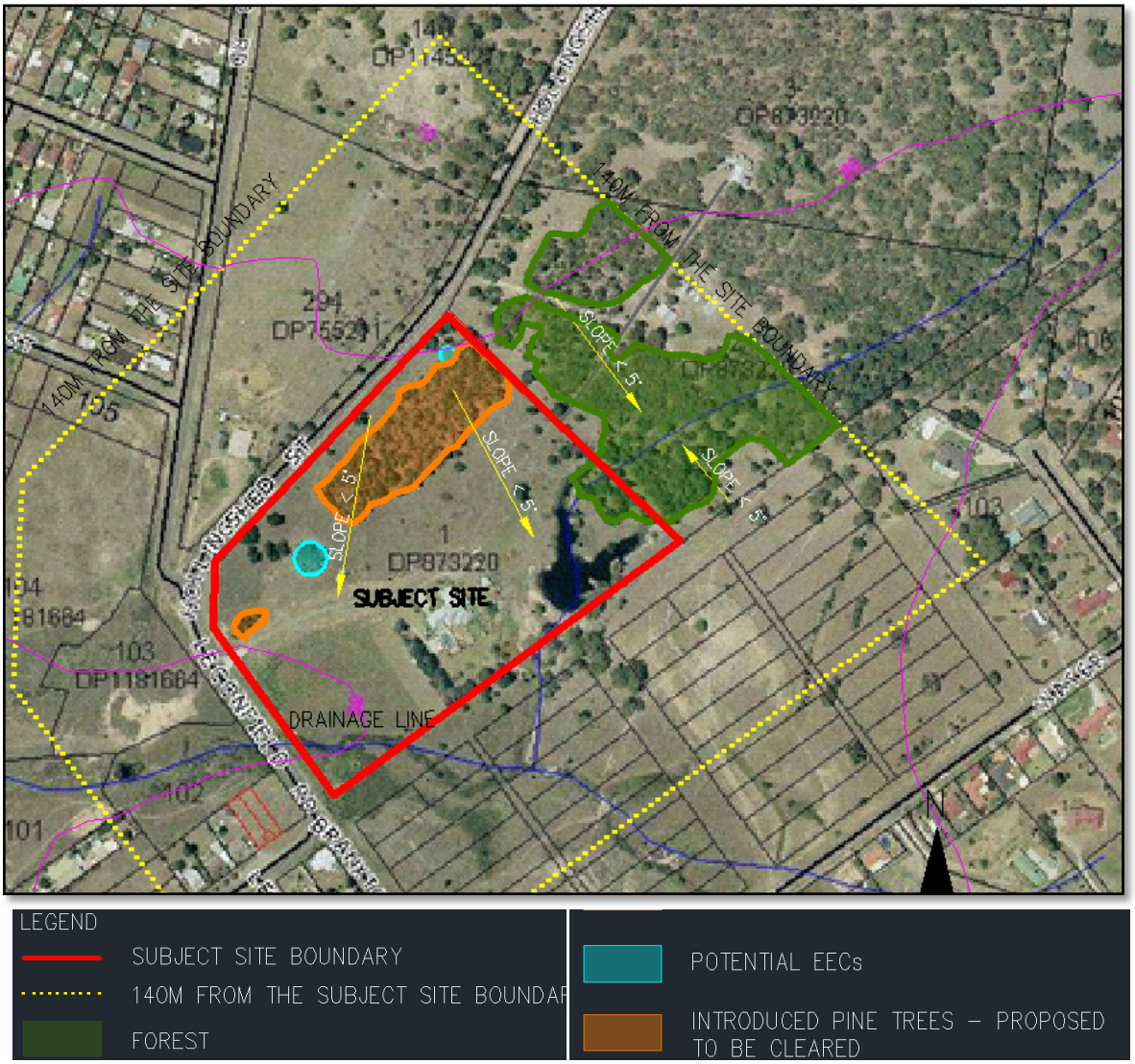

Figure 7: Vegetation within 140m of the subject site
Source - HDB Town Planning & Design

Figure 8: Vegetation between the neighbouring dwellings within the 140m buffer
Source - HDB Town Planning & Design

Figure 9: Vegetation adjoining the north-east part of the site
Source - HDB Town Planning & Design

The assessment has excluded the existing pine trees on the site, as the proposed residential development will require their removal with Council's consent.

Owing to its small size (less than 1hectare), and the distance from the bushfire prone vegetation (more than 100m), the area with potential EECs is not considered a bushfire threat; nevertheless it is noted that they will be removed for development purpose.

A mix of vegetation assemblages were identified in the 140m buffer along the sites north-east boundary. Areas of cleared and managed landscape were observed within the curtilage of the neighbouring dwellings and their access ways. In unmanaged areas, away from the dwellings and closer to the drainage line; open forests formed the main vegetation assemblage.

The slope under the vegetation (for a distance of 100m) was determined from electronic contour maps (10m contour interval) and from site inspection.

A summary of the vegetation type and their respective slopes are given in ***Table 1***.

Direction	Distance to the vegetation from the site boundary	Vegetation assemblage	Effective slope
North-east	Adjoins the boundary	Predominantly open forest with small areas of cleared and managed vegetation. Refer to Figures 7, 8 & 9.	Cross slope (considered to be level with respect to subject site)
South-east	N/A	N/A - Adjoined by a recently approved subdivision with a potential future road along the boundary.	N/A
South-east	N/A	N/A - Adjoined by road and cleared land.	N/A
North-west	N/A	N/A - adjoined by road and private residential property.	N/A

Table 1: Summary of vegetation analysis within 140m of the site
Source - HDB Town Planning & Design

4.2 DETERMINATION OF THE APZ

The FDI for Cessnock LGA is 100. Appendix 2 of PBP 2006 specifies the minimum requirement for Asset Protection Zones (m) for Residential and Rural Residential subdivision purposes to correspond to a radiant heat exposure less than or equal to 29kW/m^2. Based on the setback distances given in Table 4 of AS3959-2009 it is recommended that an APZ of 25m is maintained along the north-eastern boundary of the subject site to achieve a minimum Bushfire Attack Level (BAL) rating of 29 for the future residential subdivision.

5.0 BUSHFIRE MANAGEMENT MEASURES

The ability of the future subdivision to support bushfire management measures was assessed based on the performance criteria specified in chapter 4 of *Planning for Bushfire Protection 2006* as provided below:

5.1 APZ

As mentioned in ***Section 4.2*** of this report, the subdivision will require an APZ of 25m along the north-eastern boundary. This is largely absorbed within the 18m wide road reserve at the interface of the bushland. The remaining APZ can be easily accommodated in the front setback of the lots as indicated in the subdivision layout in ***Appendix A***. Therefore all the lots in the proposed subdivision comply with the APZ requirements.

5.2 ACCESS

The subject site is currently bounded by two sealed roads (Branxton Street and Hollingshed Street) and a third access option will be available along its south-eastern boundary upon completion of the West Street extension.

An access road off Hollingshead Street and another one via the newly extended West Street will provide access to the proposed lots. With regard to access requirements for fire fighting and evacuation purposes, the subdivision meets the specifications of PBP.

In general, there are no topographical constraints preventing the construction of the proposed roads to the requirements in 4.1.3 (1) of PBP and the subdivision is capable of meeting the performance criteria for access.

5.3 SERVICES

The subdivision site will be serviced with reticulated water. The fire hydrant spacing, sizing, and pressures are able to comply with AS 2419.1-2005, to ensure adequate water supply for fire fighting.

All new electrical and telecommunications cable can be provided underground to meet the requirements of PBP 2006.

5.4 LANDSCAPING AND MAINTENANCE

Maintenance of the property, with particular attention to the APZ's, will be required. All landscaping and management of vegetation are able to comply with the requirements of Appendix 5 of PBP 2006.

5.5 CONSTRUCTION REQUIREMENTS

The construction of future dwellings should be in accordance with the requirements of AS 3959-2009 depending on the BAL rating.

5.6 SPECIAL CONSIDERATIONS

ECOLOGICAL CONSTRAINTS: FLORA AND FAUNA

The Flora and Fauna Assessment undertaken by MJD Environmental does not identify any significant impact from the vegetation clearing associated with the development.

FLOODING

The flood affected parts in the southern and eastern corners of the site have been excluded from the development site. All access roads and services are proposed on flood free areas to ensure smooth functioning and evacuation during a bushfire emergency.

5.7 ASSESSMENT OF ENVIRONMENTAL IMPACT

The proposed development does not involve removal of any significant flora, or any other measures that would have a significant impact on the environment.

6.0 CONCLUSION AND RECOMMENDATIONS

This assessment demonstrates that the proposed subdivision is able to satisfy the performance criteria for bushfire management as stipulated in PBP and AS 3959-2009. It is therefore considered that having regard to the Bushfire Threat Assessment, the subject site is suitable for subdivision.

The following recommendations are made for the compliance of the proposal with the relevant legislative requirements:

- An APZ of 25m is to be provided along the north-eastern boundary of the site. Ongoing maintenance of the APZ will be required to reduce fuel loads.
- The landscaping of the site is to comply with the requirements of Appendix 5 of PBP 2006.
- This assessment does not deal with the level of construction or specifications for dwellings on individual lots. Separate assessments are to be undertaken for infill development at the DA stage.
- The road network and utilities / services shall meet the fire fighting and management requirements as outlined in PBP 2006.

APPENDIX A

SUBDIVISION LAYOUT

Scale - 1:1500 @ A3
Date - 24/07/2017
Revision - A
Drawn - AOB

Option 1
Lot 1 DP 873228
71 Branxton Street, Greta

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hdb TownPlanning&Design
planning > design > development

ATTACHMENT 8

GEOTECHNICAL ASSESSMENT REPORT

Proposed Subdivision - Urban Capability Assessment

71 Branxton Street, GRETA, NSW

NEW17P-0193-AA
20 November 2017

Qualtest
LABORATORY (NSW) PTY LTD

GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

20 November 2017

Mr Karl Waeger
c/- Hunter Development Brokerage Pty Ltd
1st Floor, 44 Church Street,
MAITLAND NSW 2320

Attention: Karl Waeger

Dear Karl,

RE: PROPOSED RESIDENTIAL SUBDIVISION
71 BRANXTON STREET, GRETA NSW
URBAN CAPABILITY ASSESSMENT

Please find enclosed our Preliminary Geotechnical Assessment in the form of an Urban Capability Assessment for the proposed residential subdivision to be located at 71 Branxton Street, Greta.

The purpose of the Preliminary Geotechnical Assessment is to support an application to Cessnock City Council for rezoning of the site for residential subdivision. The report includes preliminary recommendations for suitability of the site for development from a geotechnical perspective.

The subject site has been identified as being located within a Mine Subsidence area. A separate mine subsidence assessment report has been prepared by Regional Geotechnical Solutions, ref: RGS31387.1-AA.

Additional detailed geotechnical investigation work will be required for design purposes at a later stage, including site classification for footings and pavement design for subdivision roads.

If you have any questions regarding this report, please do not hesitate to contact Shannon Kelly or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd

Emma Coleman
Senior Environmental Scientist

Table of Contents:

Attachments:

Figures: Figure AA1: Site Location & Approximate test Locations

Appendix A: Results of Field Investigations

Appendix B: Results of Laboratory Testing

Appendix C: AGS 2007 Excerpts

1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this report to Hunter Development Brokerage Pty Ltd (HDB) on behalf of Mr Karl Waeger for the proposed residential subdivision to be located at 71 Branxton Street, Greta.

Based on the brief and plans provided in an email from HDB dated 28 September 2017, the proposed development is understood to comprise subdivision into about 41 residential allotments, associated road pavements and subdivision infrastructure.

The objectives of the work were to provide recommendations on the following:

- Preliminary Contamination Assessment;
- Preliminary Geotechnical Assessment in the form of an Urban Capability Assessment to assess suitability of the site for rezoning for residential subdivision including:
    - Acid Sulfate Soil and Salinity Assessment;
    - Risk of slope instability and associated geotechnical constraints;
    - Suitability of the site for development from a geotechnical perspective.
- Mine Subsidence Desktop Assessment.

This report presents the results of the preliminary geotechnical assessment, including field work investigations, laboratory testing, and recommendations.

The preliminary contamination assessment and mine subsidence assessment are presented in reports NEW17P-0197-AB, and RGS31387.1-AA, respectively.

2.0 Scope of Work

In order to meet the objective, the following scope of work was carried out:

- Desktop study, including review of:
    - Regional geological maps;
    - Department of Soil Conservation Soil Landscape Maps and Publications; and,
    - Acid Sulfate Soils Risk Maps;
- Field and laboratory investigations, including:
    - Site walkover and field mapping of surface features;
    - Site observations for visible evidence of Acid Sulfate Soils or Salinity;
    - Drilling of five hand auger boreholes;
    - Laboratory testing of three samples for Emerson Dispersion tests, three samples for Salinity tests (including electrical conductivity and pH), and three samples for Particle Size Distribution tests;
- Engineering analysis and reporting.

3.0 Desktop study

3.1 Geology Map

Reference to the 1:100,000 Cessnock Regional Geology Series Sheet 9132 indicates the site to be underlain by the Greta Coal Measures, which is characterised by lenticular conglomerates, sandstone, shale, and splitting coal seams.

3.2 Acid Sulfate Soil Risk Maps

The 1:25,000 Greta Acid Sulfate Soil Risk Map (9132S1) shows the site is located in an area of no known occurrence of Acid Sulfate Soils.

4.0 Field Work

The field investigations were carried out carried on 24 October 2017 and comprised drilling of five boreholes (HA01 to HA05) using hand auger methods. The boreholes were drilled to depths of between 0.45m and 1.0m, where refusal was reached on weathered conglomerate or sandstone. Disturbed samples were collected from each borehole for subsequent laboratory testing.

Two Dynamic Cone Penetrometer (DCP) tests were carried out adjacent to boreholes HA01 and HA02.

Investigations were carried out by an experienced Geotechnical Engineer from Qualtest who located the hand auger boreholes, carried out the testing and sampling, produced field logs, and made observations of the site conditions. Boreholes were located in the field relative to existing site features including topographic features, lot boundaries, existing developments and trees.

Engineering logs of the boreholes are presented in Appendix A.

Approximate borehole locations are shown on the attached Figure AA1.

5.0 Site Description

5.1 Surface Conditions

The subject site is located at the corner of Hollingshed and Branxton Streets, Greta, and comprises Lot 1 DP 873220, (No. 71 Branxton Street, Greta). The site comprises an approximately rectangular area of about 5.85 hectares, with the site location and area shown in Figure AA1 attached.

The site is bounded to the north by Hollingshed Street, to the west by Branxton Street, to the south by undeveloped lots within a residential zoning area, and by low density residential lots and bushland to the east.

The site is located within a region of gently undulating topography, on the lower slopes of a broadly sloping east-west oriented spur formation.

The site contains multiple tributaries and natural easements, with drainage and surface runoff assessed to generally flow towards the southeast and southwest parts of the site, where a tributary to Anvil Creek crosses the site. Anvil Creek, located about 500m west of the site, flows south to south-east.

Survey plans were not provided to Qualtest at the time of preparing this report, however, from survey data contained on Six Maps, ground levels at the site are assessed to range from approximately RL 50m (AHD) to approximately RL 60m (AHD).

The site generally slopes in an approximately southern direction, towards the Anvil Creek tributary at the south-eastern and south-western boundaries of the site. Surface slopes are typically in the order of between 5° and 6°, with localised slopes in the order of about 15-20°.

The majority of the site is undeveloped, with a single storey dwelling with attached garage, a short concrete driveway, and swimming pool located near the centre of the western boundary. The site also contained some shipping containers and piles of construction materials (such as concrete, timber, metal sheeting and wire) primarily) to the east of the dwelling. There was also noted to be a small derelict brick and concrete structure near the centre of the eastern-most boundary.

An unsealed driveway connects the dwelling to Branxton Street to the west. The site is divided into several paddocks by timber post and barbed wire fencing.

There were several areas of surface settlement and open potholes which a were judged to be likely due to mine subsidence in the north-western areas of the site. Reference should be made to the Mine Subsidence report prepared by Regional Geotechnical Solutions (ref: RGS31387.1-AA) in regards to mine subsidence.

Vegetation generally comprised grass cover and a few scattered trees, with sparse bushland present in the north-western area of the site, as shown on Figure AA1.

The site was judged to have good trafficability by way of 4WD vehicle on the day of the field investigation. The site was generally judged to be moderately drained mostly by way of surface runoff and infiltration into the near surface soils. There was no seepage or ponded water observed during the site visit.

Photographs of the site taken on the day of the site investigations are shown below.

Photograph 1: View northern portion of site facing southeast.

Photograph 2: Southeast portion of site, showing Anvil Creek tributary.

Photograph 3: View from south-eastern portion of site facing north-northwest.

Photograph 4: View from north-western portion of the site facing south, looking at residence.

Photograph 5: Waste materials on eastern side of residence.

Photograph 6: View from northern corner of site facing west showing trees in north-western portion of site.

Photograph 7: View from southwestern portion of site facing north-northeast.

Photograph 8: View from south-south-western part of the site facing south, showing site entrance from Branxton Street.

Photograph 9: Showing a mine subsidence pothole in north-western portion of site.

Photograph 10: Showing a pothole in west-south-western portion of site, probably related to mine subsidence.

5.2 Subsurface Conditions

The typical soil types encountered at the borehole locations during the field investigation have been divided into geotechnical units as summarised in Table 1.

Table 2 contains a summary of the distribution of the geotechnical units at borehole locations.

TABLE 1 – SUMMARY OF GEOTECHNICAL UNITS AND SOIL TYPES

Unit	Soil Type	Description
1	TOPSOIL	Silty SAND – fine to medium grained, dark grey-brown, fines of low plasticity, root affected.
2	Slopewash	Silty SAND / Clayey SAND – fine to coarse grained, dark grey to grey / pale brown to brown, fines of low to medium plasticity, trace to some fine to medium grained sub-angular to sub-rounded gravel. Trace cobbles up to ~63mm as Highly Weathered SANDSTONE at HA05. Silty Gravelly SAND / Silty Sandy GRAVEL – fine to coarse grained sub-rounded, pale grey-brown, fine to coarse grained sand, fines of low plasticity, with trace cobbles up to ~63mm as Highly Weathered SANDSTONE.
3	Colluvium / Alluvium	Gravelly Clayey SAND – fine to coarse grained, pale grey to grey, fines of low to medium plasticity, fine to medium grained sub-rounded gravel. Sandy CLAY – medium to high plasticity, brown, fine to coarse grained sand, some fine to medium grained sub-angular gravel.
4	Residual	Gravelly Clayey SAND – fine to coarse grained, pale orange-brown, fines of low to medium plasticity, fine to medium grained sub-rounded gravel. Sandy CLAY – medium to high plasticity, brown with pale grey and pale orange-brown / pale grey and pale orange-brown, fine to medium grained sand, trace fine grained sub-rounded gravel.

TABLE 2 – SUMMARY OF GEOTECHNICAL UNITS ENCOUNTERED AT EACH BOREHOLE LOCATION

Location	Unit 1 Topsoil	Unit 2 Slopewash	Unit 3 Colluvium / Alluvium	Unit 4 Residual Soil
	Depth (metres)			
HA01	0.00 – 0.20	0.20 – 0.45	0.45 – 0.65	0.65 – 0.85^
HA02	0.00 – 0.25	0.25 – 0.60	-	0.60 – 0.65*
HA03	0.00 – 0.25	0.25 – 0.40	0.40 – 0.65	0.65 – 1.00
HA04	0.00 – 0.25	0.25 – 0.45	-	0.45 – 0.65*
HA05	0.00 – 0.20	0.20 – 0.40	-	0.40 – 0.45*
Note:	** Borehole terminated due to very slow progress or refusal of the hand auger.*			

No groundwater was observed in the hand auger boreholes during the limited time that they remained open on the day of the investigation.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

6.0 Laboratory Testing

Samples collected during the field investigations were returned to our NATA accredited Warabrook Laboratory for testing. The testing comprised three Emerson Crumb tests, three Particle Size Distributions (Gradings).

In addition, three samples were despatched to Eurofins mgt, a NATA accredited laboratory for chemical testing. The three samples were tested for pH and Electrical Conductivity (EC) as part of the salinity assessment.

Results of the testing are presented in Appendix B, with a summary of the results presented in Tables 3 and 4.

TABLE 3 – SUMMARY OF PARTICLE SIZE DISTRIBUTION AND EMERSON TEST RESULTS

Location and Depth (m)	Material Description	Grading		Emerson Class
		Sieve (mm)	% Pass	
HA01 0.05 – 0.20	Sandy CLAY	37.5	100	Not tested
		19.0	100	
		2.36	96	
		0.075	50	
HA03 0.30 – 0.40	Silty Sandy GRAVEL	Not tested		2
HA04 0.05 – 0.20	Sandy SILT	37.5	100	5
		19.0	100	
		2.36	99	
		0.075	46	
HA04 0.25 – 0.45	Sandy SILT	37.5	100	2
		19.0	100	
		2.36	99	
		0.075	51	

Results of the laboratory testing indicate the site sub soils have an Emerson Class 2, which can generally be described as having the following properties:

- Is susceptible to slaking (breaking up upon absorbing water from oven-dried condition); and,
- Is susceptible to minor dispersion (allowing the clay fraction of the soil to dissolve) when submerged in water.

The surface soil sample that was tested revealed an Emerson Class 5, which can generally be described as having the following properties:

- Is susceptible to slaking (breaking up upon absorbing water from oven-dried condition); and,
- Will not disperse (allow the clay fraction of the soil to dissolve) when submerged in water.

Based on the results of fieldwork and laboratory testing, it is assessed that soil erosion should be able to be maintained within normally acceptable levels by adopting good soil erosion and sedimentation control practices, including:

- Minimise the area and duration of soil exposure by staged development and controlled clearing;
- Stockpile stripped soil for reuse and protect from erosion;
- Control storm water run-off by diverting clean run-off from denuded areas, minimising slope gradient, length and run-off velocities;
- Trap soil and water pollutants using silt traps, sediment basins, perimeter banks, silt fences and nutrient traps as appropriate;
- Re-vegetate as soon as is practicable.

7.0 Discussion and Recommendations

7.1 General

The site is considered suitable for the proposed development from a geotechnical viewpoint provided that development is carried out in accordance with sound engineering principles and good hillside practice, and with respect to the constraints and recommendations of this report.

Consideration should be given to proposed residential lots which are located in or immediately adjacent to the areas observed to be affected by mine subsidence. The RGS report on mine subsidence (ref: RGS31387.1-AA) must be referred to for further information and recommendations for these areas.

Further geotechnical investigation and advice should be carried out during detailed design phase including site classification to AS2870-2011 and pavement design as required.

7.2 Slope Stability and Recommended Geotechnical Constraints

7.2.1 Basis of Assessment

The risk of slope instability has been assessed from the observed site conditions using methods consistent with those presented in the Australian Geomechanics Society (AGS) publication "*Practice Note Guidelines for Landslide Risk Management, 2007*". Based on those methods, the risks to property associated with slope instability on the subject area have been assessed using the terms presented in AGS 2007, *Landslide Risk Assessment Qualitative Terminology for Use in Assessing Risk to Property*, extracts of which are attached in Appendix B.

The report provides an assessment of the risk of slope instability on the proposed development area. The report also recommends some geotechnical constraints for the site development in light of the slope instability assessment. The assessed risk to the proposed development is based on the geotechnical constraints and recommendations provided in this report being implemented. The onus is on the owner, potential owner, or interested party to decide whether the assessed level of risk is acceptable taking into account the likely consequences of the risk and the recommended geotechnical constraints.

7.2.2 Principal Site Features and Evidence of Instability

The assessment of the risk of slope instability has been based on the site observations recorded in Section 3 and the principal site features summarised below:

- Site situated in an area of gently undulating topography with moderate relief;
- Ground surface slopes are generally in the order of about 5° to 6° across the majority of the site, with localised steeper slopes up to about 15° to 20° near the banks of gullies;
- Soil depths encountered were generally in the range of about 0.5m to 1.5m;
- Soil profile generally comprising topsoil to depths in the order of 0.25m, overlying slopewash, colluvium, and residual clay soils typically of very stiff to hard consistency;
- The site drains primarily to the southeast and southwest to the tributary located on site, which drains to Anvil Creek;
- No evidence of seepage was observed and the site generally appeared moderately to well drained, mostly by way of downhill surface runoff. No water was observed to be ponded on the site;
- No evidence of deep soil erosion was observed at the site at the time of the field work;
- No obvious evidence of overall slope instability or significant damage attributable to mass ground movement (excluding mine subsidence) was observed on or in the vicinity of the site during the field work,

7.2.3 Hazard Identification

Elements at risk for the identified hazards are the proposed subdivision developments, which may include proposed residences, sheds, swimming pools, driveways and / or other site infrastructure.

The following hazards that could potentially impact on this site are assessed as follows:

H1. Potential broad deep-seated instability;

H2. Potential shallow instability such as overloading of slopes by excessive loads, unsuitable batters/support or unsuitable founding depths, or failure of fill not placed in a proper manner or subject to erosion by concentrated surface flows.

H3. Potential shallow ground 'creep' movements.

7.2.4 Risk Evaluation for the Proposed Development

The matrix below evaluates the hazards outlined above and their likelihood of occurring based on the proposed development of the site, and assuming the geotechnical constraints and recommendations of this report are implemented. If these recommendations are not followed, the likelihood of hazards occurring may increase and the level of risk may change. Further advice should be sought where necessary.

Hazard	Location	Consequence	Likelihood	Risk
H1	Overall Site	Major	Rare	Low
H2	Overall Site	Major	Rare	Low
H3	Overall Site	Minor	Unlikely	Low

Based on the above, the proposed development is assessed as having a **"Low"** risk of slope instability.

It would be normal practice in the Cessnock City Council local government area for development to proceed on a site with a risk level classification of Low.

Development should be carried out in accordance with sound engineering principles and good hillside practice (as set out in Appendix B), and the geotechnical constraints outlined in this report.

7.2.5 Recommended Geotechnical Constraints for Residential Development

Type of Structure:

There are no particular geotechnical constraints on the type of structures provided they are founded on footings designed and constructed in accordance with AS2870, '*Residential Slabs and Footings*'.

Area for Development:

All of the site is considered feasible for development from a slope stability viewpoint.

Development of the site should be undertaken in accordance with good hillside construction practice and sound engineering principles as presented in the excerpts from AGS 2007 provided in Appendix B.

Care should be taken in the design of any developments in the vicinity of any existing excavations, fill platforms, embankments, retaining walls and dams, particularly if they involve surcharge loads or excavations.

Foundation Type:

Strip / pad footings, pier and beam systems or split-level raft slabs would be feasible from a slope stability viewpoint (broad raft slabs may not be suited to sloping areas of the site due to the slope modifications required).

Footings should not be founded within any existing uncontrolled fill. If uncontrolled fill is encountered, this will require piered foundations founded beneath the fill, removal of the fill, or removal and replacement of the fill to engineering specification.

Foundations should be designed and constructed in accordance with the recommendations and advice of AS2870, '*Residential Slabs and Footings'*.

Foundations near the crest of excavations should be taken to rock or founded behind or below a 1V:2H projection from the toe of the excavation.

Footings are to be founded outside of or below all zones of influence resulting from existing or future service trenches.

Excavations:

Excavations should be supported by properly designed and constructed retaining walls or else battered at 1V:2H or flatter and protected from erosion.

Excavations in competent bedrock (below the level of backhoe / excavator refusal) may be battered at 1V:1H.

Temporary excavations to depths of up to 1.2m in competent compact material with sufficient cohesion, such as clay of stiff consistency or better may be battered steeper than 1V:1H, subject to inspection during excavation by the geotechnical authority.

The safe working procedures of Work Cover NSW Excavation work code of practice, dated July 2014 should be followed.

Excavations should be designed for surcharge loading from slopes, retaining walls, structures and other improvements in the vicinity of the excavation.

Care should be taken not to disturb or destabilise existing underground services or structures. Excavations should remain outside a 1V:2H projection from the base of any structural footings.

Drainage measures should be implemented above and behind all temporary and permanent excavations to avoid concentrated water flows on the face of the cut or infiltration into the soil/rock profile behind the cut. Surface water flows from upslope areas should be diverted away from the cut face.

Filling:

The depth of unsupported fill on the site should preferably not exceed 1.5m and should be battered at 1V:2H or flatter and protected against erosion. All fill greater than 1.5m deep should preferably be supported by engineer designed retaining walls.

Where fill is to be placed on slopes in excess of 1V:8H (7°), a prepared surface should be benched or stepped into the slope.

Care should be taken during backfilling of any dams, gully areas or drainage depressions to reduce the risk of leaving a preferential underground drainage path which could result in softening of the surrounding area, piping erosion and/or localised seepage.

Earthworks should be carried out in accordance with the recommendations outlined in AS3798-2007 *'Guidelines for Earthworks for Commercial and Residential Developments'*.

Geotechnical advice should be sought with regards to site preparation and fill construction procedures at the time of detailed geotechnical investigations and design.

Retaining Walls

All structural retaining walls and all landscaping walls in excess of 1.0m should be designed by an experienced engineer familiar with the site conditions. All retaining walls should be designed for surcharge loading from slopes, structures and other existing/future improvements in the vicinity of the wall. Adequate subsurface and surface drainage should be provided behind all retaining walls.

Excavations for the construction of retaining walls result in a temporary reduction in the stability of the adjacent area particularly during wet weather until the wall is complete. This increased risk can be managed or reduced by appropriate construction planning, using temporary support, staged excavation and control of drainage.

Drainage and Sewage Disposal:

Adequate surface and storm water drainage should be installed and maintained on the site in accordance with local government requirements.

All collected stormwater run-off should be piped into the street / inter-allotment drainage system or discharged into existing storm water drains or watercourses in a controlled manner that limits erosion. Surface and sub-soil drains may be required to improve drainage. Septic wastes should be connected to the reticulated disposal system.

Other:

Inspection should be carried out by a geotechnical authority during construction to confirm the conditions assumed in this report and in the design.

Additional recommendations may be provided during further stages of the project.

7.3 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are soils which contain significant amounts of pyrite which, when exposed to oxygen, in the presence of sufficient moisture, oxidises, resulting in the generation of sulphuric acid. Unoxidised pyritic soils are referred to as potential ASS. When the soils are exposed, the oxidation of pyrite occurs and sulphuric acids are generated, and the soils are said to be actual ASS.

Pyritic soils typically form in waterlogged, saline sediments rich in iron and sulfate. Typical environments for the formation of these soils include tidal flats, salt marshes and mangrove swamps below about RL 5m AHD. They can also form as bottom sediments in coastal rivers and creeks. Key points with regards to the likelihood of ASS being present on site are:

- Reference to the relevant Acid Sulfate Soil Risk Map (Greta, 1:25,000 scale, 1997 edition supplied by the NSW Government Office of Environment and Heritage) indicates that the site and surrounding area in the vicinity of the site is within an area of "no known occurrence" of acid sulfate soil conditions.
- Surface levels typically within the range of about RL 50m AHD to RL 60m AHD across the site, (i.e. significantly greater than RL 5m AHD).
- Subsurface soil materials encountered are of residual origin, (i.e. not estuarine).

It is considered unlikely that acid sulfate soils would be present at the site, and it is assessed that the proposed development presents a low risk of disturbance of acid sulfate soils.

Therefore Potential or Actual ASS are not likely to be encountered at the site as part of proposed site developments, and on this basis there is no requirement for an ASS Management Plan.

7.4 Salinity Assessment

7.4.1 Background Information

Soils in Australia contain variable quantities of salts, generally in the lower soil profile or weathered region. Most of the salts are in relatively deep sinks and aquifers and out of reach to cause damage to most plants or infrastructure.

Urban salinity is caused by the mobilisation of salts in the soil profile by surface water or groundwater. Salts naturally occur in soil from sources such as weathering of rock and soil, soils formed on old sea beds, salt lakes or other saline soils, or from the ocean via wind and rain.

When the water table rises close to the surface, it carries dissolved salts that are normally locked in the soil and rock profile to the surface.

7.4.2 Significance of Urban Salinity

Development of agricultural land for urban use can change the movement of surface and groundwater resulting in a change in the way salts and other minerals interact.

High salinity soils can reduce or altogether preclude vegetation growth and can produce aggressive soil conditions which may be detrimental to concrete and steel components of structures, foundations, pipelines and other engineering works. Thus, the management, design and construction of urban developments must take into consideration the impacts of salinity.

The impact of salts is not only related to the amount of salt and water present, but is also associated with the types of salts or cations (positively charged ions) present in the soil, the chemical and physical reactions with building materials and the amount of wetting and drying occurring (ref: Department of Land and Water Conservation (2002) Site Investigations for Urban Salinity (DLWC, 2002)).

7.4.3 Salinity of Soil Profiles

Salinity is determined by the electrical conductivity (EC) of a soil water extract corrected for texture. As the concentration of salt increases, the EC increases because salt separates into positively and negatively charged ions when dissolved in water.

The laboratory test results used to assess the salinity of the soil profile are presented in Table 4.

TABLE 4 – SUMMARY OF SALINITY TEST RESULTS

Location and Depth (m)	Textural Class	pH	EC (ds/m)	ECe (dS/m)	Soil Salinity Class
HA01 0.05 – 0.20	Medium CLAY	7.7	0.072	0.504	Non-saline
HA04 0.05 – 0.20	Clay LOAM	8.1	0.053	0.477	Non-saline

Location and Depth (m)	Textural Class	pH	EC (ds/m)	ECe (dS/m)	Soil Salinity Class
HA01 0.05 – 0.20	Medium CLAY	7.7	0.072	0.504	Non-saline
HA04 0.25 – 0.45	Clay LOAM	7.4	0.011	0.099	Non-saline

A saline soil is defined as a soil that contains sufficient soluble salt to adversely affect plant growth and / or land use. Reference to DLWC (2002) indicates that a soil with an ECe equal to or greater than 4 dS/m is considered saline, as it is the level at which many crops are affected.

As shown by the results in Table 4, urban salinity is unlikely to be an issue within the proposed allotments on this site. The samples tested were characterised by an ECe of <2 dS/m, whch DLWC (2002) indicates is non-saline.

It is noted that in the close vicinity of creeks and waterways, there may be some areas of saline soils.

7.4.4 Management of Salinity

It is assessed that the soil salinity on this site, if present, would be limited to low lying areas along the existing waterway. It is understood that the proposed residential development has been setback from these areas. Therefore, salinity should not be an issue for the proposed development in its current layout given the setback from existing waterways and non-saline results from the samples tested. It is anticipated that the proposed building envelopes will not be affected by soil salinity.

7.5 Site Classification to AS2870-2011

Site classification in accordance with the classification system presented in AS2870-2011 'Residential Slabs and Footings' should be undertaken following further detailed geotechnical investigation of the site once site layout and site regrade designs are known.

Site classification will depend on a number of factors including depth of topsoil, depth of fill and residual soil, depth to rock, and reactivity of the natural soil and any fill material placed. A preliminary indication is that lots may potentially be classified Class 'M' or 'H1'.

All structural elements should be supported on footings founded beneath all uncontrolled fill, layers of inadequate bearing capacity, soft/loose, or other potentially deleterious material.

If any areas of uncontrolled fill of depths greater than 0.4m are encountered during construction, footings should be designed in accordance with engineering principles for Class 'P' sites.

Consideration should be given to proposed residential lots which are located in or immediately adjacent to the areas observed to be affected by mine subsidence. The RGS report on mine subsidence (ref: RGS31387.1-AA) must be referred to for further information and recommendations for these areas.

7.6 Road Pavements

Pavement design should be carried out following further detailed geotechnical investigation of the site. The existing residual clay soils are generally expected to be suitable for subgrade support subject to moisture conditions at the time of construction.

Due to the gently to moderately sloping nature of the site, road construction is generally anticipated to be on grade or within about 1m or existing surface levels, with only minor cut into soil or weathered rock, on-grade construction, and/or minor filling.

Consideration should be given to proposed pavements located in or immediately adjacent to the areas observed to be affected by mine subsidence. The RGS report on mine subsidence (ref: RGS31387.1-AA) must be referred to for further information and recommendations for these areas.

8.0 Limitations

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practices and standards. To our knowledge, they represent a reasonable interpretation of the general conditions of the site.

The extent of testing associated with this assessment is limited to discrete test locations. It should be noted that subsurface conditions between and away from the test locations may be different to those observed during the field work and used as the basis of the recommendations contained in this report.

If subsurface conditions encountered during construction differ from those given in this report, further advice should be sought without delay.

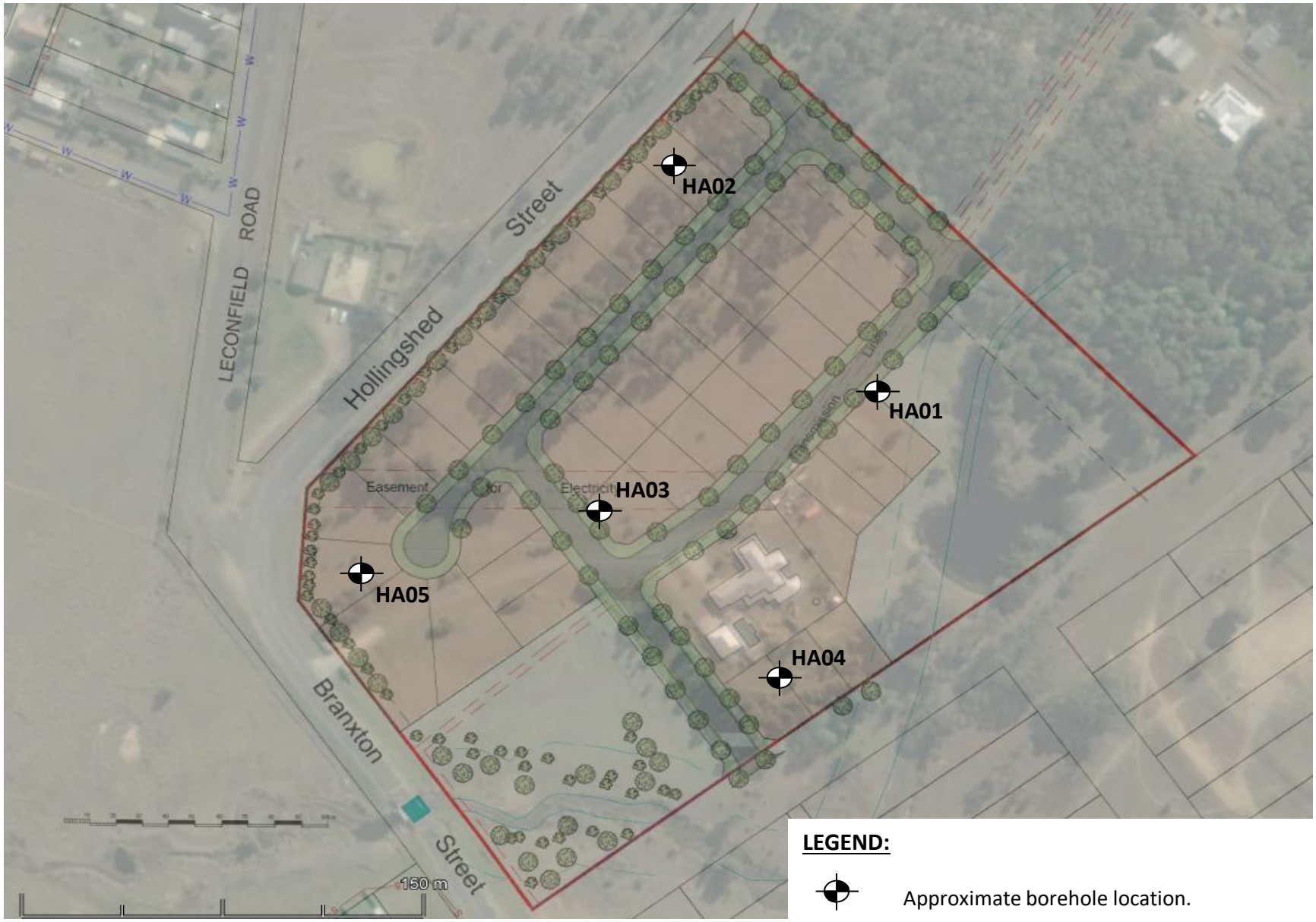
Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

If you have any further questions regarding this report, please do not hesitate to contact Jason Lee or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd.

Emma Coleman
Senior Environmental Scientist

FIGURES:



LEGEND:

Approximate borehole location.

Based on proposed site plan provided by HDB ("Option 1, Lot 1 DP 873228, 71 Branxton Street, Greta", Rev. A, dated 24/07/2017) overlain on Google Earth image.

Qualtest LABORATORY (NSW) PTY LTD

Client:	KARL WAEGER C/- HDB	Drawing No:	FIGURE AA1
Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193
Location:	71 BRANXTON STREET, GRETA	Scale:	AS SHOWN
Title:	SITE PLAN AND APPROXIMATE TEST LOCATIONS	Date:	20/11/2017

APPENDIX A:

Results of Field Investigations

ENGINEERING LOG - HAND AUGER

HAND AUGER NO: HA01

CLIENT: HUNTER DEVELOPMENT BROKERAGE PTY LTD
PAGE: 1 OF 1
PROJECT: URBAN CAPABILITY ASSESSMENT
JOB NO: NEW17P-0193
LOCATION: 71 BRANXTON STREET, GRETA
LOGGED BY: BB
DATE: 24/10/17

DRILL TYPE: HAND AUGER
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	Not Encountered	0.05m D 0.20m				SC	TOPSOIL: Sandy CLAY / Clayey SAND - fine to medium grained, dark grey-brown, fines of low plasticity, root affected.					TOPSOIL
		D 0.30m				SC	Clayey SAND - fine to coarse grained, dark grey to grey, fines of low to medium plasticity, some fine to medium grained sub-angular to sub-rounded gravel.	M	MD			SLOPE WASH
		0.60m D 0.70m		0.5		SC	Gravelly Clayey SAND - fine to coarse grained, pale grey to grey, fines of low to medium plasticity, fine to medium grained sub-rounded gravel.					COLLUVIUM / RESIDUAL SOIL
		D 0.80m				SC	Gravelly Clayey SAND - fine to coarse grained, pale orange-brown, fines of low to medium plasticity, fine to medium grained sub-rounded gravel.	D - M	D - VD			RESIDUAL SOIL
				1.0			Hole Terminated at 0.85 m Very slow progress					

0.20m
0.45m
0.65m
0.85m

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - HAND AUGER

HAND AUGER NO: HA02

CLIENT: HUNTER DEVELOPMENT BROKERAGE PTY LTD
PAGE: 1 OF 1
PROJECT: URBAN CAPABILITY ASSESSMENT
JOB NO: NEW17P-0193
LOCATION: 71 BRANXTON STREET, GRETA
LOGGED BY: BB
DATE: 24/10/17

DRILL TYPE: HAND AUGER
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	Not Encountered	0.10m D 0.20m				SM	TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, root affected.	D - M				TOPSOIL
		0.30m D 0.40m		0.5		SM	0.25m Silty Gravelly SAND - fine to coarse grained, pale grey-brown, fine to coarse grained angular to sub-angular gravel, fines of low to medium plasticity, trace cobbles up to ~63mm, as Highly Weathered SANDSTONE - fine to medium grained, red-brown to orange-brown.	D	D			SLOPE WASH
		0.60m D 0.65m				Cl	0.60m Sandy CLAY - medium to high plasticity, pale grey and pale orange-brown, fine to medium grained sand. 0.65m	M < w_p	H			RESIDUAL SOIL
				1.0			Hole Terminated at 0.65 m Practical Refusal					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - HAND AUGER

HAND AUGER NO: HA03

CLIENT: HUNTER DEVELOPMENT BROKERAGE PTY LTD
PROJECT: URBAN CAPABILITY ASSESSMENT
LOCATION: 71 BRANXTON STREET, GRETA

PAGE: 1 OF 1
JOB NO: NEW17P-0193
LOGGED BY: BB
DATE: 24/10/17

DRILL TYPE: HAND AUGER
BOREHOLE DIAMETER: 100 mm
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
HA	Not Encountered	0.10m D 0.20m				SM	TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, root affected.	M				TOPSOIL
		0.30m D 0.40m				GM	0.25m Silty Sandy GRAVEL - fine to coarse grained sub-rounded to rounded, pale grey-brown, fine to coarse grained sand, fines of low plasticity.	D - M	D			SLOPE WASH / ALLUVIUM
		D 0.50m		0.5		CH	0.40m Sandy CLAY - medium to high plasticity, brown, fine to coarse grained sand, some fine to medium grained sub-angular gravel.	M ~ w_P	H / Fb			COLLUVIUM
		0.70m D 0.80m				CH	0.65m Sandy CLAY - high plasticity, brown with pale orange-brown and pale grey mottling, fine to medium grained sand.	M > w_P	VSt - H	HP	340 - 420	RESIDUAL SOIL
				1.0			1.00m Hole Terminated at 1.00 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - HAND AUGER

HAND AUGER NO: HA04

CLIENT: HUNTER DEVELOPMENT BROKERAGE PTY LTD
PAGE: 1 OF 1
PROJECT: URBAN CAPABILITY ASSESSMENT
JOB NO: NEW17P-0193
LOCATION: 71 BRANXTON STREET, GRETA
LOGGED BY: BB
DATE: 24/10/17

DRILL TYPE: HAND AUGER
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	Not Encountered	0.05m D 0.20m				SM	TOPSOIL: Silty SAND - fine to medium grained, brown to dark brown, fines of low plasticity, root affected.	D - M				TOPSOIL
							0.25m					
		0.30m D 0.40m				SM	Silty SAND - fine to medium grained, pale brown to brown, fines of low plasticity, trace fine grained sub-rounded to sub-angular gravel.		MD			SLOPE WASH
							0.45m					
		0.50m D 0.60m		0.5		CH	Sandy CLAY - medium to high plasticity, pale orange-brown with pale grey, fine to medium grained sand, trace fine grained sub-rounded gravel.	M < w_P	H / Fb			RESIDUAL SOIL
							0.65m					
				1.0			Hole Terminated at 0.65 m Practical Refusal					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - HAND AUGER

HAND AUGER NO: HA05

CLIENT: HUNTER DEVELOPMENT BROKERAGE PTY LTD
PAGE: 1 OF 1
PROJECT: URBAN CAPABILITY ASSESSMENT
JOB NO: NEW17P-0193
LOCATION: 71 BRANXTON STREET, GRETA
LOGGED BY: BB
DATE: 24/10/17

DRILL TYPE: HAND AUGER
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	Not Encountered	0.05m D 0.20m				SM	TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, root affected.					TOPSOIL
						SM	0.20m Silty SAND - fine to medium grained, brown to grey-brown, fines of low plasticity, some fine to medium grained sub-rounded to sub-angular gravel, trace cobbles up to ~63mm as Highly Weathered SANDSTONE - fine to medium grained, red-brown to orange-brown with some pale grey.	D - M	D			SLOPE WASH
						CH	0.40m Sandy CLAY - medium to high plasticity, orange-brown to brown, fine to medium grained sand, trace fine to medium grained sub-angular gravel, trace cobbles up to ~63mm as Highly Weathered SANDSTONE - fine to medium grained, red-brown to orange-brown. 0.45m	M < w_p	H / Fb			RESIDUAL SOIL
				0.5			Hole Terminated at 0.45 m Very slow progress					
				1.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

APPENDIX B:

Results of Laboratory Testing

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Material Test Report

Report No: MAT:NEW17W-4913--S01
Issue No: 1

Client: Karl Waeger
38/48 Zaara Street
Newcastle NSW 2300

Principal:
Project No.: NEW17P-0193
Project Name: Proposed Residential Subdivision

Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 1/11/2017

Sample Details

Sample ID:	NEW17W-4913--S01
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	24/10/2017
Source:	On-Site
Material:	Silty Sandy Gravel
Specification:	No Specification
Project Location:	71 Branxton Street, Greta, NSW
Sample Location:	HA03 - (0.3 - 0.4m)

Test Results

Description	Method	Result	Limits
Emerson Class Number	AS 1289.3.8.1	2	
Soil Description		Grey Silt	
Type of Water		Distilled Water	
Temperature of Water (°C)		23.0	

Comments

N/A

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
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E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Material Test Report

Report No: MAT:NEW17W-4913--S02
Issue No: 1

Client:	Karl Waeger 38/48 Zaara Street Newcastle NSW 2300
Principal:	
Project No.:	NEW17P-0193
Project Name:	Proposed Residential Subdivision

Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 1/11/2017

Sample Details

Sample ID:	NEW17W-4913--S02
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	24/10/2017
Source:	On-Site
Material:	Silty Sand
Specification:	No Specification
Project Location:	71 Branxton Street, Greta, NSW
Sample Location:	HA04 - (0.05 - 0.2m)

Other Test Results

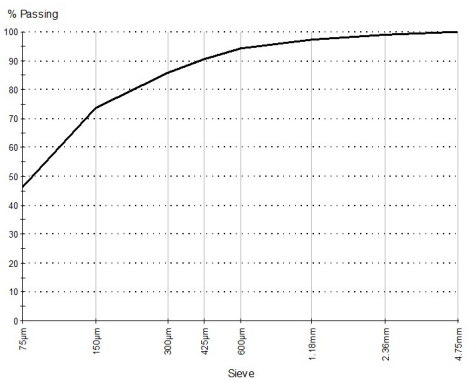
Description	Method	Result	Limits
Emerson Class Number	AS 1289.3.8.1	5	
Soil Description		Grey Sandy Silt	
Type of Water		Distilled Water	
Temperature of Water (°C)		23.0	

Particle Size Distribution

Method:	AS 1289.3.6.1
Drying by:	Oven
Note:	Sample Washed

Sieve Size	% Passing	Limits
4.75mm	100	
2.36mm	99	
1.18mm	97	
600µm	94	
425µm	90	
300µm	86	
150µm	74	
75µm	46	

Chart



Comments

N/A

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Material Test Report

Report No: MAT:NEW17W-4913--S03
Issue No: 1

Client:	Karl Waeger 38/48 Zaara Street Newcastle NSW 2300
Principal:	
Project No.:	NEW17P-0193
Project Name:	Proposed Residential Subdivision

Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 1/11/2017

Sample Details

Sample ID:	NEW17W-4913--S03
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	24/10/2017
Source:	On-Site
Material:	Silty Sand
Specification:	No Specification
Project Location:	71 Branxton Street, Greta, NSW
Sample Location:	HA04 - (0.25 - 0.45m)

Other Test Results

Description	Method	Result	Limits
Emerson Class Number	AS 1289.3.8.1	2	
Soil Description		Grey Sandy Silt	
Type of Water		Distilled Water	
Temperature of Water (°C)		23.0	

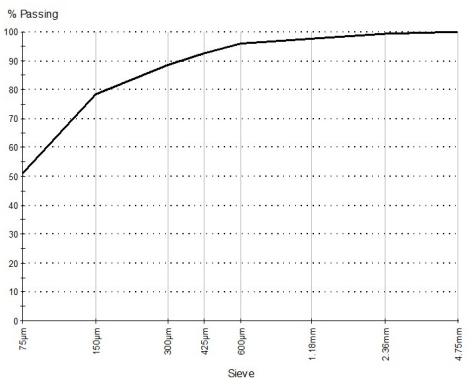
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven

Note: Sample Washed

Sieve Size	% Passing	Limits
4.75mm	100	
2.36mm	99	
1.18mm	98	
600µm	96	
425µm	92	
300µm	89	
150µm	79	
75µm	51	

Chart



Comments

N/A

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: MAT:NEW17W-4913--S04
Issue No: 1

Material Test Report

Client: Karl Waeger
38/48 Zaara Street
Newcastle NSW 2300

Principal:
Project No.: NEW17P-0193
Project Name: Proposed Residential Subdivision

Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Brent Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 31/10/2017

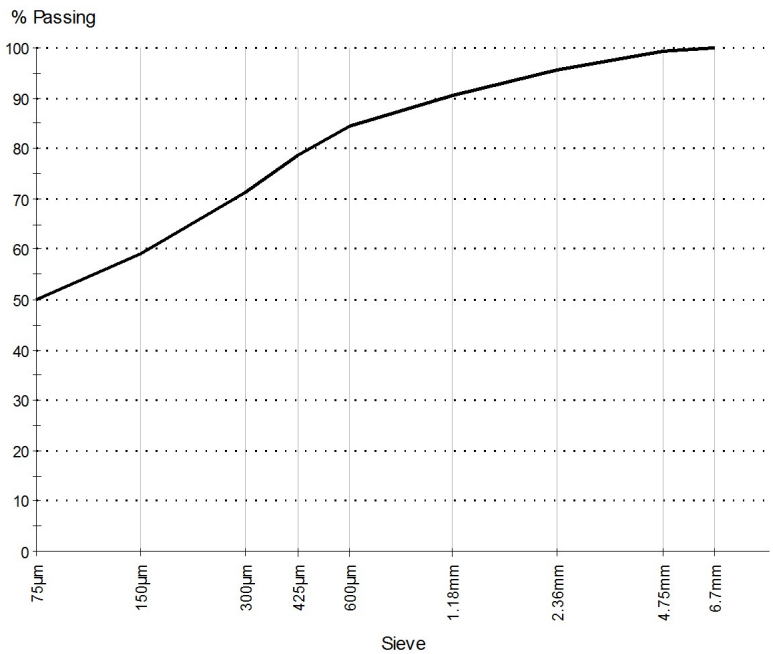
Sample Details

Sample ID:	NEW17W-4913--S04
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	24/10/2017
Source:	On-Site
Material:	Sandy Clay
Specification:	No Specification
Project Location:	71 Branxton Street, Greta, NSW
Sample Location:	HA01 - (0.05 - 0.2m)

Other Test Results

Description	Method	Result	Limits

Particle Size Distribution



Method: AS 1289.3.6.1
Drying by: Oven

Note: Sample Washed

Sieve Size	% Passing	Limits
6.7mm	100	
4.75mm	99	
2.36mm	96	
1.18mm	91	
600µm	84	
425µm	79	
300µm	71	
150µm	59	
75µm	50	

Comments

N/A

eurofins | mgt

30 years Testing For Life 1987–2017
Celebrating 30 years Testing and Protecting Human Health

Certificate of Analysis

Qualtest
8 Ironbark Close
Warabrook
NSW 2304

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Dane Cullen**

Report **569735-S**
Project name PROPOSED RESIDENTIAL SUBDIVISION
Project ID NEW17P-0193
Received Date Oct 27, 2017

Client Sample ID			**NEW17W-4913-S02**	**NEW17W-4913-S03**	**NEW17W-4913-S04**
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M17-Oc31312**	**M17-Oc31313**	**M17-Oc31314**
Date Sampled			**Oct 24, 2017**	**Oct 24, 2017**	**Oct 24, 2017**
Test/Reference	LOR	Unit			
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	72	53	11
pH (1:5 Aqueous extract)	0.1	pH Units	7.7	8.1	7.4
% Moisture	1	%	12	3.2	15

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Conductivity (1:5 aqueous extract at 25°C)	Melbourne	Oct 30, 2017	7 Day
- Method: LTM-INO-4030			
pH (1:5 Aqueous extract)	Melbourne	Oct 30, 2017	7 Day
- Method: LTM-GEN-7090 pH in soil by ISE			
% Moisture	Melbourne	Oct 27, 2017	14 Day
- Method: LTM-GEN-7080 Moisture			

ABN– 50 005 085 521
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Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
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Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	Qualtest	**Order No.:**	NEW17W-4913	**Received:**	Oct 27, 2017 8:44 AM
Address:	8 Ironbark Close Warabrook NSW 2304	**Report #:**	569735	**Due:**	Nov 3, 2017
		Phone:	02 4968 4468	**Priority:**	5 Day
		Fax:	02 4960 9775	**Contact Name:**	Dane Cullen
Project Name:	PROPOSED RESIDENTIAL SUBDIVISION				
Project ID:	NEW17P-0193				

Eurofins | mgt Analytical Services Manager : Andrew Black

Sample Detail						Conductivity (1:5 aqueous extract at 25°C)	pH (1:5 Aqueous extract)	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	NEW17W-4913-S02	Oct 24, 2017		Soil	M17-Oc31312	X	X	X
2	NEW17W-4913-S03	Oct 24, 2017		Soil	M17-Oc31313	X	X	X
3	NEW17W-4913-S04	Oct 24, 2017		Soil	M17-Oc31314	X	X	X
Test Counts						3	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Conductivity (1:5 aqueous extract at 25°C)			uS/cm	< 10			10	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M17-Oc31313	CP	%	3.2	3.4	9.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25°C)	M17-Oc31314	CP	uS/cm	11	13	12	30%	Pass	
pH (1:5 Aqueous extract)	M17-Oc31314	CP	pH Units	7.4	7.5	pass	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Authorised By

Andrew Black	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

APPENDIX C:

Selected Excerpts from AGS 2007 - Practice Note Guidelines for Landslide Risk Management

Foundation Maintenance and Footing Performance:
A Homeowner's Guide

CSIRO

BTF 18 replaces Information Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction
There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion
All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation
This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil
All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure
This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

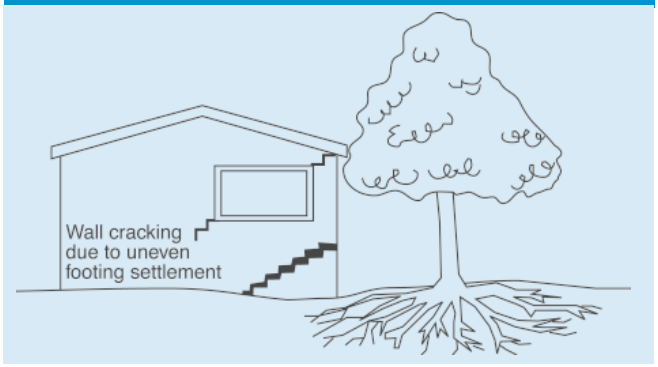
Seasonal swelling/shrinkage in clay

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

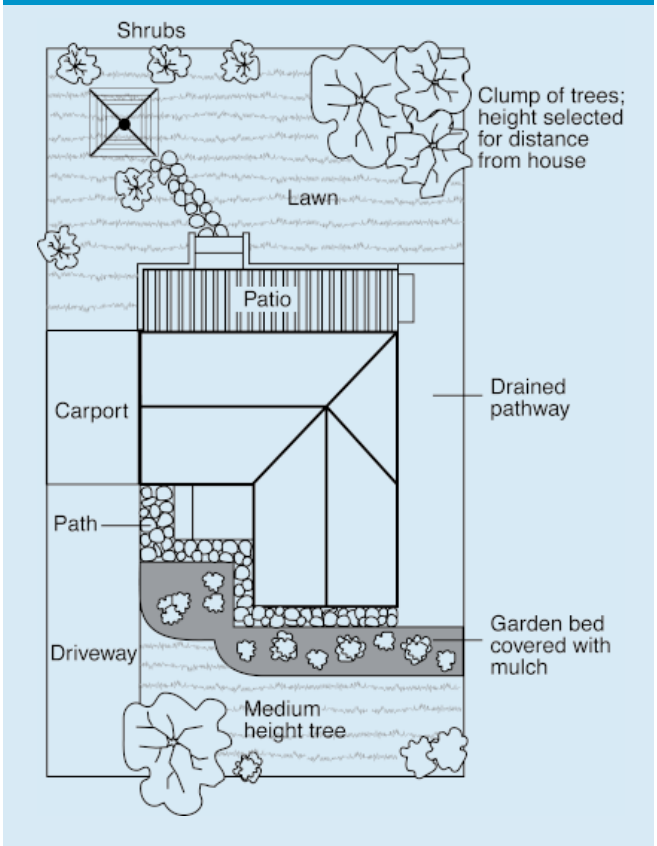
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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Proposed Subdivision Preliminary Contamination Assessment

71 Branxton Street, Greta NSW

NEW17P-0193-AB
20 November 2017

Qualtest
LABORATORY (NSW) PTY LTD

GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

20 November 2017

Mr Karl Waeger
c/- Hunter Development Brokerage Pty Ltd
1st Floor, 44 Church Street,
Maitland NSW 2320

Attention: Mr Karl Waeger

Dear Karl

RE: PROPOSED RESIDENTIAL SUBDIVISION
71 BRANXTON STREET, GRETA NSW
PRELIMINARY CONTAMINATION ASSESSMENT

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this report to Hunter Development Brokerage Pty Ltd (HDB) on behalf of Mr Karl Waeger. Please find enclosed our Preliminary Contamination Assessment report for the proposed residential subdivision located at 71 Branxton Street, Greta NSW.

Based on the brief and plans provided in an email from HBD dated 28 September 2017, the proposed development is understood to comprise subdivision into about 41 residential allotments, associated road pavements and subdivision infrastructure. Therefore, an application to Cessnock City Council is required for rezoning for residential subdivision. A Preliminary Contamination Assessment is required as part of the rezoning application.

This report was prepared in accordance with the relevant sections of the NSW OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd

Emma Coleman
Senior Environmental Scientist

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1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this report to Hunter Development Brokerage Pty Ltd (HDB) on behalf of Mr Karl Waeger for the proposed residential subdivision to be located at 71 Branxton Street, Greta (the site). Figure 1 (Appendix A) shows the site location.

Based on the brief and plans provided in an email from HDB dated 28 September 2017, the proposed development is understood to comprise about 41 residential allotments, associated road pavements and subdivision infrastructure. The proposed subdivision layout is shown in Figure 2.

The project included the following assessments:

- Preliminary Contamination Assessment;
- Preliminary Geotechnical Assessment in the form of an Urban Capability Assessment to assess suitability of the site for development, including: acid sulfate soil and salinity Assessment; risk of slope instability and associated geotechnical constraints; and suitability of the site for development from a geotechnical perspective.
- Mine Subsidence Desktop Assessment, completed by Regional Geotechnical Solutions Pty Ltd (RGS).

This report presents the results of the Preliminary Contamination Assessment. This report was prepared in general accordance with the relevant sections of the NSW OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites.

The preliminary geotechnical assessment and mine subsidence assessment are presented in reports NEW17P-0197-AA, and RGS31387.1-AA, respectively.

1.1 Objectives

The objectives of the PCA were to provide a preliminary assessment of the potential for soil contamination to be present on the site.

1.2 Scope of Works

In order to meet the above objectives, Qualtest carried out the following scope of works:

- Desk study and site history review to assess Areas of Environmental Concern (AECs) and associated Chemicals of Potential Concern (COPC);
- A site walkover by a Qualtest senior environmental scientist;
- Data assessment and preparation of a PCA report.

2.0 Site Description

2.1 Site Identification

General site information is provided below in Table 2.1. The site location is shown in Figure 1, Appendix A.

Table 2.1: Summary of Site Details

Site location:	71 Branxton Street, Greta NSW
Approximate site area:	5.85 hectares (ha)
Title Identification Details:	Lot 1 DP 873220, within the Cessnock Council local government area, Branxton Parish in the county of Northumberland.
Current Ownership:	The title documents show the site is owned by Karl Waeger.
Previous Landuse:	Rural residential property with predominantly undeveloped vacant land. Former coal mine workings in the northwest portion of the site.
Current Landuse:	Rural residential property with predominately undeveloped vacant land.
Proposed Landuse:	Residential housing development.
Adjoining Site Uses:	• Branxton Street to the west followed by rural residential properties and vacant blocks; • A vacant block, possibly grazing land, lies to the south, followed by residential properties south of Water Street; • Hollingshed Street to the north followed by rural/ residential properties, • Bushland and rural residential properties to the east.
Site Coordinates:	32°40'21 S 151°23'25 E

2.2 Topography and Drainage

Reference to the NSW Land and Property Information Spatial Information Exchange website (https://six.nsw.gov.au/wps/portal/) indicated the elevation of the site ranged from approximately 60m AHD in the north of the site to approximately 50m AHD in the south of the site.

Surface water would be expected to infiltrate into the site soils, with excess surface water draining to the waterway on site, which is a tributary of Anvil Creek. This onsite waterway flows to the west into Anvil Creek, which flows south to south east.

2.3 Regional Geology

Reference to the 1:100,000 Cessnock Regional Geology Sheet (Sheet 9132) indicates that the site is underlain by the Greta Coal Measures, which are characterised by lenticular conglomerate, sandstone, shale and splitting coal seams.

2.4 Hydrogeology

Groundwater beneath the site is anticipated be present in semi-confined aquifers in weathered rock greater than 5m below ground surface (bgs). Groundwater beneath the site would be expected to follow the surface topography and flow towards the north east. There is an unnamed creek that crosses the southeastern and southwestern corners of the site. The unnamed creek flows offsite in a westerly direction and joins with Anvil creek about 500m west of the site.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

A search of the NSW Department of Primary Industries (Office of Water) registered groundwater bores located within a 500m radius of the site was undertaken. The search revealed that there are 5 registered bores within this radius. A copy of the search is provided in Appendix D and summarised below in Table 2.2.

Table 2.2 – Summary of Groundwater Bore Data

Bore ID	Purpose	Approximate Distance & Direction from Site	Water Bearing Zone (m bgs)	Standing Water Level (m bgs)
GW202767	Monitoring Bore	344m South West	2.2-2.8	2.3
GW202768	Monitoring Bore	351m South West	2.5-3.0	2.8
GW201659	Monitoring Bore	352m South West	2.75-4.5	2.75
GW201658	Monitoring Bore	380m South West	2.75-4.5	2.75
GW201657	Monitoring Bore	402m South West	2.2-4.2	2.20

2.5 Acid Sulfate Soils

Reference to the 1:25,000 Greta Acid Sulfate Soil Risk Map 9132S1 (supplied by the NSW Department of Land and Water Conservation) indicates that the site is located within an area of "no known occurrence" of Acid Sulfate Soils (ASS).

It is noted that the Greta coal measures contain rocks and soils which are known to be acidic (pH <4.5) and to contain jarosite, a straw coloured mineral, which is an oxidiation product of pyrite (FeS_2). The presence of pyrite and jarosite means these soils can have a high potential to generate acid run-off if not managed appropriately.

The potential environmental impact, and the treatment and management of acidic soils and rocks from the Greta coal measures are similar to those for ASS. Should excavations on site be likely to encounter acidic soils or rocks from the Greta coal measures, then a management plan should be prepared which would outline the handling, management and treatment of the material.

3.0 Site History Review

A site history review was undertaken as part of the assessment, and included:

- A review of historical ownership of the site;
- A review of aerial photography from the past 50 years;
- A site walkover to help identify current and previous activities carried out on the site, identify surrounding land uses, and assess AECs and COPCs;
- Interviews with people familiar with the site history; and,
- Search of the NSW EPA's list of contaminated sites applying to the site and nearby properties.

The information provided from the above reviews is summarised in the sections below.

3.1 Historical titles search

A search of historical titles for the site was undertaken by Advanced Legal Searchers Pty Ltd. A list of past registered proprietors for the lot was obtained dating back to 1987. The results of the search are included in Appendix C and presented below in Table 3.1.

Table 3.1: Summary of historical titles

Date	Proprietor	Inferred Land Use
1987 - Present	Karl Waeger (supervisor) with Hela Evelyne Waeger between 1989 and 1997	Private
Pre-1987	Crown Land, with notes: • 1965-1987 Special Lease 1965 – 31 Maitland to Clement Patrick Withers • 1959-1965 Within Reserve 2664 from the Leasing Provision of the Mining Act vide Government Gazettal 9 January 1959 • 1912-1959 Within Mining Lease 3	Government / Mining

The historical titles search indicated that the site from about 1987 to present, has predominately been owned by private individuals, who likely used the site for rural residential purposes. Prior to 1987, it appears the site was leased from the government for mining purposes. This is likely associated with the area in the north-western portion of the site, which shows some surface subsidence effects from former mining.

3.2 Aerial photograph review

Aerial photographs of the site from 1963, 1974, 1984 and 1994 were purchased from the Department of Land and Property Information, and satellite images from Google Earth for 2004 to 2017. The photographs were assessed by a Qualtest Environmental Scientist. The results of the aerial photograph review are summarised below in Table 3.2. The aerial photographs are presented in Appendix C.

Table 3.2: Aerial photograph review

Year	Site	Surrounding Land
1963	The site appears to be a predominantly vacant cleared block of land.	The surrounding land is largely vacant land. Branxton Street and Hollingshed Street border the site on the western and northern extremes of the site. Residential properties lay to the south of the site in the town of Greta.
1974	The site appears similar to the 1963 photograph.	The surrounding area appears to be similar to the previous photograph.
1984	A building, likely the existing residence, has been constructed in the centre of the site, with an access road from Branxton Street.	Properties to the north west of Leconfield Road have been constructed. Revegetation of a vacant lot to the north east has occurred.
1994	The site appears similar to the 1984 photograph.	The surrounding areas are similar to the previous photographs.
2004	Extensions on the western side of the existing structure on site appear to have been constructed.	A housing development to the south east of the property has been established including both rural and residential properties. The remaining surrounding area appears similar to the previous photograph.
2017	The site appears similar to the previous google earth image.	Further residential development has occurred to the south east and north west of the site. The remaining surrounding area appears similar to the previous google earth image.

3.3 Site Observations

A Qualtest Environmental Scientist carried out a site walkover on 24 October 2017. Selected site photographs are presented in Appendix E. Figure 3 (Appendix B) shows the layout of the site and some of the observed features. The observations noted during the site walkover are summarised below:

- The site was located within a region of gently undulating topography, on the lower slopes of a broadly sloping east-west oriented spur formation.
- The majority of the site was undeveloped, with a single storey dwelling with attached garage, a short concrete driveway and swimming pool located near the centre of the western boundary (see Photograph 4).

- To the north and west of the residence, several shipping containers and piles of construction / waste materials (such as concrete, timber, metal sheeting and wire) were observed (see Photographs 5 to 7). It is not known what is stored in the shipping containers.
- A small derelict brick and concrete structure was observed near the centre of the eastern boundary (see Photograph 8). It is not known what this building may have been used for.
- An unsealed driveway connects the dwelling to Branxton Street to the west. The site is divided into several paddocks by timber post and barbed wire fencing.
- A road is being constructed to the southeast of the site. From site observations it appears the construction contractor uses the site as a turning bay, and for storage of boulder of sandstone rock.
- There was observed to be several areas of surface settlement and open potholes which were likely due to mine subsidence in the north-western areas of the site (see Photograph 9). A pothole was also observed in the southern portion of the site. This pothole had been infilled with soil and boulders, which may have been sourced from off site (see Photograph 10). It is not known if this pothole was associated with mining or other site activities.
- An unnamed creek crosses the site in the southeast and southwest corners of the site (see Photograph 1).
- Vegetation generally comprised grass cover and a few scattered trees, with sparse bushland present in the north-western area of the site.

3.4 NSW EPA records

A search of the NSW EPA database revealed that there are two properties within the Cessnock City Council area that are registered as having current notices:

- Caltex Service Station, 279-281 Lang Street, Kurri Kurri – located about 20km from the site; and,
- Ayrefield Colliery, Main Road, Rothbury – located about 12km from the site.

Based on the distance from the site, contamination on these properties is considered unlikely to impact the site. A copy of the search is provided in Appendix C.

A search of properties that have been reported to NSW EPA as potentially contaminated identified three properties in Greta:

- Redevelopment Site (now McDonalds restaurant) 112-114 High Street, Greta – about 500m southwest of the site;
- Coles Express Service Station, 122 New England Highway, Greta – about 500m southwest of the site; and,
- Former Landfill, Hollingshed Street, Greta – about 300m northwest of the site.

The NSW EPA has determined that these properties do not require regulation under the Contaminated Land Management Act, 1997. Based on information provided by NSW EPA, these sites are unlikely to have significant contamination migrating off-site onto surrounding sites.

3.5 Anecdotal information

The site owner, Mr Karl Waeger, has provided the following information:

- They have been familiar with the site since 1977 (about 40 years);
- The site was used for small scale market gardening during Mr Waeger's ownership;
- During this small scale market gardening no chemicals were used or stored on site;
- Wastes were not stored or disposed on the site;
- No fuelling facilities or fuel storage areas were present on the site;
- Prior to his ownership, the site was Crown Land, which he thinks was used for grazing;
- They are not aware of other past activities that may have caused contamination.

3.6 Section 149 Certificate

A Section 149 Certificate for the site was obtained from Cessnock City Council. Relevant information is summarised below.

Zoning	RU2 Rural Landscape.
Critical Habitat	The land is not land that includes or comprises critical habitat declared to be critical habitat under Part 3 of the Threatened Species Conservation Act 1995.
Conservation Area	The land is not a conservation area under the Cessnock Local Environmental Plan 2011.
Environmental Heritage	An item of environmental heritage identified in Cessnock Local Environmental Plan 2011 is not situated on the land.
Mine Subsidence	Land is within a proclaimed district.
Bushfire	Land is bushfire prone.
Contaminated Land Management Act 1997	Nil prescribed matters

3.7 Previous reports

No previous reports for the site have been provided to Qualtest.

3.8 Former Coal Mining

Based on information provided in the mine subsidence report (RGS31387.1-AA), the north-western portion of the site was historically mined for coal. The mines were the New Greta Colliery and the Whitburn Colliery, which worked the Greta Coal Seam. The assessed maximum depth of the Greta Coal Seam beneath the sites ground level is 16m to 20m, and the thickness of the seam was 1.86m. The former mine workings appeared to be present under the north-western half of the site, based on the observed pothole and depression features observed during the site walkover for the mine subsidence assessment. The record tracings did not indicate that surface infrastructure associated with the former collieries were located on the site. It is noted that the record tracings do not always include this information.

3.9 Summary of Site History

The information obtained from the site history review has been summarised below:

- Based on the information provided in the historical titles, aerial photographs and anecdotal information, the majority of the site has remained undeveloped land, previously used as grazing and mining (coal) land (northwestern portion).
- The anecdotal information indicates that chemicals were not used or stored on site during the time the site was used for small scale market gardening.

3.10 Gaps in the Site History

Whilst the site history is reasonably comprehensive there are some gaps identified in the review as follows:

- The extent of mining practices in the north-western section of the site is uncertain, but appears to cover the north-western half of the site;
- The exact operation and use of chemicals on site prior to 1987 is uncertain.

4.0 Conceptual Site Model

Based on the results of the PCA carried out on the site a conceptual site model (CSM) has been developed.

4.1 Potential Sources of Contamination

Table 4.1 (below) shows the areas of environmental concern (AECs) and associated Chemicals of Concern (COCs) identified for the site.

Table 4.1 – Potential AECs and COCs

AEC	Potentially Contaminating Activity	Potential COCs	Likelihood of Contamination	Comments
1. Use of site for small scale market farming.	Potential use of chemicals pesticides and herbicides.	Heavy Metals, OCPs, OPPs, phenoxy herbicides, Nutrients.	Low	The site owner indicated that chemicals were not used or stored on site.
2. Former site buildings and structures.	Potential use of hazardous building materials.	Asbestos, heavy metals .	Low	No hazardous building materials were observed, however a hazardous materials survey was not completed as part of the scope of work.
3. Potential use of fill in mine subsidence voids.	Potential importation of fill of unknown origin and quality.	TRH, BTEX, PAH, Heavy metals, Asbestos, OCP, OPP.	Low	No widespread use of fill was observed. Small mounds of fill were observed in several locations.
4. Unnamed creek	Potential contamination of unnamed creek from run-off from site.	Heavy Metals, OCPs, OPPs pH, salinity.	Low	Run-off from low pH soils weathered from Greta Coal Measures, could be impacting the surface water

4.2 Potentially Affected Media, Receptors and Exposure Pathways

Table 4.2 summarises the potentially affected media, potential receptors to contamination, and potential and complete exposure pathways.

Table 4.2 – Summary of Potentially Affected Media, Receptors and Exposure Pathways

Consideration	Information
Potentially affected media	Soil Surface water Groundwater
Potential transport mechanisms & exposure pathways	Leaching of soil contaminants to surface water and/or groundwater Direct dermal contact with contaminated soil and surface water Ingestion of contaminated soil Surface water discharge to the unnamed creek which runs through the southern corner and western corner of the site, and flows offsite in a westerly direction to Anvil Creek.
Potential receptors of contamination	***Site occupants & construction/maintenance workers*** Potential exposure via dermal contact with soil and surface water, and ingestion of soil. Contact with groundwater is considered unlikely, taking into account the anticipated depth to groundwater (>5m bgs in a semi confined/confined aquifer), groundwater is not currently extracted on site for beneficial use, and the discharge zone is anticipated to be Anvil Creek located about 500m west of the site. ***Surface water*** Contaminants could leach from soils into the unnamed creek. ***Groundwater*** Contaminants could leach from soils into groundwater. This is considered a low risk, as potential contaminants are "top-down" source and likely contained within the top 0.5m of the site (if present), and groundwater is expected to be present at depths >5m bgs within a semi confined/confined aquifer.

4.3 Potential and Complete Exposure Pathways

Table 4.3 summarises the potential and complete exposure pathways.

Table 4.3 – Potential and Complete Exposure Pathways

Receptor/Media	Exposure Pathway	Comment
Site occupants and construction/maintenance workers	Complete	There is a potential for site users and workers to be exposed to contaminated soil, if present.
Surface water ecosystems and users	Partially complete	Excess surface water on the site is expected to flow into Anvil Creek To the west of the site. If soil contamination is present, this could run-off into the unnamed creek.

Receptor/Media	Exposure Pathway	Comment
Groundwater users	Incomplete	Groundwater is anticipated to be at depths >5m. Therefore, a complete exposure pathway probably does not exist.

5.0 Discussion

The site history review showed that the site has predominately been used for rural-residential purposes. The site was used for small scale market gardening from about 1987, and the owner indicated that no chemicals were used for this activity. The north-western portion of the site was subjected to coal mining historically. Available information indicates that there was no surface infrastructure associated with the former mining on the site.

Four AECs were identified for the site, relating to: use of the site for small scale market gardening; use of hazardous building materials in the existing residence; potential use of fill of unknown origin and quality to infill mine subsidence voids; and low pH surface water in onsite unnamed creek. These AECs were assessed to have a low likelihood of contamination.

The site is underlain by the Greta Coal Measures, which are known to contain acidic soils and rocks, and can have a high potential to generate acid run-off if not managed appropriately.

The existing residence is proposed to remain, with its own allotment in the proposed subdivision. Based on this, further assessment of the existing residence and its allotment is not proposed.

6.0 Conclusions and Recommendations

Based on the site history and site inspection, it is considered that the site is suitable for the proposed residential development, providing the following is completed:

- The stockpiles of waste materials (concrete, timber, brick, metals etc) are removed and disposed off-site to appropriately licensed recyclers or waste facilities;
- Due to the presence of waste materials, small fill mounds, and the former mining on the northwest portion of the site, an Unexpected Finds Procedure should be prepared and implemented during earthworks. The Unexpected Finds Procedure would provide guidance on identifying potentially contaminated materials, and procedures for handling and management of potentially contaminated materials.

If soils are proposed to be disposed offsite, they will require further assessment. The natural soils (excluding topsoil) may be able to be classified as Virgin Excavated Natural Material (VENM), although assessment for acidic soils and rocks would be required as part of the VENM assessment, given that the site being underlain by the Greta Coal Measures. Other materials may be suitable for assessment as Excavated Natural Material (ENM) under the Resource Recovery Order/Exemption under Part 9, Clause 91 to 93 of the POEO (Waste) Regulation, or they may require waste classification in accordance with the NSW EPA (2014) Waste Classification Guidelines, and disposal to an appropriate licensed landfill or facility.

7.0 Limitations

The findings presented in the report and used as the basis for recommendations presented herein, were obtained using normal, industry accepted practices and standards. To our knowledge, they represent a reasonable interpretation of the general conditions of the site.

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

If you have any further questions regarding this report, please do not hesitate to contact the undersigned.

Emma Coleman
Senior Environmental Scientist

8.0 References

Friebel & Nadebaum (2011). *Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater* (technical paper No.10) Guidelines, CRC for Contamination Assessment and Remediation of the Environment (CRC CARE).

NEPC (2013) *National Environmental Protection (Assessment of Site Contamination)* Measure 1999, as amended in 2013, National Environment Protection Council (ASC NEPM, 2013).

NSW Department of Primary Industries (Office of Water) Registered Groundwater Bore Map, accessed from http://allwaterdata.water.nsw.gov.au/water.stm, accessed on 23 October 2017.

NSW Land and Property Information, Spatial Information eXchange (SIX) Maps - Topographic Map, accessed from https://maps.six.nsw.gov.au/, accessed on 23 October 2017.

NSW Department of Land and Water Conservation (1997) Greta Acid Sulfate Soil Risk Map (1:25,000 scale, Edition Two)

NSW OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites.

NSW EPA (1995) Sampling Design Guidelines

APPENDIX A:

Figures

Source: Google Earth Image 2016.

Qualtest LABORATORY (NSW) PTY LTD	Client:	KARL WAEGER C/- HUNTER DEVELOPMENT BROKERAGE PTY LTD	Drawing No:	FIGURE 1
	Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193-AB
	Location:	71 BRANXTON STREET, GRETA	Scale:	AS SHOWN
	Title:	SITE LOCATION	Date:	09/11/2017

Based on proposed site plan provided by HDB ("Option 1, Lot 1 DP 873228, 71 Branxton Street, Greta", Rev. A, dated 24/07/2017) overlain on Google Earth image.

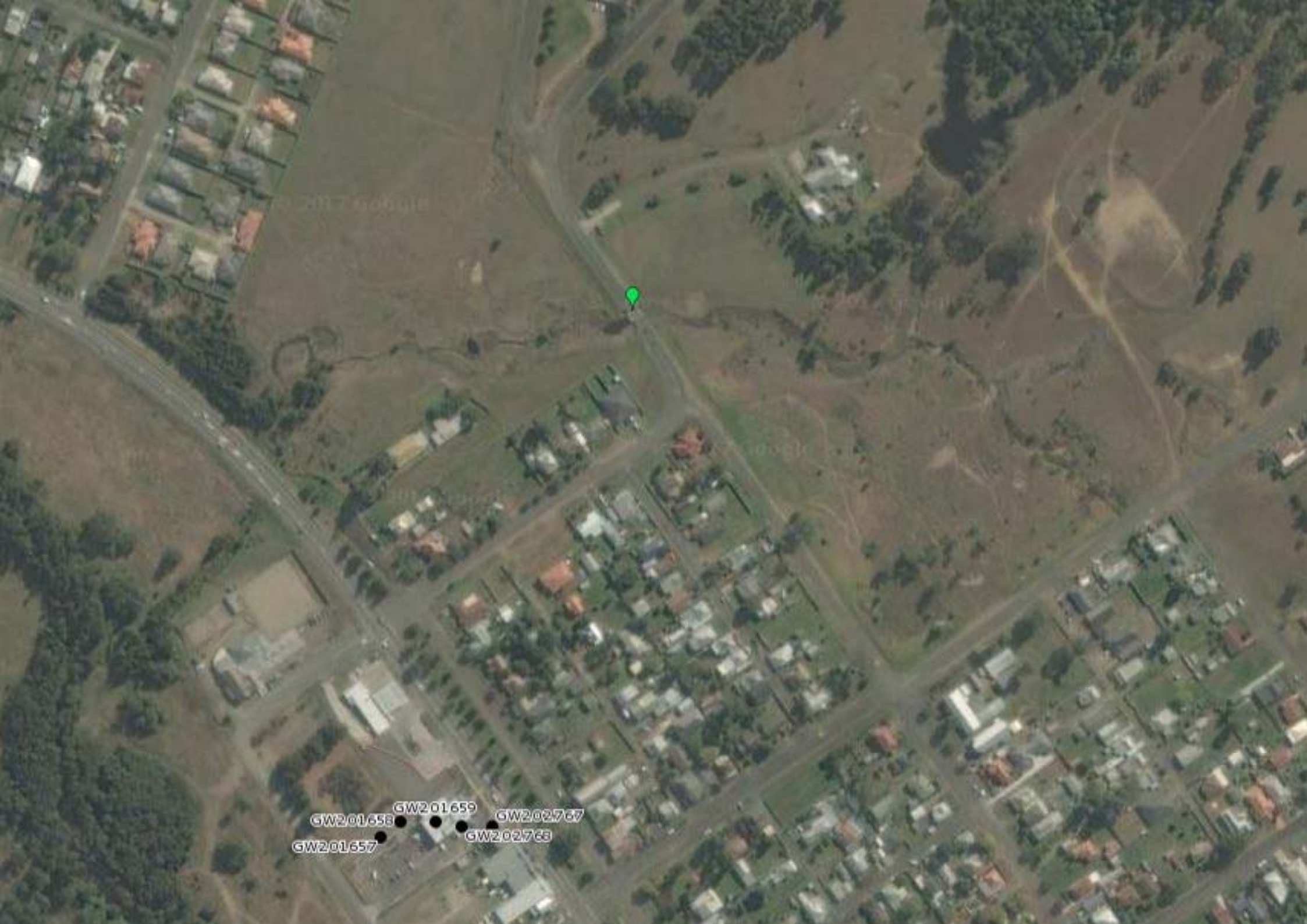
Qualtest LABORATORY (NSW) PTY LTD	Client:	KARL WAEGER C/- HUNTER DEVELOPMENT BROKERAGE PTY LTD	Drawing No:	FIGURE 2
	Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193-AB
	Location:	71 BRANXTON STREET, GRETA	Scale:	AS SHOWN
	Title:	PROPOSED SUBDIVISION LAYOUT	Date:	09/11/2017

Based on Near Maps image dated 26 September 2017.

Qualtest LABORATORY (NSW) PTY LTD	Client:	KARL WAEGER C/- HUNTER DEVELOPMENT BROKERAGE PTY LTD	Drawing No:	FIGURE 3
	Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193-AB
	Location:	71 BRANXTON STREET, GRETA	Scale:	AS SHOWN
	Title:	SITE LAYOUT	Date:	09/11/2017

APPENDIX B:

Groundwater Bore Data


GW201658
GW201659
GW202767
GW201657
GW202768

NSW Office of Water
Work Summary

GW201657

Licence: 20BL172996 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Auger - Solid Flight
Owner Type: Private

Commenced Date:
Completion Date: 29/06/2010
Final Depth: 4.20 m
Drilled Depth: 4.20 m

Contractor Name: Total Drilling
Driller: Ryan Alan Whyte
Assistant Driller: C Howle

Property: N A 112 HIGH STREET GRETA 2334 NSW
GWMA:
GW Zone:
Standing Water Level: 2.200
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.9	21//708439
Licensed:			

Region: 20 - Hunter
River Basin: 210 - HUNTER RIVER
Area/District:
CMA Map: 9132-1S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6383370.0
Easting: 348806.0
Latitude: 32°40'37.2"S
Longitude: 151°23'14.8"E

GS Map: -
MGA Zone: 0
Coordinate Source: GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.20	100			Auger - Solid Flight
1		Annulus	Bentonite	0.00	0.80	100	60		PL:Poured/Shovelled
1		Annulus	Waterworn/Rounded	0.80	4.20	100	60		Graded, PL:Poured/Shovelled
1	1	Casing	Pvc Class 18	0.00	1.20	60	50		Seated on Bottom, Kwik-lock
1	1	Opening	Slots - Horizontal	1.20	4.20	60		1	Mechanically Slotted, PVC Class 18, Screwed, SL: 5.0mm, A: 0.40mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
2.20	4.20	2.00	Unknown	2.20					

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

0.00	0.60	0.60	Fill; sandy clay, brown/orange	Fill	
0.60	2.60	2.00	Sand, silty clayed	Sand	
2.60	4.20	1.60	Sand, Silty clayed, & weathered sandstone	Sand	

Remarks

29/06/2010: Form A Remarks:
Nat Carling, 1-May-2012; Coordinates based on location map provided with the Form-A.

***** End of GW201657 *****

NSW Office of Water
Work Summary

GW201658

Licence: 20BL172996 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Auger - Solid Flight
Owner Type: Private

Commenced Date:
Completion Date: 29/06/2010
Final Depth: 4.50 m
Drilled Depth: 4.50 m

Contractor Name: Total Drilling
Driller: Ryan Alan Whyte
Assistant Driller: C Howle

Property: N A 112 HIGH STREET GRETA 2334 NSW
GWMA:
GW Zone:
Standing Water Level: 2.750
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.9	21//708439
Licensed:			

Region: 20 - Hunter
River Basin: 210 - HUNTER RIVER
Area/District:
CMA Map: 9132-1S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6383380.0
Easting: 348819.0
Latitude: 32°40'36.9"S
Longitude: 151°23'15.3"E

GS Map: -
MGA Zone: 0
Coordinate Source: GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.50	100			Auger - Solid Flight
1		Annulus	Bentonite	0.00	1.00	100	60		PL:Poured/Shovelled
1		Annulus	Waterworn/Rounded	1.00	4.50	100	60		Graded, PL:Poured/Shovelled
1	1	Casing	Pvc Class 18	0.00	1.50	60	50		Seated on Bottom, Kwik-lock
1	1	Opening	Slots - Horizontal	1.50	4.50	60		1	Mechanically Slotted, PVC Class 18, Screwed, SL: 5.0mm, A: 0.40mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
2.75	4.50	1.75	Unknown	2.75					

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

0.00	1.50	1.50	Fill; Gravelly Clayey Sand	Fill	
1.50	3.20	1.70	Sandy Clay; brown	Sandy Clay	
3.20	4.50	1.30	Clay; stiff, grey	Clay	

Remarks

29/06/2010: Form A Remarks:
Nat Carling, 1-May-2012; Coordinates based on location map provided with the Form-A.

***** End of GW201658 *****

NSW Office of Water
Work Summary

GW201659

Licence: 20BL172996 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Auger - Solid Flight
Owner Type: Private

Commenced Date:
Completion Date: 29/06/2010
Final Depth: 4.50 m
Drilled Depth: 4.50 m

Contractor Name: Total Drilling
Driller: Ryan Alan Whyte
Assistant Driller: C Howle

Property: N A 112 HIGH STREET GRETA 2334 NSW
GWMA:
GW Zone:
Standing Water Level: 2.750
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.9	21//708439
Licensed:			

Region: 20 - Hunter
River Basin: 210 - HUNTER RIVER
Area/District:
CMA Map: 9132-1S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6383381.0
Easting: 348842.0
Latitude: 32°40'36.9"S
Longitude: 151°23'16.2"E

GS Map: -
MGA Zone: 0
Coordinate Source: GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.50	100			Auger - Solid Flight
1		Annulus	Bentonite	0.00	1.00	100	60		PL:Poured/Shovelled
1		Annulus	Waterworn/Rounded	1.00	4.50	100	60		Graded, PL:Poured/Shovelled
1	1	Casing	Pvc Class 18	0.00	1.50	60	50		Seated on Bottom, Kwik-lock
1	1	Opening	Slots - Horizontal	1.50	4.50	60		1	Mechanically Slotted, PVC Class 18, Screwed, SL: 5.0mm, A: 0.40mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
2.75	4.50	1.75	Unknown	2.75					

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

0.00	0.50	0.50	Fill; Gravelly Sand	Fill	
0.50	1.00	0.50	Fill; Sandy Clay	Fill	
1.00	2.50	1.50	Silty Clay; orange/grey	Silty Clay	
2.50	3.60	1.10	Sand, brown, moist	Sand	
3.60	4.50	0.90	Sand, Clayey Silty	Sand	

Remarks

29/06/2010: Form A Remarks:
Nat Carling, 1-May-2012; Coordinates based on location map provided with the Form-A.

***** End of GW201659 *****

NSW Office of Water
Work Summary

GW202767

Licence: 20BL173204 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Auger - Solid Flight
Owner Type: Private

Commenced Date:
Completion Date: 12/07/2012
Final Depth: 4.10 m
Drilled Depth: 4.10 m

Contractor Name: FICO
Driller: Mark Lynch
Assistant Driller: Dean Gardiner

Property: N A 112-114 HIGH STREET GRETA 2334 NSW
GWMA:
GW Zone:
Standing Water Level: 2.300
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.9	1//1184140
Licensed:			

Region: 20 - Hunter
River Basin: 210 - HUNTER RIVER
Area/District:
CMA Map: 9132-1S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6383378.0
Easting: 348879.0
Latitude: 32°40'37.0"S
Longitude: 151°23'17.6"E

GS Map: -
MGA Zone: 0
Coordinate Source: GPS - Global Positioning System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.10	100			Auger - Solid Flight
1		Annulus	Waterworn/Rounded	0.00	0.30	100	60		Graded, PL:Poured/Shovelled
1		Annulus	Bentonite/Grout	0.30	0.80	100	60		PL:Poured/Shovelled
1		Annulus	Waterworn/Rounded	0.80	4.10	100	60		Graded, PL:Poured/Shovelled
1	1	Casing	Pressure Cemented Casing	0.00	1.10	60	50		Seated on Bottom, Screwed
1	1	Opening	Slots - Horizontal	1.10	4.10	60		1	Mechanically Slotted, PVC Class 18, Screwed, SL: 5.0mm, A: 1.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
2.20	2.80	0.60	Unknown	2.30					

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.90	0.90	Fill; gravelly sandy clay	Fill	
0.90	2.20	1.30	Fill; sandy clay	Fill	
2.20	4.10	1.90	Clay, sandy; refusal on rock	Clay	

Remarks

12/07/2012: Form A Remarks:
Nat Carling, 3-mar-2014; GPS provided by the drillers.

***** End of GW202767 *****

NSW Office of Water
Work Summary

GW202768

Licence: 20BL173205 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Auger - Solid Flight
Owner Type: Private

Commenced Date:
Completion Date: 12/07/2012
Final Depth: 4.40 m
Drilled Depth: 4.40 m

Contractor Name: FICO
Driller: Mark Lynch
Assistant Driller: Dean Gardiner

Property: N A 112-114 HIGH STREET GRETA 2334 NSW
GWMA:
GW Zone:
Standing Water Level: 2.800
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.9	1//1184140
Licensed:			

Region: 20 - Hunter
River Basin: 210 - HUNTER RIVER
Area/District:
CMA Map: 9132-1S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6383378.0
Easting: 348859.0
Latitude: 32°40'37.0"S
Longitude: 151°23'16.8"E

GS Map: -
MGA Zone: 0
Coordinate Source: GPS - Global Positioning System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.40	100			Auger - Solid Flight
1		Annulus	Waterworn/Rounded	0.00	0.40	100	60		Graded, PL:Poured/Shovelled
1		Annulus	Bentonite	0.40	0.90	100	60		PL:Poured/Shovelled
1		Annulus	Waterworn/Rounded	0.90	4.40	100	60		Graded, PL:Poured/Shovelled
1	1	Casing	Pvc Class 18	0.00	1.40	60	50		Seated on Bottom, Screwed
1	1	Opening	Slots - Horizontal	1.40	4.40	60		1	Mechanically Slotted, PVC Class 18, Screwed, SL: 50.0mm, A: 1.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
2.50	3.00	0.50	Unknown	2.80					

Geologists Log

Drillers Log

From	To	Thickness	Drillers Description	Geological Material	Comments

(m)	(m)	(m)			
0.00	0.60	0.60	Fill; gravelly clay	Fill	
0.60	2.20	1.60	Fill; sandy clay	Fill	
2.20	4.40	2.20	Clay, sandy, refusal on rock	Clay	

Remarks

12/07/2012: Form A Remarks:
Nat Carling, 3-Mar-2014; GPS provided by the drillers.

***** End of GW202768 *****

APPENDIX C:

Historical Titles

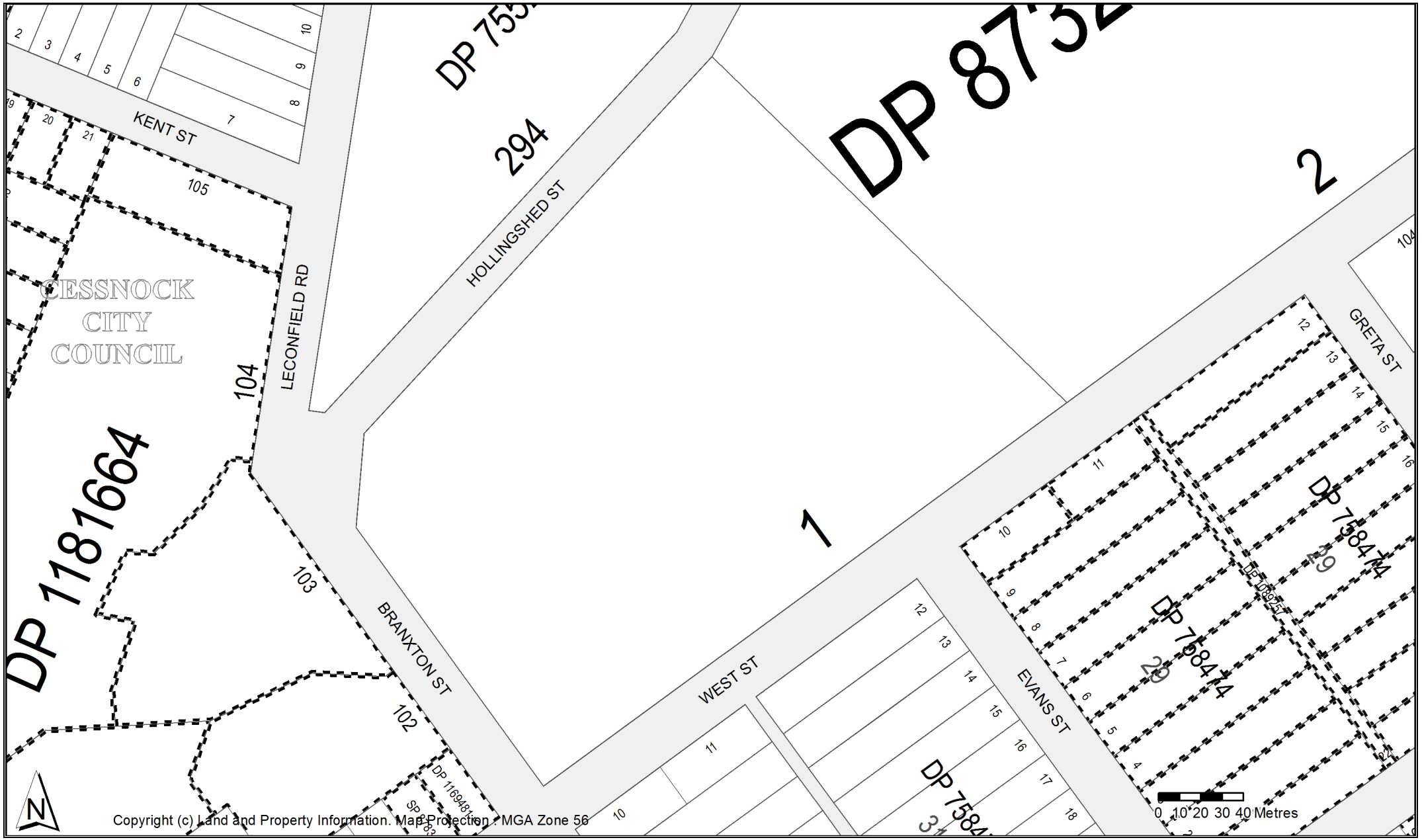
Cadastral Records Enquiry Report

Ref : Advance Legal Searchers Pty Ltd

Requested Parcel : Lot 1 DP 873220

Identified Parcel : Lot 1 DP 873220

Locality : GRETA **LGA :** CESSNOCK **Parish :** BRANXTON **County :** NORTHUMBERLAND



	Status	Surv/Comp	Purpose
DP758474			
Lot(s): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 Section : 29			
CA96824 - LOTS 1-21 SECTION 29 DP758474 AND LOT 22 DP1089257			
NSW GAZ. 17-06-1977 Folio : 2429 VESTED IN COUNCIL AS PUBLIC RESERVE LOTS 1-21 SECTION 29 DP758474 AND LOT 22 DP1089257			
DP1043392			
Lot(s): 6			
DP852037	HISTORICAL	SURVEY	SUBDIVISION
DP1027360	REGISTERED	SURVEY	SUBDIVISION
DP1089257			
Lot(s): 22			
CA96824 - LOTS 1-21 SECTION 29 DP758474 AND LOT 22 DP1089257			
NSW GAZ. 17-06-1977 Folio : 2429 VESTED IN COUNCIL AS PUBLIC RESERVE LOTS 1-21 SECTION 29 DP758474 AND LOT 22 DP1089257			
DP1102576			
Lot(s): 12			
DP5904	HISTORICAL	SURVEY	UNRESEARCHED
DP1118026			
Lot(s): 7, 12, 13, 14, 15, 17, 19, 20, 21			
DP829250	HISTORICAL	SURVEY	DELIMITATION
DP1169481			
Lot(s): 5			
DP1087	HISTORICAL	COMPILATION	UNRESEARCHED
DP1181664			
Lot(s): 101, 102, 103, 104, 105			
DP755211	HISTORICAL	COMPILATION	CROWN ADMIN NO.
NSW GAZ. 07-03-2008 Folio : 1458 REVOCATION OF RESERVATION OF CROWN LAND RESERVE NO. 755211 - LOT 142 DP755211			
SP87834			
DP1087	HISTORICAL	COMPILATION	UNRESEARCHED
DP1169481	REGISTERED	SURVEY	REDEFINITION

Requested Parcel : Lot 1 DP 873220 **Identified Parcel :** Lot 1 DP 873220

Locality : GRETA **LGA :** CESSNOCK **Parish :** BRANXTON **County :** NORTHUMBERLAND

Plan	Surv/Comp	Purpose
DP1087	COMPILATION	UNRESEARCHED
DP5904	SURVEY	UNRESEARCHED
DP755211	COMPILATION	CROWN ADMIN NO.
DP758474	COMPILATION	CROWN ADMIN NO.
DP850912	SURVEY	SUBDIVISION
DP852037	SURVEY	SUBDIVISION
DP873220	SURVEY	SUBDIVISION
DP1043392	SURVEY	SUBDIVISION
DP1089257	COMPILATION	LIMITED FOLIO CREATION
DP1102576	SURVEY	SUBDIVISION
DP1118026	SURVEY	SUBDIVISION
DP1118026	UNRESEARCHED	SUBDIVISION
DP1169481	SURVEY	REDEFINITION
DP1169481	UNRESEARCHED	REDEFINITION
DP1181664	SURVEY	SUBDIVISION
SP87834	COMPILATION	STRATA PLAN

A294

PLAN OF PORTION 157

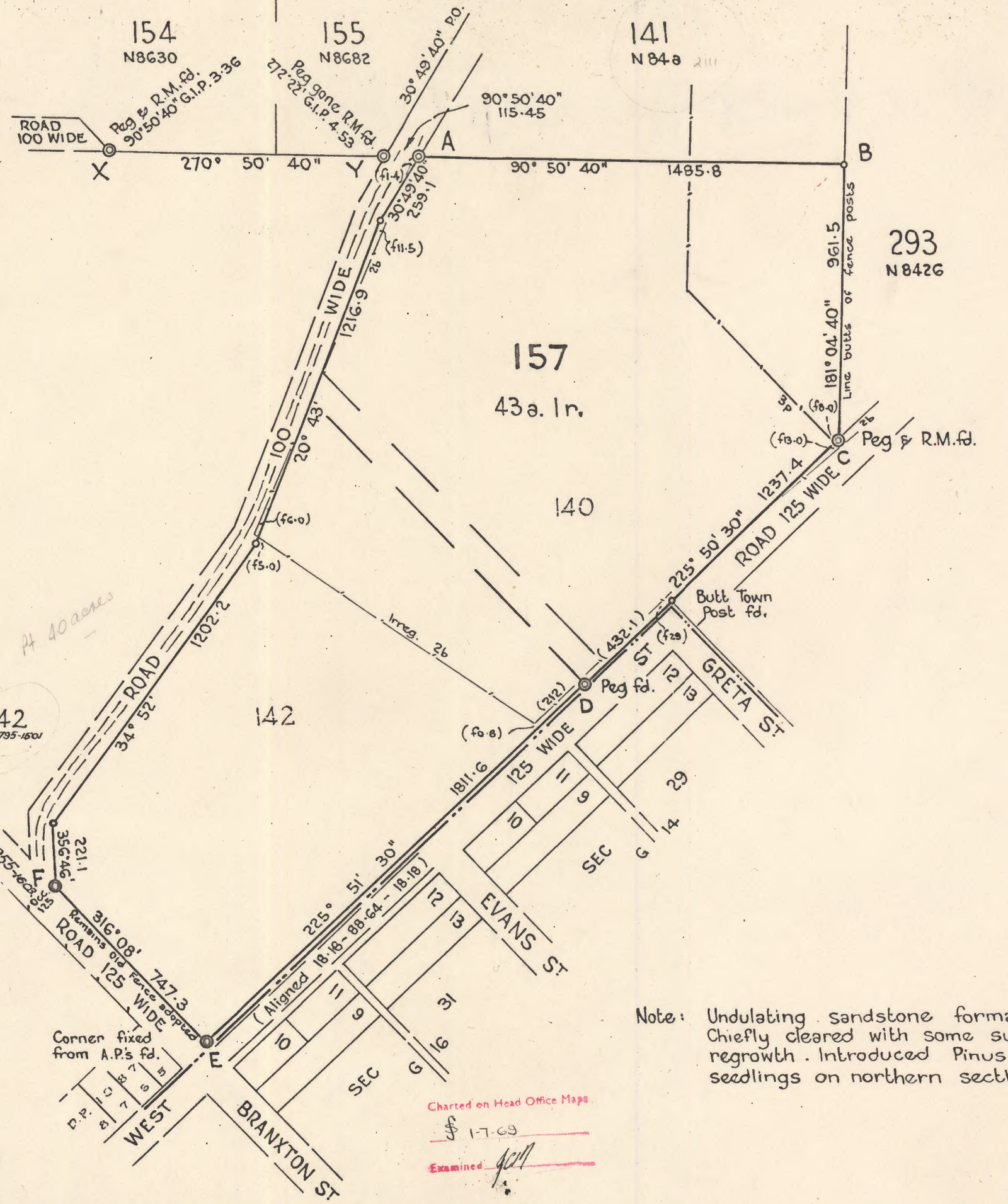
PARISH BRANXTON
LAND DISTRICT MAITLAND

COUNTY NORTHUMBERLAND
~~SHIRE~~ CITY OF GREATER CESSNOCK

NOTATION PLAN

I, the Officer-in-Charge, General Drafting Branch, CERTIFY that this notation plan is a PHOTOGRAPHIC COPY OF THE ORIGINAL AT DATE OF ITS APPROVAL.

DATE 20 JUN 1969



Note: Undulating sandstone formation. Chiefly cleared with some sucker regrowth. Introduced Pinus Radiata seedlings on northern section.

Charted on Head Office Maps
17-7-69
Examined

SURROUND AREA
43·37268 Acres.

SCALE 4 CHAIN TO AN INCH. All measurements shown in Links.

CANCELS : Part Plans N.84a-2111 and N.795-1501
WITHIN : Council of the City of Greater Cessnock Town and Country Planning Scheme.
: Suburban Lands; Town of Greta. Proclaimed 3-10-1891.
: R.2664 from the Leasing Provisions of the Mining Act. 1906-52. Not'd 9-1-1959
Title limited to the surface and to a depth of 50 ft. below the surface.

Portion 157: Sp.L. 65-31 Clement Patrick WITHERS.

REFERENCE MARKS.

CORNER	BEARING	FROM	DISTANCE	NO. ON TREE
A	90° 50' 40"	G.I.P.	5·0	
	Peg on Corner			157
B	260° 30'	Gum	62·7	157
C	1° ~~05~~ 04' 40"	G.I.P.	3·22 ~~2·27~~	fd.
D	45° 52'	G.I.P.	5·2	
E	45° 52'	G.I.P.	5·0	
	Peg on Corner			157
F	136° 08'	G.I.P.	5·0	
	Peg on Corner			157

AZIMUTH TAKEN FROM XY
FIELD BOOK LDGGOG PAGES 1-4

I Ian Harold Marshall of Cessnock
a Surveyor registered under the Surveyors Act, 1929-1946, hereby certify that the survey represented in this plan is accurate and has been made by me ~~under my immediate supervision~~ in accordance with the Survey Practice Regulations, 1933, and the special requirem of the Department of Lands and was completed on 8th. Nov.

Signature Ian Marshall
Surveyor registered under the Surveyors Act, 1929-194
CHECKED & CHARTED Richard Cairns 17-
PLAN APPROVED H.R.Phelps
Authorised Officer 18-3-19

This space for office use only.

PLAN MICROFILMED
NO ADDITIONS OR AMENDMENTS TO BE MADE

PAPER NO. L.B. 65-1351 Ten. 68-84 CAT. NO. N.8719-2111.R. NOTATION PLAN

NOTATION PLAN

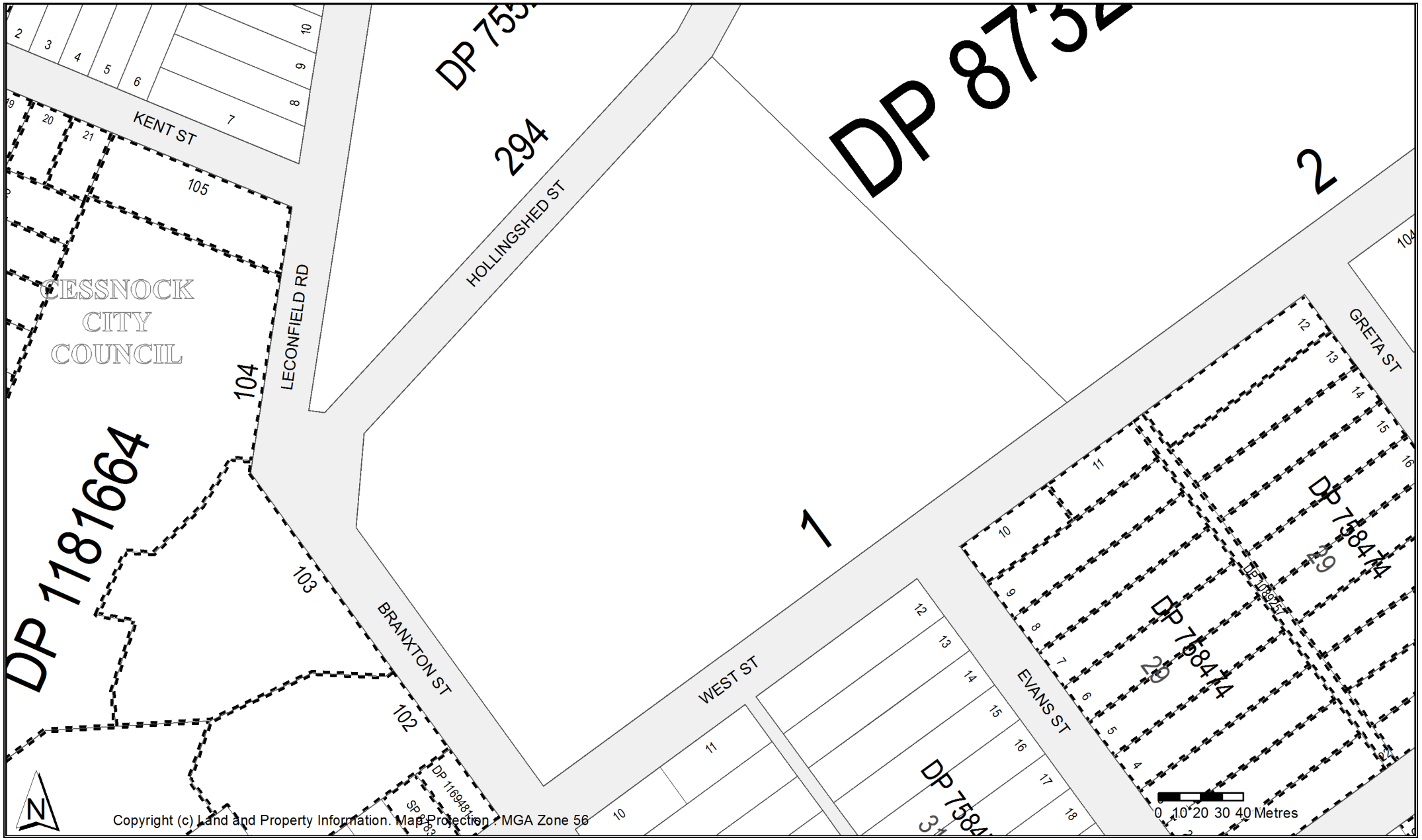
Cadastral Records Enquiry Report

Ref : Advance Legal Searchers Pty Ltd

Requested Parcel : Lot 1 DP 873220

Identified Parcel : Lot 1 DP 873220

Locality : GRETA **LGA :** CESSNOCK **Parish :** BRANXTON **County :** NORTHUMBERLAND



	Status	Surv/Comp	Purpose
DP758474			
Lot(s): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 Section : 29			
CA96824 - LOTS 1-21 SECTION 29 DP758474 AND LOT 22 DP1089257			
NSW GAZ. 17-06-1977 Folio : 2429 VESTED IN COUNCIL AS PUBLIC RESERVE LOTS 1-21 SECTION 29 DP758474 AND LOT 22 DP1089257			
DP1043392			
Lot(s): 6			
DP852037	HISTORICAL	SURVEY	SUBDIVISION
DP1027360	REGISTERED	SURVEY	SUBDIVISION
DP1089257			
Lot(s): 22			
CA96824 - LOTS 1-21 SECTION 29 DP758474 AND LOT 22 DP1089257			
NSW GAZ. 17-06-1977 Folio : 2429 VESTED IN COUNCIL AS PUBLIC RESERVE LOTS 1-21 SECTION 29 DP758474 AND LOT 22 DP1089257			
DP1102576			
Lot(s): 12			
DP5904	HISTORICAL	SURVEY	UNRESEARCHED
DP1118026			
Lot(s): 7, 12, 13, 14, 15, 17, 19, 20, 21			
DP829250	HISTORICAL	SURVEY	DELIMITATION
DP1169481			
Lot(s): 5			
DP1087	HISTORICAL	COMPILATION	UNRESEARCHED
DP1181664			
Lot(s): 101, 102, 103, 104, 105			
DP755211	HISTORICAL	COMPILATION	CROWN ADMIN NO.
NSW GAZ. 07-03-2008 Folio : 1458 REVOCATION OF RESERVATION OF CROWN LAND RESERVE NO. 755211 - LOT 142 DP755211			
SP87834			
DP1087	HISTORICAL	COMPILATION	UNRESEARCHED
DP1169481	REGISTERED	SURVEY	REDEFINITION

Requested Parcel : Lot 1 DP 873220 **Identified Parcel :** Lot 1 DP 873220

Locality : GRETA **LGA :** CESSNOCK **Parish :** BRANXTON **County :** NORTHUMBERLAND

Plan	Surv/Comp	Purpose
DP1087	COMPILATION	UNRESEARCHED
DP5904	SURVEY	UNRESEARCHED
DP755211	COMPILATION	CROWN ADMIN NO.
DP758474	COMPILATION	CROWN ADMIN NO.
DP850912	SURVEY	SUBDIVISION
DP852037	SURVEY	SUBDIVISION
DP873220	SURVEY	SUBDIVISION
DP1043392	SURVEY	SUBDIVISION
DP1089257	COMPILATION	LIMITED FOLIO CREATION
DP1102576	SURVEY	SUBDIVISION
DP1118026	SURVEY	SUBDIVISION
DP1118026	UNRESEARCHED	SUBDIVISION
DP1169481	SURVEY	REDEFINITION
DP1169481	UNRESEARCHED	REDEFINITION
DP1181664	SURVEY	SUBDIVISION
SP87834	COMPILATION	STRATA PLAN

RP 13

STAMP DUTY

OFFIC[illegible] REVENUE (N.S.W. TREASURY)

1989/C[illegible] NT3

STAMP $1.00 DUTY

CHIEF COMMISSIONER

Y580778

TRANSFER

REAL PROPERTY ACT, 1900

T | CA | 1 of 1 | X | R 1/1

$ 44

Torrens Title Reference	If Part Only, Delete Whole and Give Details	Location
Identifier 157/755211	WHOLE	at Greta

DESCRIPTION OF LAND Note (a)

TRANSFEROR Note (b)

KARL WAEGER

ESTATE Note (c)

(the abovenamed TRANSFEROR) hereby acknowledges receipt of the consideration of $27,000.00 and transfers an estate in fee simple as to his one-third share as tenant in common in the land above described to the TRANSFEREE

TRANSFEREE Note (d)

HELA EVELYNE WAEGER of 62 Wyndham Street, Greta, Supervisor

OFFICE USE ONLY

OVER

TENANCY Note (e)

as joint tenants/tenants in common

PRIOR ENCUMBRANCES Note (f)

subject to the following PRIOR ENCUMBRANCES 1. Nil 2. ..... 3. .....

DATE 17th August 1989

We hereby certify this dealing to be correct for the purposes of the Real Property Act, 1900.

EXECUTION Note (g)

Signed in my presence by the transferor who is personally known to me

..... Signature of Witness

BARBARA IRENE TROWBRIDGE

Name of Witness (BLOCK LETTERS)

9 RAILWAY STREET, CESSNOCK 2325

Address and occupation of Witness

JUSTICE OF THE PEACE.

Signature of Transferor

Signed in my presence by the transferee who is personally known to me

Note (g)

..... Signature of Witness

..... Name of Witness (BLOCK LETTERS)

..... Address and occupation of Witness

Solicitor Signature of Transferee

R.P. Mallik

TO BE COMPLETED BY LODGING PARTY Notes (h) and (i)

LODGED BY Morris, Hayes & Edgar
LAW STATIONERS
99 ELIZABETH STREET
SYDNEY AK6651
DX 420 232-2411
35 D
Ref:
Delivery Box Number

LOCATION OF DOCUMENTS	CT	OTHER	
	✓	Ministers Consent	Herewith ✓
			In L.T.O. with
			Produced by

OFFICE USE ONLY

Checked	Passed	REGISTERED - -19
EB3		
Signed	Extra Fee	

Secondary Directions		
Delivery Directions	over	

LJ

consent 35D.

RP 13
1985

INSTRUCTIONS FOR COMPLETION

This dealing should be marked by the Stamp Duties Division, Department of Finance before lodgment by hand at the Land Titles Office.

Typewriting and handwriting should be clear, legible and in permanent dense black or dark blue non-copying ink.

Alterations are not to be made be erasure; the words rejected are to be ruled through and initialled by the parties to the dealing in the left-hand margin.

If the space provided is insufficient, additional sheets of the same size and quality of paper and having the same margins as this form should be used. Each additional sheet must be identified as an annexure and signed by the parties and the attesting witnesses.

If it is intended to create easements, covenants, &c., use forms RP13A, RP13B, RP13C as appropriate.

Rule up all blanks.

The following instructions relate to the SIDE NOTES on the form.

(a) Description of land:

(i) TORRENS TITLE REFERENCE. — For a manual reference insert the Volume and Folio (e.g., Vol. 8514 Fol. 126) — For a computer folio insert the folio identifier (e.g., 12/701924).

(ii) PART/WHOLE. — If part only of the land in the folio of the Register is being transferred, delete the word "WHOLE" and insert the lot and plan number, portion, &c. See also sections 327 and 327AA of the Local Government Act, 1919.

(iii) LOCATION. — Insert the locality shown on the Certificate of Title/Crown Grant, e.g., at Chullora. If the locality is not shown, insert the Parish and County, e.g., Ph. Lismore Co. Rous.

(b) Show the full name of the transferor(s).

(c) If the estate being transferred is a lesser estate than an estate in fee simple, delete "fee simple" and insert appropriate estate.

(d) Show the full name, address and occupation or description of the transferee(s).

(e) Delete if only one transferee. If more than one transferee, delete either "joint tenants" or "tenants in common", and, if the transferees hold as tenants in common, state the shares in which they hold.

(f) In the memorandum of prior encumbrances, state only the registered number of any mortgage, lease, charge or writ to which this dealing is subject.

(g) Execution:

GENERALLY (i) Should there be insufficient space for the execution of this dealing, use an annexure sheet.
(ii) The certificate of correctness under the Real Property Act, 1900, must be signed by all parties to the transfer, each party to execute the dealing in the presence of an adult witness, not being a party to the dealing, to whom he/she is personally known.
The solicitor for the transferee may sign the certificate on behalf of the transferee, the solicitor's name (not that of his/her firm), to be typewritten or printed adjacent to the signature. Any person falsely or negligently certifying is liable to the penalties provided by section 117 of the Real Property Act, 1900.

ATTORNEY (iii) If the transfer is executed by an attorney for the transferor/transferee pursuant to a registered power of attorney, the form of attestation must set out the full name of the attorney, and the form of execution must indicate the source of his/her authority, e.g., "AB by his attorney (or receiver or delegate, as the case may be) XY pursuant to power of attorney registered Book No.

AUTHORITY (iv) If the transfer is executed pursuant to an authority (other than specified in (iii)) the form of execution must indicate the statutory, judicial or other authority pursuant to which the transfer has been executed.

CORPORATION (v) If the transfer is executed by a corporation under seal, the form of execution should include a statement that the seal has been properly affixed, e.g., in accordance with the Articles of Association of the corporation. Each person attesting the affixing of the seal must state his/her position (e.g., director, secretary) in the corporation.

(h) Insert the name, postal address, Document Exchange reference, telephone number and delivery box number of the lodging party.

(i) The lodging party is to complete the LOCATION OF DOCUMENTS panel. Place a tick in the appropriate box to indicate the whereabout of the Certificate of Title. List, in an abbreviated form, other documents lodged, e.g., stat. dec. for statutory declaration, pbte for probate, L/A. for letters of administration, &c.

OFFICE USE ONLY

FIRST SCHEDULE DIRECTIONS

(A) FOLIO IDENTIFIER	(B) DIRECTION	(C) NAME
	PROP.	KARL HEINZ WAEGER IN 1/3 SHARE
		INGRID WAEGER IN 1/3 SHARE
		HELA EVELYNE WAEGER IN 1/3 SHARE
		AS TENANTS IN COMMON

SECOND SCHEDULE AND OTHER DIRECTIONS

(D) FOLIO IDENTIFIER (OR REGD DEALING AND FOLIO IDENTIFIER)	(E) DIRECTION	(F) NOTFN TYPE	(G) DEALING NUMBER	(H) DETAILS
	C7.		35D.	

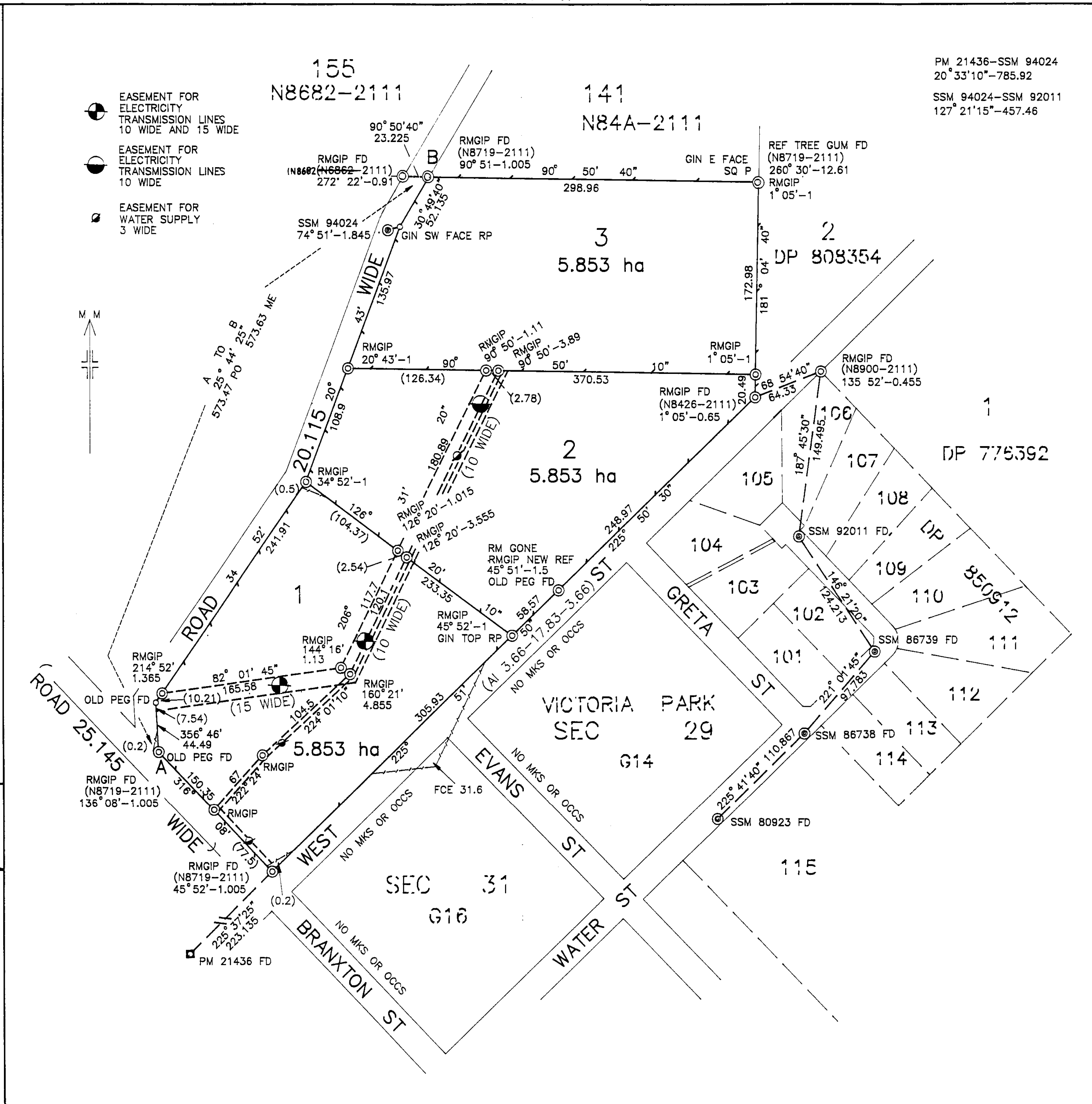
Req:R542674 /Doc:DL Y580778 /Rev:09-Aug-2010 /Sts:OK.SC /Pgs:ALL /Prt:18-Oct-2017 08:55 /Seq:2 of 2
Ref:advlegs /Src:P

PLAN FORM 2

Plan Drawing only to appear in this space

*OFFICE USE ONLY

SIGNATURES, SEALS AND STATEMENTS of intention to dedicate public roads or to create public reserves, drainage reserves, easements, restrictions on the use of land or positive covenants.



DP 873220 Ⓔ
Registered: 11-12-1997
C.A: 46/91 OF 12.5.1997
Title System: TORRENS
Purpose: SUBDIVISION
Ref. Map: U3680 – 4#
Last Plan: 8719.2111

PLAN OF SUBDIVISION OF LOT 157 DP 755211

Lengths are in metres. Reduction Ratio 1: 2500

~~Mun./Shire City~~	LGA CESSNOCK
Locality:	GRETA
Parish:	BRANXTON
County:	NORTHUMBERLAND

This is sheet ~~1 of my plan in~~ sheets. ~~(Delete if inapplicable)~~

I, ROBERT DOUGLAS OBERMAN of BRANXTON ST GRETA 2334 a surveyor registered under the Surveyors Act, 1929, as amended, hereby certify that the survey represented in this plan is accurate and has been made in accordance with the Survey Practice Regulation 1990, and any special requirements of the Department of Lands, and was completed on #30TH AUGUST 1996

Signature ...

Surveyor registered under Surveyors Act, 1929, as amended.
Datum Line of Azimuth. A – B
#Insert date of survey.

Plans used in preparation of survey/compilation.
N84a–2111 N8426–2111
N8682–2111 N8719–2111
N8900–2111 DP 776392
DP 850912 DP 808354

PANEL FOR USE ONLY for statements of intention to dedicate public roads or to create public reserves, drainage reserves, easements, restrictions on the use of land or positive covenants.

PURSUANT TO SEC 88B OF THE CONVEYANCING ACT 1919–1964 IT IS INTENDED TO CREATE :–

1. EASEMENT FOR ELECTRICITY TRANSMISSION LINES 10 WIDE AND 15 WIDE
2. EASEMENT FOR ELECTRICITY TRANSMISSION LINES 10 WIDE
3. EASEMENT FOR WATER SUPPLY 3 WIDE

U 3680 – 11

DP 873220

Crown Lands Office Approval

PLAN APPROVED ... Authorised Officer
Land District ...
Paper No. ...
Field Book ... pages

Council Clerk's Certificate

I hereby certify that –
(a) the requirements of the Local Government Act, 1919 (other than the requirements for the registration of plans), and
*(b) the requirements of Part 3 Division 2 of the ~~†Water Board Act 1987 and~~ †Water Supply Authorities Act 1987

have been complied with by the applicant in relation to the proposed SUBDIVISION
(insert "new road", "subdivision" or "consolidated lot") set out herein

Subdivision No. 46/91
Date 12TH May 1997.
(Signature) ...
~~Council Clerk~~ General Manager
Council File No. 150/591/46

*This part of certificate to be deleted where the application is only for a consolidated lot or the opening of a new road or where the land to be subdivided is wholly outside the areas of operations of the Metropolitan Water Sewerage and Drainage Board and the Hunter District Water Board.
† Delete if inapplicable.

TOS 2

SURVEYOR'S REFERENCE: G16–S

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
18/10/2017 8:50AM

FOLIO: 1/873220

First Title(s): 157/755211
Prior Title(s): 157/755211

Recorded	Number	Type of Instrument	C.T. Issue
11/12/1997	DP873220	DEPOSITED PLAN	FOLIO CREATED EDITION 1
12/12/1997	3601651	TRANSFER	EDITION 2
31/3/2000	6682358	MORTGAGE	EDITION 3
17/6/2004	AA726158	MORTGAGE	EDITION 4

*** END OF SEARCH ***

advlegs PRINTED ON 18/10/2017

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
18/10/2017 8:52AM

FOLIO: 157/755211

First Title(s): 157/755211
Prior Title(s): CROWN LAND

Recorded	Number	Type of Instrument	C.T. Issue
24/9/1987	FI305504	FOLIO INSTRUCTION	FOLIO CREATED EDITION 1
22/2/1989	Y196397	APPLICATION FOR RECORDING OF ACTION AFFECTING CROWN HOLDING	
12/9/1989	Y580778	TRANSFER	EDITION 2
21/11/1997	3601649	CHANGE OF NAME	
21/11/1997	3601650	CHANGE OF NAME	
11/12/1997	DP873220	DEPOSITED PLAN	FOLIO CANCELLED
25/8/1999	6130240	DEPARTMENTAL DEALING	

*** END OF SEARCH ***

advlegs PRINTED ON 18/10/2017

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 1/873220

SEARCH DATE	TIME	EDITION NO	DATE
18/10/2017	8:49 AM	4	17/6/2004

LAND

LOT 1 IN DEPOSITED PLAN 873220
AT GRETA
LOCAL GOVERNMENT AREA CESSNOCK
PARISH OF BRANXTON COUNTY OF NORTHUMBERLAND
TITLE DIAGRAM DP873220

FIRST SCHEDULE

KARL HEINZ WAEGER (T 3601651)

SECOND SCHEDULE (6 NOTIFICATIONS)

1 LAND EXCLUDES MINERALS AND IS SUBJECT TO RESERVATIONS AND CONDITIONS IN FAVOUR OF THE CROWN - SEE MEMORANDUM S700000B
2 EXCEPTING LAND BELOW A DEPTH FROM THE SURFACE OF 20 METRES
3 DP873220 EASEMENT FOR ELECTRICITY TRANSMISSION LINES 10 WIDE AND 15 WIDE AFFECTING THE PART(S) SHOWN SO BURDENED IN THEIN THE TITLE DIAGRAM
4 DP873220 EASEMENT FOR WATER SUPPLY 3 WIDE AFFECTING THE PART(S) SHOWN SO BURDENED IN THE TITLE DIAGRAM
5 6682358 MORTGAGE TO WESTPAC BANKING CORPORATION
6 AA726158 MORTGAGE TO WESTPAC BANKING CORPORATION

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

advlegs PRINTED ON 18/10/2017

APPENDIX D:

Aerial Photographs

Aerial Photographs

1963	

Aerial Photographs

Aerial Photographs

1974	

Aerial Photographs

Aerial Photographs

1984	

Aerial Photographs

Aerial Photographs

1994	

Aerial Photographs

APPENDIX E:

Site Photographs

Photograph 1 - Southeast portion of site, showing Anvil Creek tributary.

Photograph 2 - View from south-eastern portion of site facing north-northwest.

Qualtest LABORATORY (NSW) PTY LTD

Client:	HUNTER DEVELOPMENT BROKERAGE	Photo No:	1 to 2
Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193
Location:	71 BRANXTON STREET, GRETA NSW	Date Taken:	24/10/2017
Title:	SITE PHOTOGRAPHS	Date Compiled:	09/11/17

Photograph 3 - View from south-southwestern part of the site facing south, showing site entrance from Branxton Street

Photograph 4 - View from northwestern portion of the site facing south, looking at residence.

Client:	HUNTER DEVELOPMENT BROKERAGE	Photo No:	3 to 4
Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193
Location:	71 BRANXTON STREET, GRETA NSW	Date Taken:	24/10/2017
Title:	SITE PHOTOGRAPHS	Date Compiled:	9/11/2017

Qualtest LABORATORY (NSW) PTY LTD

Photograph 5 - Showing shipping containers located to north of residence

Photograph 6 - Showing waste/construction materials located north-west of site

Client:	HUNTER DEVELOPMENT BROKERAGE	Photo No:	5 to 6
Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193
Location:	71 BRANXTON STREET, GRETA NSW	Date Taken:	24/10/2017
Title:	SITE PHOTOGRAPHS	Date Compiled:	9/11/2017

Qualtest LABORATORY (NSW) PTY LTD

Photograph 7 - Waste materials, and one of the small fill mounds observed

Photograph 8 - Small derelict building in northern part of the site.

Client:	HUNTER DEVELOPMENT BROKERAGE	Photo No:	7 to 8
Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193
Location:	71 BRANXTON STREET, GRETA NSW	Date Taken:	24/10/2017
Title:	SITE PHOTOGRAPHS	Date Compiled:	9/11/2017

Qualtest LABORATORY (NSW) PTY LTD

Photograph 9 - Example of pothole from mine subsidence in northwestern portion of the site.

Photograph 10 - Pothole in southern portion of the site, infilled with fill including boulders.

Client:	HUNTER DEVELOPMENT BROKERAGE	Photo No:	9 to 10
Project:	PROPOSED RESIDENTIAL SUBDIVISION	Project No:	NEW17P-0193
Location:	71 BRANXTON STREET, GRETA NSW	Date Taken:	24/10/2017
Title:	SITE PHOTOGRAPHS	Date Compiled:	9/11/2017

Qualtest LABORATORY (NSW) PTY LTD

APPENDIX F:

NSW EPA Search

minated land

ment of contaminated land
nts and site auditor
und petroleum storage
s under the CLM Act
hendment
uidance
f notices
the record
n the record
n tips
mer
SW contaminated sites
o EPA
y asked questions

Search results

Your search for: LGA: Cessnock City Council

Matched 4 notices relating to

Search Again Refine S

Suburb	Address	Site Name	Notices related to this site
KURRI KURRI	279-281 Lang STREET	Caltex Service Station	3 current
NORTH ROTHBURY	Main ROAD	Ayrefield Colliery	1 current

Page 1 of 1

23 O

APPENDIX G:

Section 149 Certificate

PLANNING CERTIFICATE

ISSUED UNDER SECTION 149(2) and (5)
ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979
and
ENVIRONMENTAL PLANNING & ASSESSMENT REGULATION 2000

Emma Coleman
8 Ironbark Close
Warabook
New South Wales 2304

Applicants Reference
HDB Greta

CERTIFICATE DETAILS

CERTIFICATE NUMBER: 2822

DATE OF CERTIFICATE: 18/10/2017

PROPERTY DETAILS

ADDRESS: 71 Branxton Street GRETA NSW 2334

TITLE: LOT: 1 DP: 873220

PARCEL NO.: 27340

BACKGROUND INFORMATION

This certificate provides information on how the relevant parcel of land may be developed, including the planning restrictions that apply to development of the land, as at the date the certificate is issued. The certificate contains information Council is aware of through its records and environmental plans, along with data supplied by the State Government. The details contained in this certificate are limited to that required by Section 149 of the *Environmental Planning and Assessment Act, 1979*.

TELEPHONE: (02) 4993 4100. FAX (02) 4993 2500
POSTAL ADDRESS: PO BOX 152, CESSNOCK, 2325 or DX 21502 CESSNOCK
EMAIL ADDRESS: council@cessnock.nsw.gov.au Visit us at: http://www.cessnock.nsw.gov.au
ABN 60 919 148 928

PLANNING CERTIFICATE

ISSUED UNDER SECTION 149(2) and (5)
ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979
and
ENVIRONMENTAL PLANNING & ASSESSMENT REGULATION 2000

1. Name of relevant planning instruments and DCPs

(1) The name of each environmental planning instrument that applies to the carrying out of development on the land:

Cessnock Local Environmental Plan 2011

Hunter Regional Plan 2036

State Environmental Planning Policy No 14—Coastal Wetlands

State Environmental Planning Policy No 21—Caravan Parks

State Environmental Planning Policy No 30—Intensive Agriculture

State Environmental Planning Policy No 33—Hazardous and Offensive Development

State Environmental Planning Policy No 36—Manufactured Home Estates

State Environmental Planning Policy No 44—Koala Habitat Protection

State Environmental Planning Policy No 50—Canal Estate Development

State Environmental Planning Policy No 52—Farm Dams and Other Works in Land and Water Management Plan Areas

State Environmental Planning Policy No 55—Remediation of Land

State Environmental Planning Policy No 62—Sustainable Aquaculture

State Environmental Planning Policy No 64—Advertising and Signage

State Environmental Planning Policy No 65—Design Quality of Residential Apartment Development

State Environmental Planning Policy No 70—Affordable Housing (Revised Schemes)

State Environmental Planning Policy No 71—Coastal Protection

State Environmental Planning Policy (Affordable Rental Housing) 2009

State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004

State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017

State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Integration and Repeals) 2016

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environmental Planning Policy (Miscellaneous Consent Provisions) 2007

State Environmental Planning Policy (Penrith Lakes Scheme) 1989

State Environmental Planning Policy (Rural Lands) 2008

State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State Significant Precincts) 2005

State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017

(2) The name of each proposed environmental planning instrument that will apply to the carrying out of development on the land and that is or has been the subject of community consultation or on public exhibition under the Act (unless the Director-General has notified the council that the making of the proposed instrument has been deferred indefinitely or has not been approved):

There are no Draft Local Environmental Plan/s affecting this land.

(3) The name of each development control plan that applies to the carrying out of development on the land.

Cessnock Development Control Plan 2010

2. Zoning and land use under relevant LEPs

(a) The land is identified as being in:

RU2 Rural Landscape under the Cessnock Local Environmental Plan 2011

(b) The purpose for which development may be carried out without consent within the zone;
(c) The purposes for which development may not be carried out within the zone except with development consent; and
(d) The purpose for which development is prohibited within the zone.

RU2 Rural Landscape

2) Permitted without consent

Extensive agriculture; Home occupations; Horticulture

3) Permitted with consent

Cellar door premises; Dual occupancies; Dwelling houses; Environmental protection works; Farm buildings; Garden centres; Hardware and building supplies; Health consulting rooms; Home industries; Hospitals; Landscaping material supplies; Neighbourhood shops; Plant nurseries; Pubs; Restaurants or cafes; Roads; Roadside stalls; Rural supplies; Self-storage units; Timber yards; Vehicle sales or hire premises; Any other development not specified in item 2 or 4

4) Prohibited

Boat building and repair facilities; Car parks; Charter and tourism boating facilities; Commercial premises; Depots; Entertainment facilities; Exhibition homes; Exhibition villages; Freight transport facilities; Health services facilities; Heavy industrial storage establishments; Heliports; Highway service centres; Home occupations (sex services); Industrial retail outlets; Industrial training facilities; Industries; Marinas; Mooring pens; Moorings; Mortuaries; Passenger transport facilities; Recreation facilities (indoor); Residential accommodation; Restricted premises; Sex services premises; Storage premises; Transport depots; Truck depots; Vehicle body repair workshops; Vehicle repair stations; Warehouse or distributions centres; Wharf or boating facilities; Wholesale supplies

(e) Whether any development standards applying to the land fix minimum land dimensions for the erection of a dwelling-house on the land and, if so, the minimum land dimensions so fixed:

No

(f) Whether the land includes or comprises critical habitat:

The land is not land that includes or comprises critical habitat declared to be critical habitat under Part 3 of the Threatened Species Conservation Act 1995.

(g) Whether the land is a conservation area (however described):

The land is not a conservation area under the Cessnock Local Environmental Plan 2011.

(h) Whether an item of environmental heritage (however described) is situated on the land:

An item of environmental heritage identified in Cessnock Local Environmental Plan 2011 is not situated on the land.

3. Complying Development

(1) Complying development may be carried out on the land under each of the following codes for complying development, to the extent stated, because of the provisions of clauses 1.17A (1) (c) to (e), (2), (3) and (4), 1.18 (1) (c3) and 1.19 of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.*

(2) Complying development may not be carried out on the land under each of the following codes for complying development, to the extent and for the reasons stated under clauses 1.17A (1) (c) to (e), (2), (3) and (4), 1.18 (1) (c3) and 1.19 of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.*

Housing Code

Complying Development may not be carried out under the Housing Code as the subject land falls within a Local Environmental Plan zone that does not meet the requirements of the code.

Rural housing code

Complying Development may be carried out under the Rural Housing Code where it meets the requirements of Clause 3.5 Complying development on flood control lots contained within the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Complying Development may be carried out under the Rural Housing Code where it meets the requirements of Clause 3.4 Complying development on bush fire prone land contained within the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Housing Alterations Code

Complying Development may be carried out on the land under the Housing Alterations Code, subject to the development complying with the relevant standards contained within the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

General Development Code

Complying Development may be carried out on the land under the General Development Code, subject to the development complying with the relevant standards contained within the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Commercial and Industrial Alterations Code

Complying Development may be carried out on the land under the Commercial and Industrial Alterations Code, subject to the development complying with the relevant standards contained within the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Commercial and Industrial (New Buildings and Additions) Code

Complying Development may not be carried out under the Commercial & Industrial (New Buildings and Additions) Code as the subject land falls within a Local Environmental Plan zone that does not meet the requirements of the code.

Container Recycling Facilities Code

Complying Development may not be carried out under the Container Recycling Facilities Code as the subject land falls within a Local Environmental Plan zone that does not meet the requirements of the code.

Subdivisions Code

Complying Development may be carried out on the land under the Subdivision Code, subject to the development complying with the relevant standards contained within the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Demolition Code

Complying Development may be carried out on the land under the Demolition Code, subject to the development complying with the relevant standards contained within the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Fire Safety Code

Complying Development may be carried out on the land under the Fire Safety Code, subject to the development complying with the relevant standards contained within the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

5. Mine subsidence

Whether or not the land is proclaimed to be a mine subsidence district within the meaning of section 15 of the *Mine Subsidence Compensation Act 1961*.

Yes

6. Road widening and road alignment

Whether or not the land is affected by any road widening or road realignment under:

(a) Division 2 of Part 3 of the *Roads Act 1993*, or

(b) any environmental planning instrument, or

(c) any resolution of the council.

The land is not affected by a road widening or road realignment proposal under:
(a) Division 2 of Part 3 of the Roads Act 1993, or
(b) any environmental planning instrument, or
(c) any resolution of the council.

7. Council and other public authority hazard risk restrictions

Whether or not the land is affected by a policy:

(a) adopted by the council, or

(b) adopted by any other public authority and notified to the council for the express purpose of its adoption by that authority being referred to in planning certificates issued by the council,

That restricts the development of the land because of the likelihood of:

(1) Landslip

No

(2) Bushfire

No

(3) Tidal inundation

No

(4) Subsidence

No

(5) Acid Sulphate Soils

No

(6) Any other risk (other than flooding)

No

7A. Flood related development controls information

(1) Whether or not development on the land or part of the land for the purposes of dwelling houses, dual occupancies, multi dwelling housing or residential flat buildings (not including development for the purposes of group homes or seniors housing) is subject to flood related development controls.

Yes

(2) Whether or not development on the land or part of the land for any other purpose subject to flood related development controls.

Yes

Note: Words and expressions in this clause have the same meanings as in the instrument set out in the Schedule to the *Standard Instrument (Local Environmental Plans) Order 2006*.

8. Land reserved for acquisition

Whether or not any environmental planning instrument or proposed environmental planning instrument referred to in clause 1 (above) makes provision in relation to the acquisition of the land by a public authority, as referred to in section 27 of the *Environmental Planning & Assessment Act 1979*.

No

9. Contributions plans

The name of each contributions plan/s applying to the land.

Section 94 Contribution Plan for Residential Development

Section 94 Contribution Plan for Tourist Development

9A. Biodiversity certified land

The land is not biodiversity certified land under Part 8 of the Biodiversity Conservation Act 2016.

Note. Biodiversity certified land includes land certified under Part 7AA of the *Threatened Species Conservation Act 1995* that is taken to be certified under Part 8 of the *Biodiversity Conservation Act 2016*.

10. Biodiversity stewardship sites

The land is not a biodiversity stewardship site under a biodiversity stewardship agreement under Part 5 of the Biodiversity Conservation Act 2016, but only insofar as the Council has been notified of the existence of the agreement by the Chief Executive of the Office of Environment and Heritage.

Note. Biodiversity stewardship agreements include biobanking agreements under Part 7A of the *Threatened Species Conservation Act 1995* that are taken to be biodiversity stewardship agreements under Part 5 of the *Biodiversity Conservation Act 2016*.

10A. Native vegetation clearing set asides

The land is not a set aside area under section 60ZC of the Local Land Services Act 2013, but only insofar as the Council has been notified of the existence of the set aside area by Local Land Services or it is registered in the public register under that section.

11. Bush fire prone land

All of the land is bushfire prone land as defined in the Environmental Planning & Assessment Act 1979.

12. Property vegetation plans

The land is not land to which a property vegetation plan approved under Part 4 of the Native Vegetation Act 2003 (and that continues in force) applies, only insofar as the Council has been notified of the existence of the plan by the person or body that approved the plan under the Act.

13. Orders under *Trees (Disputes Between Neighbours) Act 2006*

Whether an order has been made under the *Trees (Disputes Between Neighbours) Act 2006* to carry out work in relation to a tree on the land (but only if the council has been notified of the order).

No

14. Directions under Part 3A

There is not a direction by the Minister in force under Section 75P(2)(c1) of the Environmental Planning & Assessment Act 1979 that a provision of an environmental planning instrument prohibiting or restricting the carrying out of a project or a stage of a project of the land under Part 4 of that Act does not have effect.

15. Site compatibility certificates and conditions for seniors housing

(1) The land is not land to which the State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 applies.

There is no current site compatibility certificate (senior's housing) of which Council is aware, in respect of proposed development on the land.

(2) There are no terms of a kind referred to in clause 18(2) of that policy that have been imposed as a condition of consent to a development application granted after 11 October 2007 in respect of the land.

16. Site compatibility certificates for infrastructure

There is not a valid site compatibility certificate (infrastructure) of which Council is aware, in respect of proposed development on the land.

17. Site compatibility certificates and conditions for affordable rental housing

(1) There is not a current site compatibility certificate (affordable rental housing), of which the Council is aware, in respect of proposed development on the land.

(2) There are no terms of a kind referred to in clause 17(1) or 38(1) of the State Environmental Planning Policy (Affordable Rental Housing) 2009 that have been imposed as a condition of consent to a development application in respect of the land.

18. Paper subdivision information

(1) There is no development plan adopted by a relevant authority that applies to the land of that is proposed to be subject to a consent ballot.

(2) There is no subdivision order that applies to the land

Note: words and expressions in this clause have the same meaning as they have in Part 16C of the *Environmental Planning and Assessment Regulation 2000*.

19. Site verification certificates

There is not a current site verification certificate, of which Council is aware, in respect of the land.

Matters are prescribed by section 59 (2) of the *Contaminated Land Management Act 1997* as additional matters to be specified in a planning certificate:

(a) The land or part of the land is not significantly contaminated land within the meaning of the Contaminated Land Management Act 1997 at the date this certificate is issued.

(b) The land is not subject to a management order within the meaning of the Contaminated Land Management Act 1997 at the date this certificate is issued.

(c) The land is not the subject of an approved voluntary management proposal within the meaning of the Contaminated Land Management Act 1997 at the date this certificate is issued.

(d) The land is not the subject of an ongoing maintenance order within the meaning of the Contaminated Land Management Act 1997 at the date this certificate is issued.

(e) The land is not the subject of a site audit statement within the meaning of the Contaminated Land Management Act 1997 (if a copy of such a statement has been provided at any time) to the local authority issuing the certificate.

PLANNING CERTIFICATE

ISSUED UNDER SECTION 149(2) and (5)
ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979
and
ENVIRONMENTAL PLANNING & ASSESSMENT REGULATION 2000

Emma Coleman
8 Ironbark Close
Warabook
New South Wales 2304

Applicants Reference
HDB Greta

CERTIFICATE DETAILS

CERTIFICATE NUMBER: 2822

DATE OF CERTIFICATE: 18/10/2017

PROPERTY DETAILS

ADDRESS: 71 Branxton Street GRETA NSW 2334

TITLE: LOT: 1 DP: 873220

PARCEL NO.: 27340

BACKGROUND INFORMATION

This certificate provides information on how the relevant parcel of land may be developed, including the planning restrictions that apply to development of the land, as at the date the certificate is issued. The certificate contains information Council is aware of through its records and environmental plans, along with data supplied by the State Government. The details contained in this certificate are limited to that required by Section 149 of the *Environmental Planning and Assessment Act, 1979*.

TELEPHONE: (02) 4993 4100. FAX (02) 4993 2500
POSTAL ADDRESS: PO BOX 152, CESSNOCK, 2325 or DX 21502 CESSNOCK
EMAIL ADDRESS: **council@cessnock.nsw.gov.au** Visit us at: **http://www.cessnock.nsw.gov.au**
ABN 60 919 148 928

PLANNING CERTIFICATE

ISSUED UNDER SECTION 149(2) and (5)
ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979
and
ENVIRONMENTAL PLANNING & ASSESSMENT REGULATION 2000

Additional information pursuant to Section 149(5) of the *Environmental Planning & Assessment Act 1979*

(5) A council may, in a planning certificate, include advice on such other relevant matters affecting the land of which it may be aware.

Council's records do not indicate that the land the subject of this Certificate is subject to Noise Exposure.

The land the subject of this Certificate is not affected by a Tree Preservation Order. Land that is not covered by Council's urban Tree Preservation Order is subject to the provisions of the Native Vegetation Act 2003. Referrals can be made to Local Lands Services on Tel: 02 4930 1030.

UNFORMED ROADS POLICY - DUAL FRONTAGE LOT. The subject land is affected by Council's unformed roads policy wherein a road contribution is applicable if access is to be gained off the unformed road. No contribution is payable if access is off the alternate formed road. Development Consent is required if access is to be off the unformed road.

For further information, please contact Council's Strategic Land Use Planning unit, of the Planning & Environment directorate on 02 4993 4183.

Gareth Curtis
Director Planning & Environment

Hunter Development Brokerage Pty Ltd

Proposed Residential Development

71 Branxton Street, Greta

Geotechnical Assessment

Report No. RGS31387.1-AA 17 November 2017

REGIONAL
GEOTECHNICAL SOLUTIONS

Manning-Great Lakes

Port Macquarie

Coffs Harbour

17 November 2017

Mr Karl Waeger

c/- Hunter Development Brokerage Pty Ltd

1st Floor, 44 Church Street,

Maitland NSW 2320

Attention: Mr Karl Waeger

Dear Karl

RE: Proposed Residential Development at 71 Branxton Street, Greta - Geotechnical Assessment

Regional Geotechnical Solutions are pleased to provide this report providing a Mine Subsidence Desktop Study for the proposed development at 71 Branxton Street, Greta.

If you require any further information regarding the report please do not hesitate to contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Steven Morton

Principal

Regional Geotechnical Solutions Pty Ltd
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1 INTRODUCTION

Regional Geotechnical Solutions (RGS) has conducted a geotechnical assessment for a proposed residential development to be located at 71 Branxton Street, Greta. The work was commissioned by Mr Karl Waeger. The site is currently occupied by rural residential lot.

The aim of the desktop study was to provide an assessment of the extent and nature of workings beneath the site, including assessment of the stability of typical coal pillars remaining (if applicable to pillar crushing subsidence). The assessment was based on record tracings based on the as surveyed plans of the workings undertaken in the Greta Seam underlying the site.

2 SCOPE OF WORK

The desktop study involved:

- Discussions with the Mine Subsidence Board to determine which seams were mined beneath the subject site;
- Procurement of the surveyed mine record tracings from the Department of Mineral Resources in Maitland;
- Assessment of the approximate depth and thickness of each of the seams worked;
- Overlaying the surveyed mine workings from each of the coal seams over the site and surrounding area to assess the extent of mining and dimensions of coal pillars remaining in the vicinity of the site;
- Assessing the zone of influence in which mine subsidence has the potential to affect the site, based on an angle of draw of 26.5˚ measured from vertical.
- Assessment of the mode of failure of the mine workings.

3 DETAILS OF MINED COAL SEAMS BENEATH THE PROPOSED DEVELOPMENT

The site is underlain by workings of the Greta Coal Seam. Record tracings (RT0276 and RT0335) of mine workings were overlaid on aerial imagery of the site to assess the location of the mine workings. The record tracings indicate:

- The site is located over the southern edge of the New Greta Colliery and the Whitburn Colliery workings.
- The Greta Seam subcrops south west of the site (entry shafts located south of the site).
- Bord and pillar mining techniques were used.

Some hatching on the New Greta Colliery record tracings in the area of the first workings indicates some secondary extraction of some coal pillars prior to abandonment of the mine, some areas of goaf are also noted on the plans.

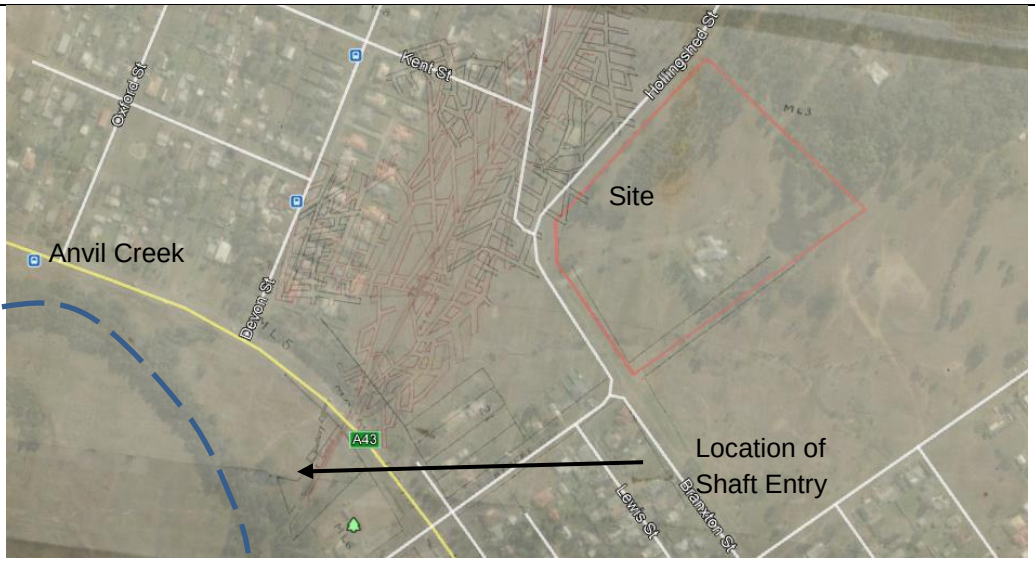


Plate 1: Approximate location of Mine Entry

Two seams have been worked within the coal seam and are noted by different coloured pen markings (top seam red and bottom seam black) on the record tracings. The details of the mining are presented in Table 1. A summary of the expected subsurface conditions beneath the site are presented in Table 2 which were extracted from the record tracings of the New Greta Colliery.

Table 1: Summary of Coal Seam Details

Coal Seam Mined	Assessed Maximum Depth Beneath Ground Level (m)	Thickness of Coal Seam (m)
Greta Seam	16 to 20	1.86

Table 2: Summary of Expected Subsurface Conditions Extracted From RT276 – New Greta Coliery

Depth Measured fromSurface Level (m)	Depth (Feet)	Material Description
3.95	13 Feet (3.95m)	Clay
4.86	3 Feet (0.91m)	Brown Sandstone
14.01	30 Feet (9.15m)	Blue Grey Sandstone With Beds of Conglomerate
14.77	2 feet 5 Inches (0.76m)	Puritious Coal and Clay

Depth Measured fromSurface Level (m)	Depth (Feet)	Material Description
16.69	6 feet 3 Inches (1.92m)	Coal
>16.69		Shale Floor

Figures 1 to 3 show the site observations and the record tracings of the mine workings which were overlaid on the aerial photographs of the site.

As discussed in Section 3, the northern portion of the site is located above the southern extent of the mine workings completed by the New Greta Colliery. The New Greta Colliery was worked using the bord and pillar techniques up until 1952 at which time it was abandoned. The record tracings of the colliery indicated that the Greta was typically 6 feet and 3 inches in thickness including the split (approximately 1.92m in) in the area of the site.

Located in Figure 3 is an aerial image of the site with the mine overlay record tracings of the New Greta Colliery. The record tracings indicate the workings extend into the north western side of the site. A line has also been shown on the plan indicating the area of influence for the collapse of the mine workings assuming an angle of draw of 26.5°. The workings of the seam generally comprise irregular shaped pillars or varying height and size. The record tracings provided for the seam do indicate some goaf areas and areas of secondary working of the pillars outside the area of investigation.

4 SITE WALKOVER ASSESSMENT

A site walkover assessment was undertaken on 9 November 2017. The following site observations were made. The observations are also noted on Figures 1 to 3:

- Numerous pothole subsidence features and a drift subsidence feature was noted along the north western boundary of the site.
- Several shallow surface depression features were also noted in the far northern and far western areas of the site.

Photos of the area showing evidence of mine subsidence are presented in Plate 2.

Pothole formation near a tree on the northwestern side of the site

Pothole formation on the northwestern side of the site. Note the area being roped off.

Photo of a collapsed drift on the northwestern side of the site. Note the trees collapsing on both sides into the drift

Photo of large depression northeastern side of the site. Depressions do not appear to be a features associated with pothole subsidence as observed in other areas of site

5 DISCUSSION OF MINE SUBSIDENCE FINDINGS

Based on the the review of the record tracings and the site walkover assessment, the following is assessed:

- The record tracings either do not include all mine workings in the area or the workings are located further east of areas plotted in the overlay. The presence of the pothole depressions and drift subsidence features indicate the workings extend well into the northern portion of the site. It should be noted that the plans of the record tracings used to locate the workings do have features to orientate the maps (i.e. Maitland Road and West Street Intersections noted on the plans plus the alignment of Anvil Creek).
- The workings are relatively shallow 16m to 20m depth and therefore the site is more at risk of pothole subsidence than subsidence associated with pillar crushing. This is confirmed by the presence of pothole features across the site.
- Due to the presence of the surface subsidence features associated with pothole formation no assessment was undertaken to assess the FoS for crushing of pillars.

6 RECOMMENDATIONS AND SUITABILITY FOR DEVELOPMENT

Due to the presence of pothole subsidence features at the site, further investigation works will be required to identify the lateral extent and depth of the workings. We recommend that further works at the site involve both test pit investigations and drilling investigations. The investigations should be undertaken in the northeastern portion of the site which show the subsidenvce features. It should be noted that while further work will need to be undertaken to investigate the site to assess the extent of workings. It is considered that with appropriate geotechnical investigations and remediation works, the area would be considered suitable for development.

7 LIMITATIONS

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

If you have any questions regarding this project, or require any additional consultations, please contact Matt Rowbotham or the undersigned.

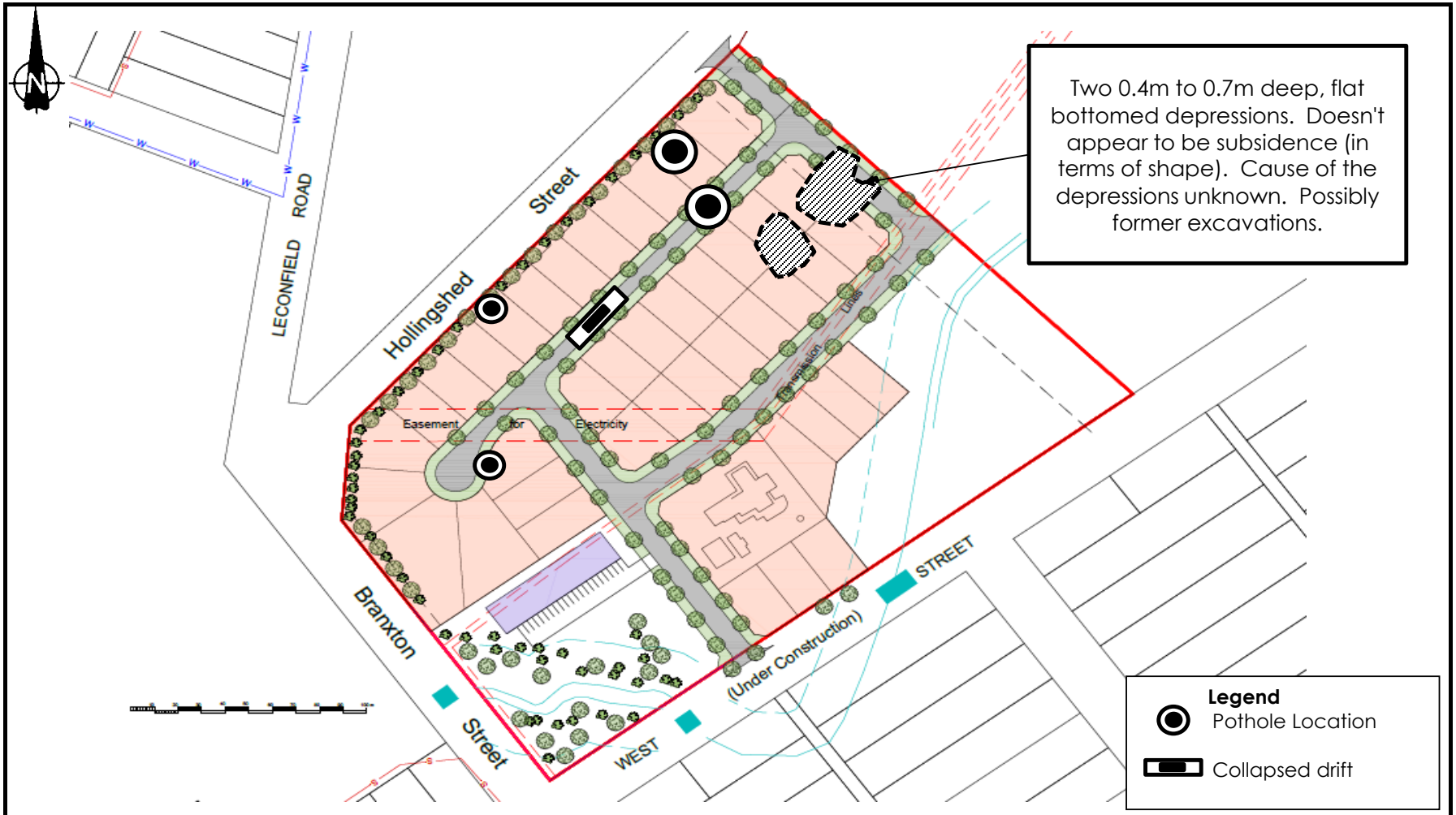
For and on behalf of

Regional Geotechnical Solutions Pty Ltd

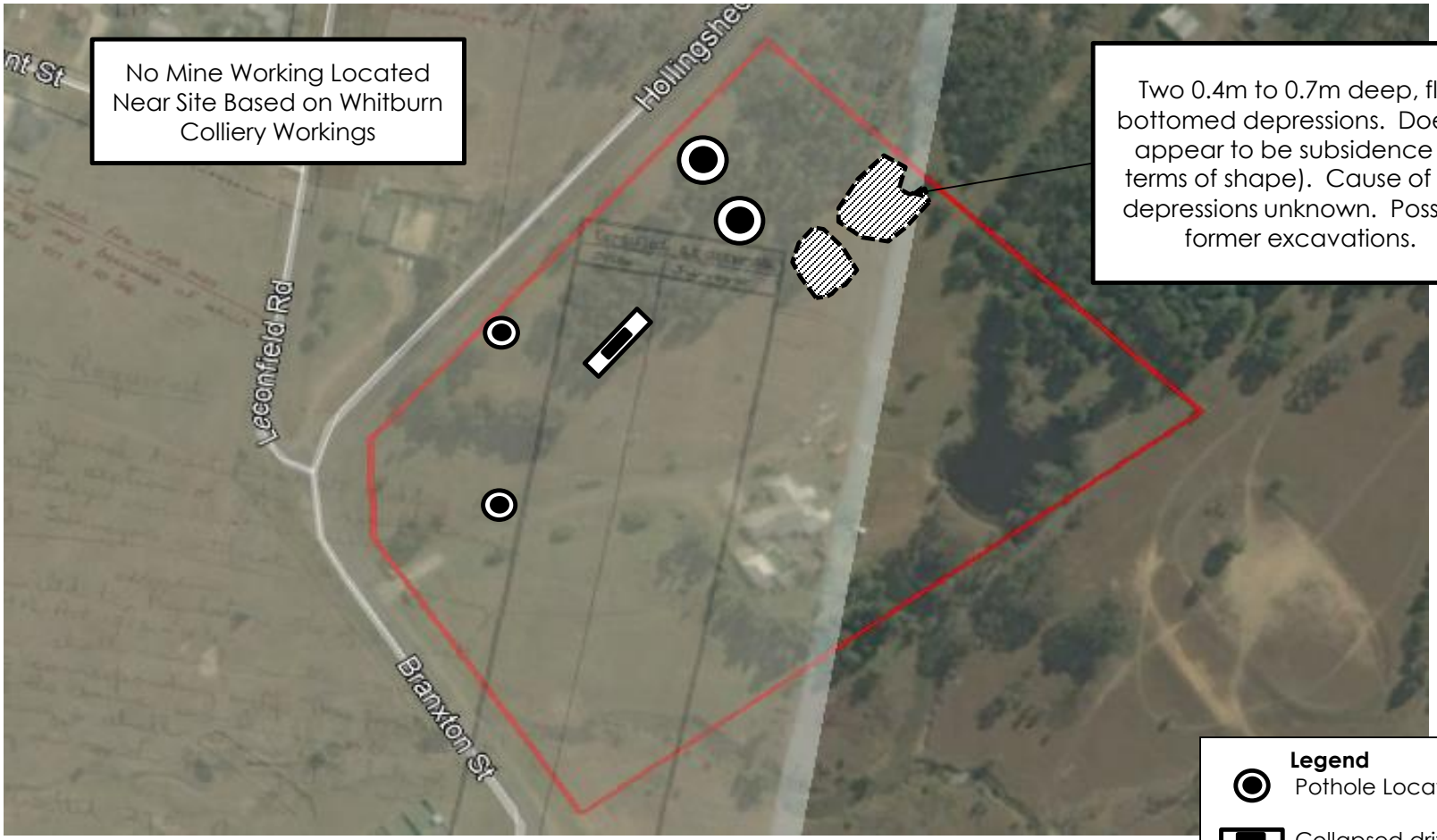
Steven Morton

Principal

Figures



REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	Hunter Development Brookerage Pty Ltd	Job No. RGS31387.1
	Project:	Proposed Subdivision 71 Branxton Street Greta	Drawn By: SRM Date: 13-Nov-17
	Title:	Mine Subsidence Site Observations	Drawing No. **Figure 1**



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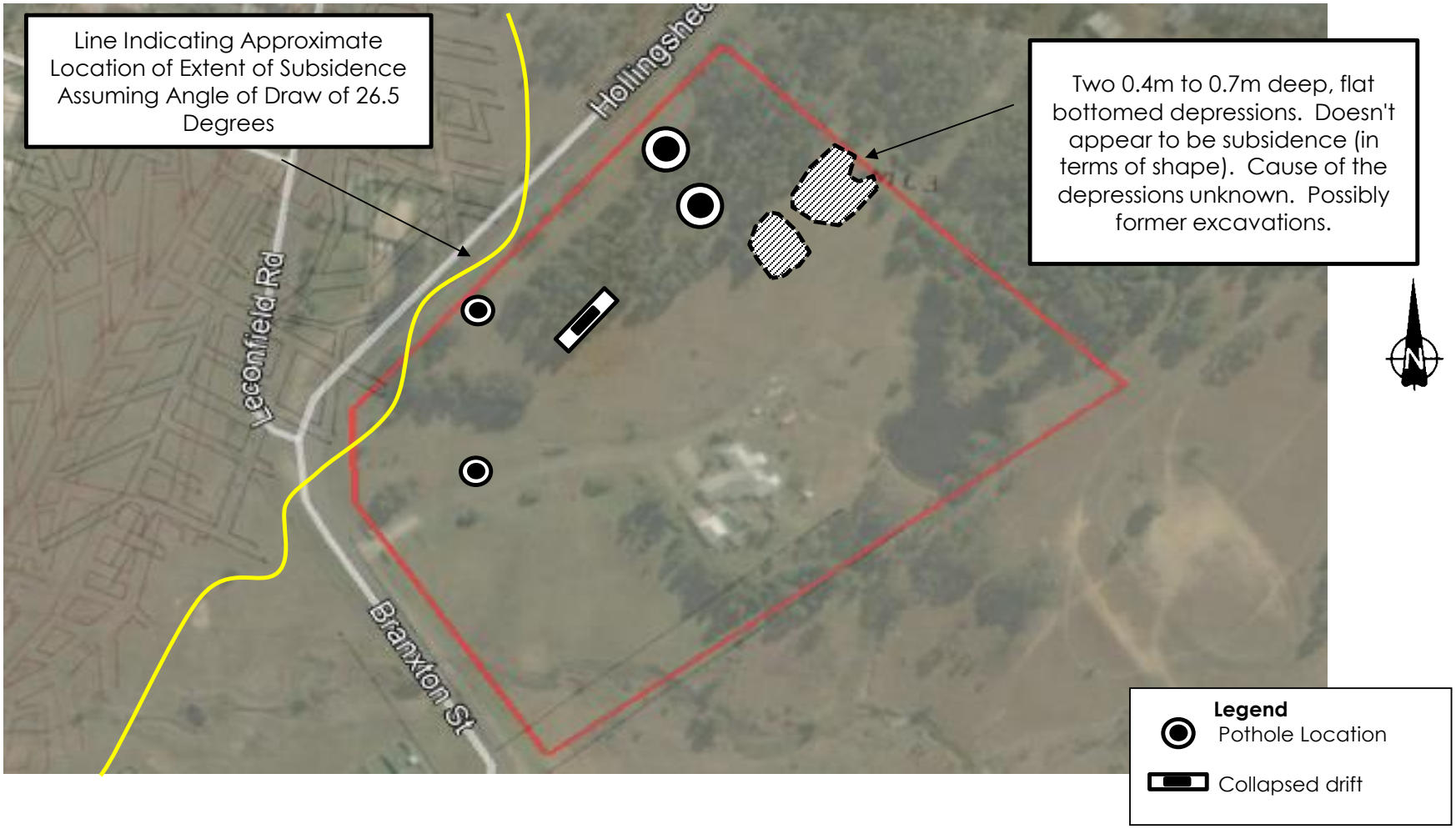
Client:	Hunter Development Brokerage Pty Ltd	Job No.	RGS31387.1
Project:	Proposed Subdivision 71 Branxton Street Greta	Drawn By:	SRM
		Date:	13-Nov-17
Title:	Whitburn Colliery Overlay with Subsidence	Drawing No.	**Figure 2**



REGIONAL GEOTECHNICAL SOLUTIONS	**Client:**	Hunter Development Brokerage Pty Ltd	Job No. RGS31387.1
	Project:	Proposed Subdivision 71 Branxton Street Greta	Drawn By: SRM Date: 13-Nov-17
	Title:	New Greta Colliery Overlay with Subsidence	Drawing No. **Figure 3**

ATTACHMENT 9

PRELIMINARY CONSULTATION WITH GOVERNMENT AGENCIES

PRELIMINARY CONSULTATION – GOVERNMENT AGENCIES

HDB Town Planning and Design (HDB) has undertaken the initial consultation with Cessnock Council, several Government agencies and service providers in regards to the preparation of a planning proposal to enable the development of 71 Branxton Street, Greta.

A summary of the feedback received in regard to the preliminary concept is provided below.

Ausgrid

Ausgrid advised that capacity exists within the current network to support the proposed development.

Telstra

Telstra raised no objection to the proposed. Exact requirements for servicing should be consider at a later stage.

Roads and Maritime Service

Roads and Maritime Service did not consider that the proposal was likely to have a significant impact on the classified road network and as such no objection was raised.

Office of Environment and Heritage

The Office of Environment and Heritage requested that as part of the development of the planning proposal the following be undertaken:

- Assessment of the impact on areas of native vegetation including how any loss could be offset;
- An assessment of the environmental requirements as they relate to the Environmental Planning and Assessment Act, SEPP 44 – Koala Habitat Protection and the Native Vegetation Act; and
- An appropriate level of aboriginal cultural heritage assessment

Mine Subsidence Board

The Mine Subsidence Board noted that the north-west corner of the site has been undermined by shallow mining associated with the Greta Seam. Geotechnical investigations will be needed to be undertaken to ascertain the extent of this undermining. Development would need to be located so to avoid any areas identified as being undermined unless works can be undertaken to eliminate any risk.

Cessnock City Council

Cessnock City Council advised that the site is not identified in either the Lower Hunter Strategy and/or the Cessnock Settlement Strategy. The proposal is therefore considered to have no strategic justification and the proposal cannot be supported.

Department of Planning and Environment

The Department of Planning and Environment (DoPE) advised that they do not provide advice on rezoning proposals prior to receiving a formal request from Council. The Department did however note the need for any rural residential proposal to address the sustainability criteria and be consistent with the local strategy in addition to maintaining the character and role of the existing centre.

DoPE also noted that given the land surrounding the site was zoned R2 Low Density Residential there may be merit in reviewing the proposal to allow for residential expansion.