SHIRE OF CHITTERING
TOWN PLANNING SCHEME NO. 6
AMENDMENT NO. 60

Prepared By

whelans
TOWN PLANNING

For

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June 2016

PLANNING AND DEVELOPMENT ACT 2005
RESOLUTION DECIDING TO AMEND A LOCAL PLANNING SCHEME

SHIRE OF CHITTERING
TOWN PLANNING SCHEME NO. 6
AMENDMENT NO. 60

RESOLVED that the local government pursuant to section 72 of the *Planning and Development Act 2005*, amend the above Local Planning Scheme by:

1. Reclassifying Lot M1606 Great Northern Highway, Muchea from "Agricultural Resource" to "Light Industry" and amending the Scheme Map accordingly.

2. Insert description of land 'No.2' within "Schedule 15 – Muchea Employment Node Special Control Area", into the Scheme as follows:

NO	DESCRIPTION OF LAND	CONDITIONS
2	Referred to as Muchea Industrial Precinct 3 West Lot M1606 Great Northern Highway	**4.5 Access and Egress** Notwithstanding the provisions of Schedule 2 – Zoning Table, access and egress where required from a major regional road must comply with Main Roads standards and requirements. Where lots are unable to comply with such standards, at the time of development, land uses shall be generally limited to the following: the following land uses are treated as 'P' use: – Storage – Warehouse – Landscape Supplies – Lunch Bar – Motor Vehicle Repair – Motor Vehicle, Boat and Caravan Sales – Open Air Display Properties with more than one road frontage shall have 'Showroom' as an additional 'P' use. All other 'P' uses listed in Table 2 in the 'Light Industrial'

		zone are treated as 'D' uses under the scheme. Uses listed as 'D' and 'A' in Table 2 in the 'Light Industrial' zone are unchanged. **4.6 Landscaping** In connection with any application for approval to commence development in any industrial zone, the Council shall require that such landscaping be provided as the Council sees fit in the interest of amenity and orderly and proper planning. Any landscaping required shall be provided in accordance with the provisions set out hereunder: a) The required landscaping shall cover a minimum of 10% of the total site area in a form approved by the Council. Such landscaping should include a landscaped area of not less than 3 metres wide adjoining all street boundaries; b) any landscaped area shall be separated from an adjacent vehicular area by a wall or kerb at least 150mm higher than the adjacent vehicular area or in some other manner be protected from vehicular damage; and c) Landscaped areas required by this policy shall be planted in accordance with an approved plan, and within 30 days of practical completion of the development, or any relevant part thereof, as determined by the Council or at such later time as may be agreed in writing by the Council.

Shire of Chittering
Town Planning Scheme Amendment No. 60

The Amendment is standard under the provisions of the *Planning and Development (Local Planning Schemes) Regulations 2015* for the following reasons:

- The proposal is an amendment that is in line with reports given due regard for the future development of the area.

Dated this _____ day of _____ 2016

_____
CHIEF EXECUTIVE OFFICER

MINISTER FOR PLANNING

PROPOSAL TO AMEND A TOWN PLANNING SCHEME

LOCAL AUTHORITY:	Shire of Chittering
DESCRIPTION OF TOWN PLANNING SCHEME:	Town Planning Scheme No. 6
TYPE OF SCHEME:	District Scheme
SERIAL NUMBER OF AMENDMENT:	Amendment No. 60
PROPOSAL:	To reclassify Lot M1606 Great Northern Highway, Muchea from "Agricultural Resource" to facilitate the development of the land in accordance with the "Light Industrial" zone.

SCHEME AMENDMENT REPORT

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INTRODUCTION

Lot M1606 (herein referred to as "the subject site") is located within the suburb of Muchea, which is approximately 53 kilometres north east of the Central Business District of Perth and 2 km east of the Muchea Town centre. Muchea is an historic rural village that in recent times has become attractive to those wanting a quiet rural lifestyle. **Figure 1** shows the location of the subject site.

The subject site is currently private land on freehold title. The owner currently resides at the property and operates a transport business from the site. This is reflected in the latest planning consent over the site from 2002.

In recent strategic reviews of the area the subject site and surrounds were investigated to become the Muchea Employment Node (*Muchea Employment Node – 2011)*. This strategic proposal has recently come to fruition with the creation of the *Muchea Employment Node Special Control Area* and the imminent construction of *Northlink,* The Perth – Darwin National Highway

In consideration of the above, this local scheme amendment seeks to reclassify Lot 3599 Great Northern Highway from 'Agricultural Resource to 'Light Industrial'. The Report provides the context under which this application for reclassifying is proposed and rationale for the proposed local scheme amendment.

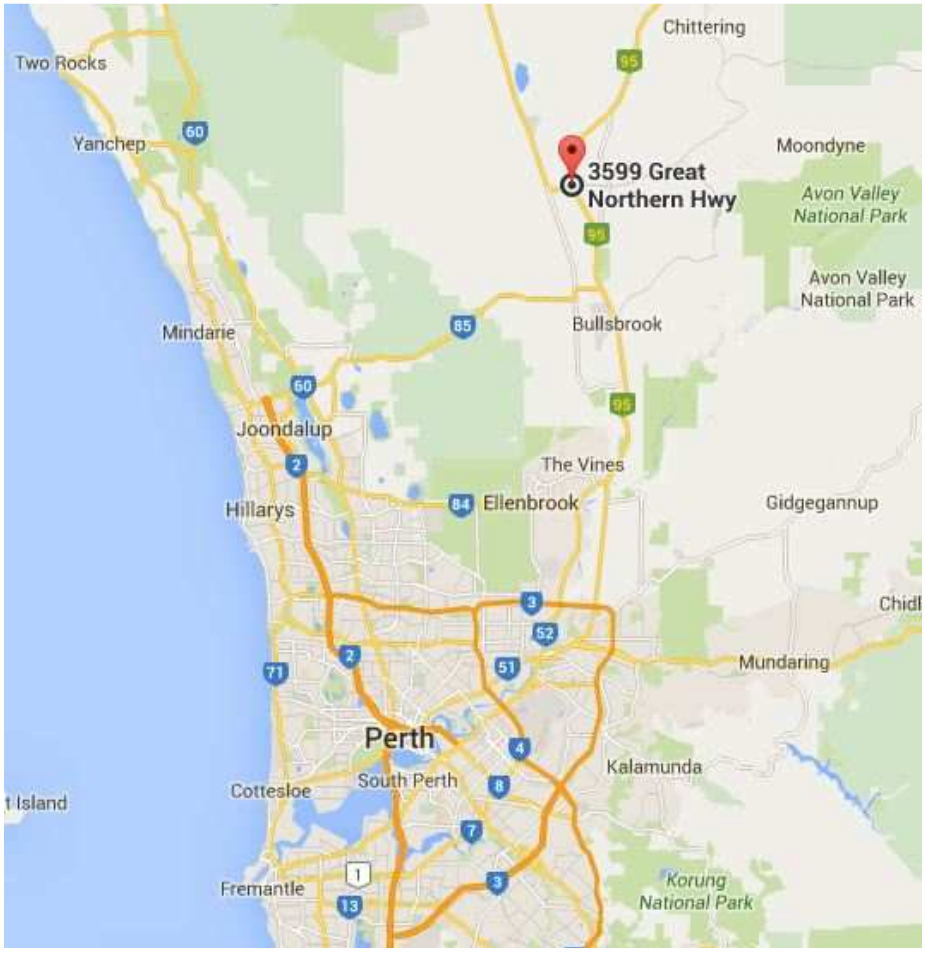


Figure 1. Location Plan – Lot 3599 Great Northern Highway, Muchea (Source: Google Maps)

1.0 Site Context

1.1 Subject Land Description

The subject site is located 2km east of the Muchea town site and is freehold land. The lot description and area of the land parcel is set out in Table 1 below. **Figure 2** shows the existing aerial and cadastral view of the lot.

Table 1. Land description and area of lots comprising subject site

Lot#	Address	CT#	Plan#	Area
M1606	3599 Great Northern Highway, Muchea	2030/784	Dia. 7048	7794m^2

Figure 2 Subject Site shown in red (Source: Landgate)

1.2 Surrounding Context

The subject site is situated within an existing agricultural area surrounded to the south and west by another larger agricultural lot. The subject site sits at the intersection of Brand Highway and Great Northern Highway.

The surrounding properties are currently zoned 'Agricultural Resource' and are much larger land parcels than the subject site with some being used for transport support services and agricultural purposes. The surrounding lots also have residential dwellings for the owner/operators of the onsite businesses.

Figure 3 shows the location of the subject site and its proximity to the Muchea town site.

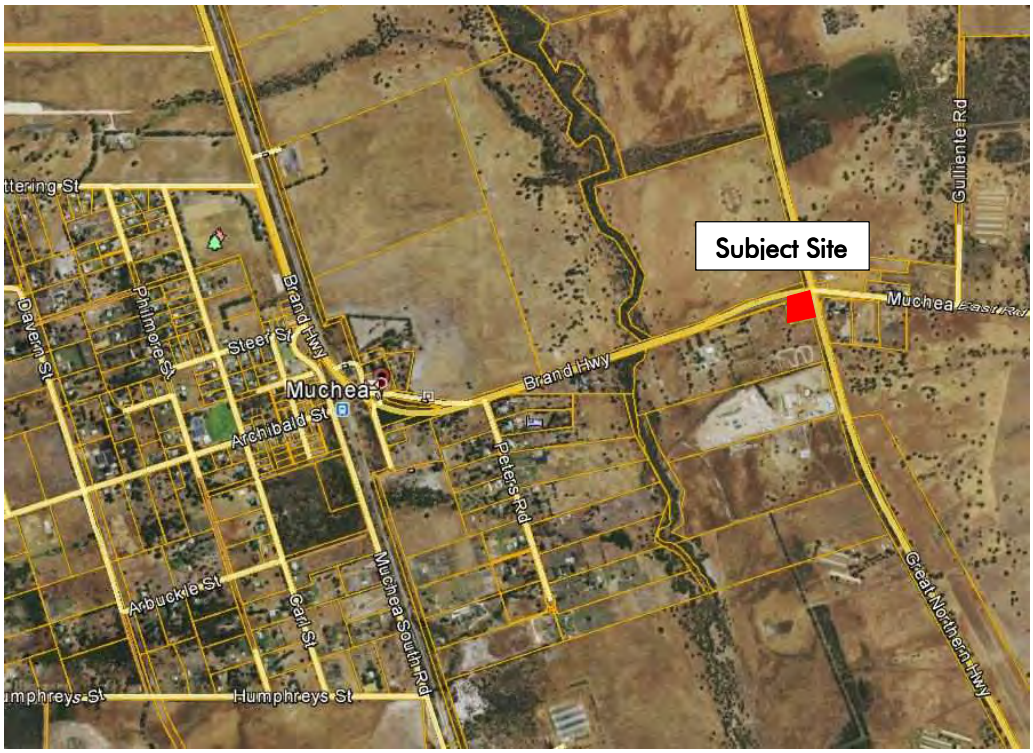


Figure 3. Surrounding land use context of the subject site [red]

2.0 SITE DESCRIPTION

2.1 *Topography*

The subject site and adjoining lot have all been previously cleared for agricultural purposes. **Figure 4** shows the current general contours of the land and its surroundings. The topography of the site relatively flat with a low gradient that slopes from east to west.

Figure 4 Topography of the subject site and surroundings (Source: Water Corporation, 2015)

2.2 *Vegetation & Flora*

Apart from the existence of some retained shade trees the subject site is devoid of any substantial vegetation as the land has been used to accommodate transport vehicular turning on site.

2.3 *Acid Sulphate Soils*

A desk top review of the subject site is categorised as no risk for acid sulphate soils. To the west is the Ellen Brook which is a class 2 area which is considered a moderate to low risk of ASS occurring within 3m of the natural soil surface. This area is however approximately 500m to the west of the subject site. **Figure 5** mapping shows the ASS mapping category over the subject site.

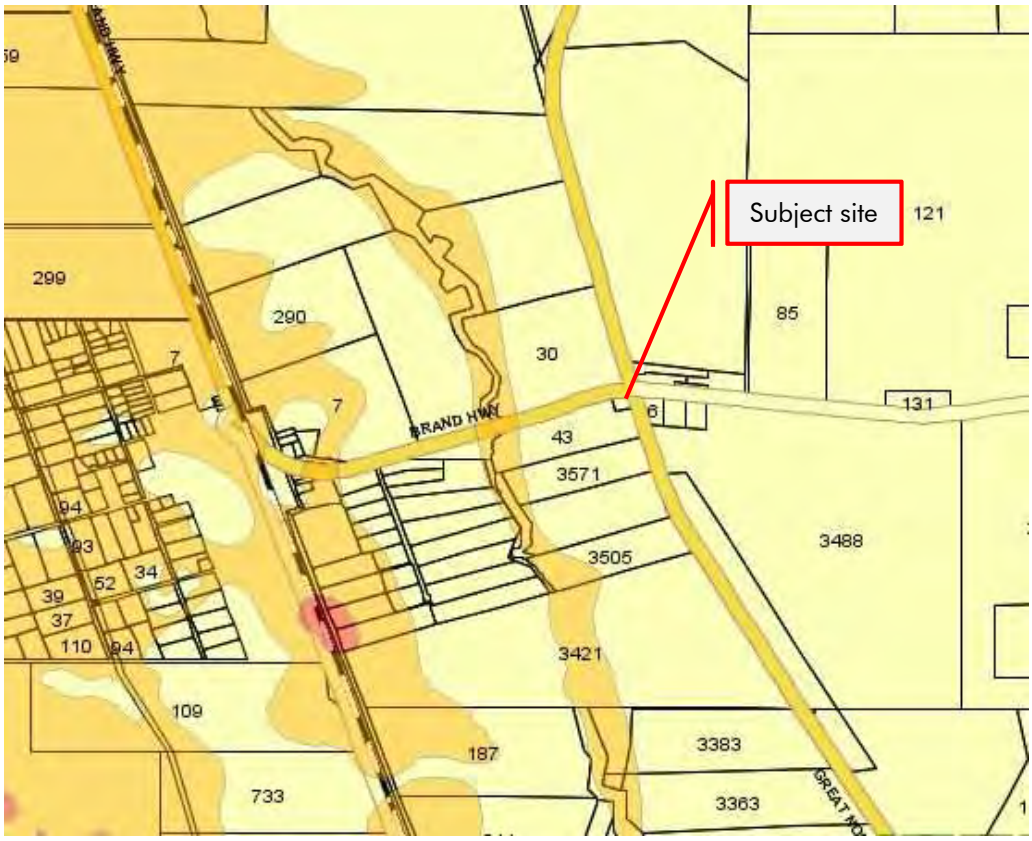


Figure 5 Acid Sulphate Soils mapping Swan Coastal Plain (Source: WA Atlas, 2014)

2.4 *Groundwater*

JDA Consulting Hydrologists prepared the documentation relating to the Stormwater Management Strategy. As part of this strategy analysis was conducted of both the current groundwater and stormwater flow situations.

A shallow groundwater bore was installed by JDA, located at the lower lying western edge of the subject site. It is understood from measurements taken and historical records that the average peak of groundwater, in the months between August and September, will come close to or at the natural surface.

Given the shallow depth of the groundwater table, it is recommended to introduce subsoil drainage under a proposed stormwater bioretention basin. This will prevent rise in the groundwater level post development due to the additional runoff captured and infiltrated in the basin. During summer when groundwater level is low, recharge to the groundwater will occur. Subsoils will only flow when the groundwater rises above the controlled groundwater level.

The complete details for the bioretention basin are set out in the Stormwater Management Strategy prepared by JDA. Appendix C.

2.5 Stormwater

The JDA report suggests that no waterways traverse the subject site, there is a non-perennial creek approximately 85m south of the subject site that which flows into the Ellen Brook.

Stormwater runoff from the subject site currently flows east to west, with sheet flows across the boundary to the neighbouring lot and south-west into the non-perennial tributary of Ellen Brook. The adjacent external catchment area drains initially to the Brand Highway road side drain, this intern continues until it drains to Ellen Brook.

In managing the future stormwater runoff a bioretention basin is proposed along the western boundary of the subject site. The complete details of the bioretention basin are set out in JDA's Stormwater Management Strategy. Appendix C.

2.6 Servicing

Wood and Grieve Engineers have prepared a preliminary servicing report in support of the proposed scheme amendment proposal. Following is an outline of points discussed in their report. The complete report has been supplied in Appendix B of this report.

2.6.1 Water

There is no water supply or water infrastructure supplied to the subject site by the Water Corporation and there is no future planning intended to extend water services to the area. Currently a groundwater bore is used for all domestic purposes other than drinking water which is supplied via a number of rainwater tanks.

It has been recommended that the current situation for the supply of potable water is sufficient with the current use; however the required demands for rainwater will need to be assessed at the time of future development.

2.6.2 Wastewater/Sewer

There is no wastewater infrastructure supplied to the subject site by the Water Corporation and there is no future planning intended to extend wastewater services to the area in the short term.

Treatment and disposal of wastewater onsite will need to follow the guidelines set out in the Muchea Employment Node – Waste Management Strategy. Options include:

- Treatment of wastewater in Aerobic Treatment Units (ATUs)
- Secondary treatment in evaporation ponds or infiltration ponds
- Use of treated water as irrigation

The high ground water level in the area and the sensitivity of the Ellen brook catchment will require special consideration when managing wastewater treatment. As such septic tanks and leach drains are not considered a viable option.

It is recommended that with any future development a full geotechnical study is conducted to determine the best way to protect the high water table from future contamination.

2.6.3 Gas

There is no gas reticulation infrastructure supplied to the subject site by ATCO and there has been no information supplied to suggest gas supply will be made available to the area in the short term.

The only viable option is the supply of gas bottles to the subject site.

2.6.4 Power

There is both Low Voltage and High Voltage above and below ground cables that can connect power to the subject site.

It should be noted that at this stage the cost of connection to a High Voltage power supply cannot be determined given the unknown intended use of the site after the change of zone has occurred. There may also be the issue of inadequate power supply, if this is the case, a substation site may be required.

2.6.5 Communications

There is an existing pit and pipe Telstra network in the vicinity that the subject site is connected to. This is appears sufficient to service the proposed future use of the site.

2.7 Traffic

Shawmac Consulting Traffic Engineers conducted an investigation into the impact on traffic flow from a change of zone of the subject site to 'Light Industry'. Their report advised that currently the subject site had one access point onto Great Northern Highway that would require upgrading at the time of a future development proposal. It was also noted that once the soon to be developed Perth-Darwin Highway was finalised the abutting portions of Brand and Great Northern Highway would be downgraded to local roads. This downgrade would however not occur until after approximately 2019.

The report concluded that a change to the 'Light Industry' zone would not have a significant impact on the current traffic levels experienced by the current road network.

The Complete report is attached under appendix D.

2.8 Indigenous Heritage

A search of Department of Aboriginal Affairs Aboriginal Heritage Enquiry System indicates that the subject site is included in land covered by the Gingin Brook Waggyl site. This is a curtilage of land on both the east and west sides of the Ellen Brook heading north. It is a historical/mythological registered area. It is understood that this is not a complete database of the surrounding area and archaeological monitoring of the site will need to be undertake at the time of further development on the site. At this stage no development is proposed on the subject site and so the amendment to the scheme can proceed unhindered.

3.0 Key Planning Framework

3.1 *North-East Corridor Extension Strategy*

This document was prepared in 2003 by the WAPC. *The North-East Corridor Extension Strategy* (NECES) covers a large part of the Ellen Brook Catchment area with the subject site centrally located. Future employment opportunities for the region were discussed as a key part of future population growth within the corridor; several locations were investigated to establish a strategic general industrial site/employment node.

The NECES identified a future industrial employment node should be located in the vicinity of the subject land west of Muchea. It was recommended that this location would facilitate service based industries including commercial, warehousing and wholesaling industries.

Muchea Employment Node Structure Plan

This document was prepared in 2011 by the WAPC under the guidance of the Muchea Employment Node Steering Committee. The purpose of the *Muchea Employment Node Structure Plan* (MENSP) was to guide and inform the development of the Employment Node such that it could take advantage of the long-term transport opportunities that would be generated by the proposed Perth-Darwin National Highway.

It was further identified that the establishment of the employment node would contribute to the employment and self- sufficiency of the region while meeting the demand for appropriately zoned and located land for industrial purposes.

The (MENSP) has the Employment Node divided into 5 Precincts, with the subject site is identified as being in Precinct 3. The precinct specific requirements for future planning and development are provided in Table 1 with a description of how these requirements can be met in future development.

Table 1: Precinct Requirements

Precinct Policy Statements	Planning Response
1. Low water use type industries with a minimum lot size of 10 000m^2 may be established in this area unless the developer can demonstrate prior to development commencing, that wastewater generated can be adequately managed as per the requirements outlined in the *Water Management Strategy* or a more detailed local water management strategy.	It is proposed that the 'Light Industry' zone be established on the subject site with a restriction of use to dry and low water uses be permitted. The proposed permitted uses will be: • Animal Establishment • Builders Storage Yard • Carpark • Civic Use • Community Purpose • Exhibition Centre • Factory Unit Building • Farm Supply Centre • Fuel Depot • Industry – Light • Industry – Rural • Industry – Service • Motor Vehicle Repair

	• Motor Vehicle Wrecking • Motor Vehicle, Boat and Caravan – Sales • Open Air Display • Public Utility • Reception Centre • Recreation - Private • Restricted Business • Road House • Salvage Yard • Service Station • Shop • Showroom • Storage • Telecommunications Infrastructure
2. For lots that do not require subdivision prior to development occurring, primary wastewater treatment shall be via aerobic treatment units followed by secondary treatment in evaporation ponds due to high groundwater levels.	This requirement will be adhered to at the development stage.
3. Development shall not conflict with the proposed Perth-Darwin National Highway road reserve and requirements external to it such as the interchange embankment build up and ramp constructions.	The subject site is located far enough away from the location of the Perth-Darwin National Highway to not be a significant factor
4. The access road shall be designed with provision for a road reserve of 30 metres. This will allow for a road cross section to be developed, which contains 2 x 3.5 metres lanes and a sealed 1.5 metres shoulder on either side, in accordance with the Shire of Chittering Local Planning Policy No 16 for other rural roads.	No roads are proposed with the change of zone.
5. Future planning is to specifically address treatment of lots abutting the future Perth-Darwin National Highway road reserve and/or the Ellen Brook, with regard to water management and amenity.	The subject site does not abut either the future Perth-Darwin National Highway road reserve and/or the Ellen Brook.
6. Structures higher than 90 m require referral to RAAF.	This requirement will be adhered to at the development stage.

3.2 *Directions 2031*

Directions 2031 and Beyond was prepared by the WAPC and released in 2010. This document recognises the importance of industrial land located strategically along transport/freight links.

The study area for Direction 2031 does not specifically refer to the Muchea Employment Node however is does acknowledgement should be given to the establishment of this area as a strategic industrial zone contributing to the economic self- sufficiency of the north-east corridor.

3.3 *Shire of Chittering Town Planning Scheme No.6*

The subject land is currently zoned 'Agricultural Resource' under the Shire of Chittering Town Planning Scheme No. 6. The proposal is to reclassify the subject land to 'Light Industry', as shown on the proposed Town Planning Scheme Amendment Plan included in this report.

The intention, with this change of zone, is to, as far as practicable; comply with the planning provisions as set out in Clause *6.7 Muchea Employment Node*. The following table address the requirements that are relevant and discussion how these requirements will be met:

6.7.2 Planning Considerations	
6.7.2.1 Notwithstanding any other land use permissibility expressed in the Scheme, no residential land uses will be approved in the Muchea Employment Node Area.	No residential uses other than caretakers dwellings are intended to be established on the subject site
6.7.2.2 In considering zoning proposals for 'Industrial Development' or 'General Industry' within the Muchea Employment Node, Council will require a comprehensive report that addresses the objectives and specific provisions of the Muchea Employment Node Structure Plan, and includes as a minimum: a) A District Water Management Strategy. b) An Environmental assessment that includes Flora and Vegetation Survey, Wetland Assessment and Level 1 Fauna Assessment. Shire of Chittering TPS 6 Page No. 48 c) A desktop Aboriginal heritage assessment.	The change of zone proposed is 'Light Industry' limited to low water uses. This report has provided the following information and reports as justification for this change of zone: • desktop Aboriginal heritage assessment • Local Water Management Strategy • Infrastructure assessment • Traffic report These reports provide added information on the ability of the subject site to support the change of zone to 'Light Industrial'

In addition to the above, requirements for the subject site will be added in 'Schedule 15 – Muchea Employment Node Special Control Area' within TPS6. These requirements will set out provisions for land use and development standards that will have to be complied with at the planning application stage.

3.3.1. *Special Control Area*

The subject site lies within the *Special Control Area* as discussed in clause *6.3 Water Prone Area – Ellen Brook Palusplain* of the Shire of Chittering Town Planning Scheme No. 6. The requirements for this clause are to manage and protect people and property from undue damage through inundation and ensure local wetland and ecological integrity are preserved through controls limiting development and nutrient run off.

Controls relevant to the requirements of the Special Control Area have been discussed earlier in this report and are expanded on within the supporting documentation provided by JDA.

3.4 *Shire of Chittering Local Planning Strategy*

The Shire of Chittering's Local Planning Strategy (LPS) was endorsed by the WAPC in 2004 and sets out the vision, mission and aims of the Shire and sets out a guide for development for the next 15-20 years.

Acknowledged in the LPS under Section *3.0 Economy and Employment* is the loss of opportunities to capitalise on the desire for industries to relocate to locations within the Shire:

> *3.2 Issues*
> *Over the past five years, the Shire has lost opportunities for many industries wanting to either relocate from outside the Shire or to establish new industries.*
>
> *There is no established industrial estate within the Shire, in which to accommodate the growing demand for additional services and employment. Most of the trades, personal services and traveller accommodation activities are home based.*
>
> *3.3 Aims*
> *To facilitate the establishment of a light industrial area in the Shire accessible to both Bindoon and the growing rural residential areas, on the south of the Shire;*
>
> *To provide employment opportunities for the residential population;*
>
> *To provide an accessible service location where the residents and farming community can obtain readily available services and supplies.*

The LSP also acknowledges that two site have been designated for industrial/light industrial development, one of which being the Chittering-Great Northern Highway (light industrial) area. At the time of endorsement however, the LSP notes that the Muchea Employment Node was an investigation area only and the area identified was subject to change and further review.

Given that there is now an 'Industrial Development' zone established in the vicinity, proposals for the change of zone to 'Light Industrial' within the appropriate precincts of the Muchea Employment Node Structure Plan should be given serious consideration.

3.5 *Shire of Chittering Local Planning Policy No.2 – Muchea Village*

The Local Planning Policy No.2-Muchea Village (LPP No.2) was prepared in 2005 by the Shire of Chittering to reflect the desires of the local population and create opportunities for local growth while considering the physical and other constraints of the local area.

While this document does not directly mention the Muchea Employment Node it does acknowledge a potential population increase for the town with the establishment of an industrial area to the west and potential increase of population relating to the Perth-Darwin Highway.

It stands to reason that as a result of these local upgrades demand for service industries strategically located to the new highway and Muchea townsite should increase.

4.0 AMENDMENT RATIONAL

It is proposed to reclassify the subject site from 'Agricultural Resource' to the 'Light Industrial' zone. Reclassifying the site to 'Light Industry', will establish land appropriately zoned within an area designated within the future Muchea Employment Node.

It is acknowledged that the reclassification of the subject land to 'Light Industry' is a 'spot rezoning', however given the existence of the 'Industrial Development' zone to the north-east, this should not be considered an isolated zone change. Discussions with both Local Government officers and the WAPC have suggested that while this is not ideal, given the ownership fragmentation within the locality and demand for 'Light Industrial' zoned land, this change of zone would be considered favourably.

The 'Industrial Development' zone to the north east is within Precinct 1 of the Muchea Employment Node Structure Plan, while a structure plan for the zone has not been finalised it is understood that lots in the range of 2-10ha have been considered with the zone of 'General Industry' most broadly established in any future design.

The subject site is within Precinct 3 of the Muchea Employment Node Structure Plan. This is an area that would more easily achieve a reclassification to the 'Light Industrial' zone given the smaller lot size and land ownership fragmentation. The change of zone of the subject site is considered a catalyst for zone change more broadly within the precinct, providing for a variety of industrial land zones catering for specific uses. The change of zone will be in line with strategic expectations for the precinct.

Traffic

It is considered that the redevelopment of the subject site will not significantly impact on existing traffic safety and movement. Any development in line with the 'Light Industry' zone will require planning approval that will discuss upgrading existing crossovers and negotiations with the MRWA as to the acceptability of addition crossover locations.

It is anticipated that with the creation of the Perth-Darwin Highway that one or both of the major roads abutting the subject site will be downgraded to local road, significantly improve the safety of access and egress from the lot.

Servicing

It is not anticipated that the change of zone will have a negative impact on the capacity of servicing infrastructure, however some services are limited and are not expected to be upgraded.

Both potable water and reticulate wastewater services are not available to this area and are unlikely to be for some time. Bottled water and on-site wastewater treatment and disposal will be the likely solutions for these services.

It is anticipated that an upgrade of power supply to the subject site will be required with the development of the land under the 'light industrial' zone. The capacity required will be determined at the time of a specific development proposal.

Telstra has a connection feed to this location; however no current plans exist for timing of the NBN rollout.

Water Management

The management of both the stormwater and groundwater can be achieved over the subject site with a single shallow bio-retention basin along the western boundary including sub surface drainage. For the change of the zone over the subject site to 'Light Industrial' the basin meets all the sizing requirements set out by the Shire of Chittering and the Department of Water and is consistent with the guidelines set out in the *Muchea Employment Node Structure Plan*.

5.0 Conclusion

It is considered that reclassification of the subject site from 'Agricultural Resource' to 'Light Industry' is in accordance with orderly and proper planning. Further, the change of zone is consistent with State and local government strategic objectives identifying the requirement for an industrial employment node with the region.

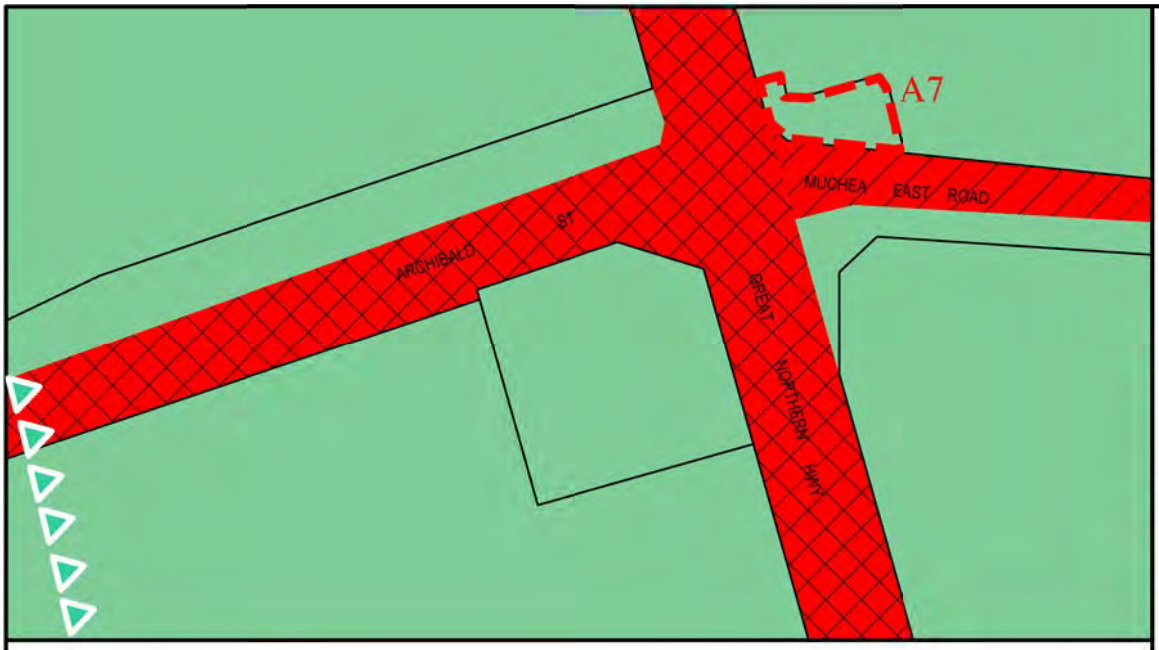
Issues with groundwater and stormwater can be suitably overcome and remain consistent with Shire and State government objectives for water management in this sensitive location.

Extra traffic generated by the change of zone will not have a significant effect on traffic flows to the area and any development will see the existing crossover upgraded and access and egress from the subject site considered by the appropriate government agencies.

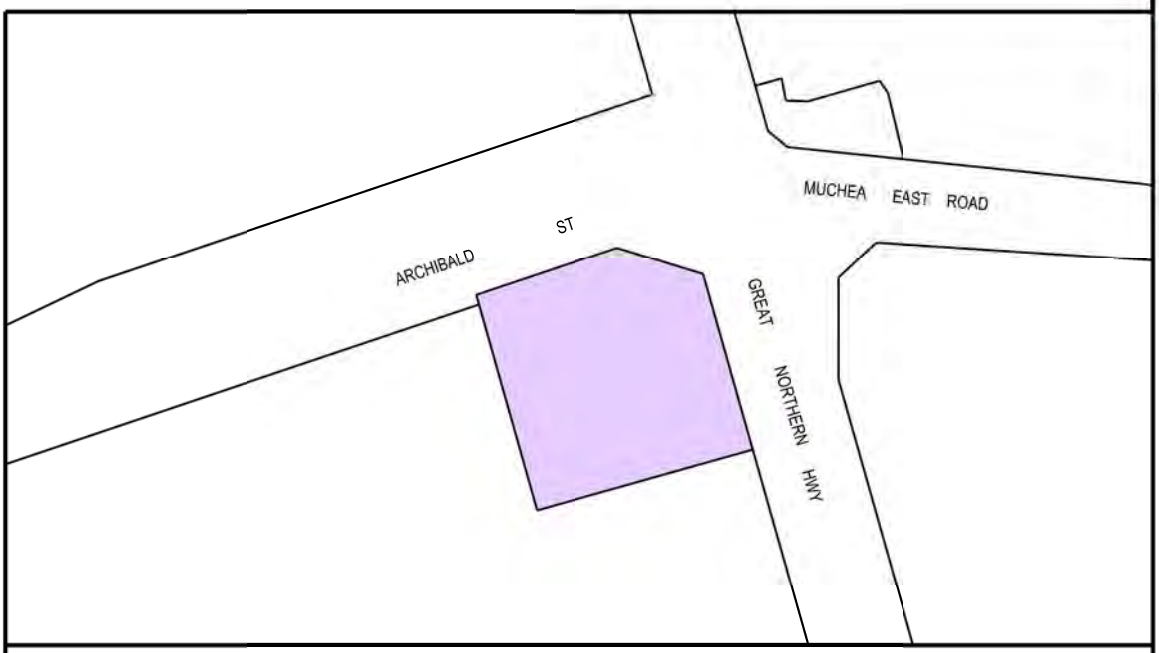
At present the 'Agricultural Resource' zone of the subject site is inconsistent with the expected strategic outcomes for the area. The proposal is therefore considered to have a potential positive affect in terms of generating interest in further similar zone changes for the area, bringing the surrounding land in line with proposed strategic planning and development of the Muchea Employment Node. This in turn will generate both positive land use and employment outcomes.

Appendix A – Scheme Amendment Map

SHIRE OF CHITTERING
TOWN PLANNING SCHEME No. 6 -Amendment No.



EXISTING ZONING



SCHEME (AMENDMENT) MAP

LEGEND

LOCAL SCHEME RESERVES
- Highway
- Major Road

LOCAL SCHEME ZONES
- Agricultural resources
- Light industry

OTHER CATEGORIES
- A1 Additional uses
- Military considerations

SCALE 1:3000

Appendix B – Servicing Report

WOOD & GRIEVE ENGINEERS

Lot 3599 Great Northern Highway, Muchea

Preliminary Servicing Report

Prepared for:

Mrs Charmagne Cassar
Atom Ant Earthmoving

Date:
11 February 2016

Prepared by:

Brett Sanderson
Project No. 28901-PER-C
P:\28901\PROJECT DOCUMENTATION\REPORTS\C_SITE SERVICING REPORT FINAL (2).DOCX

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Revision

REVISION	DATE	COMMENT	APPROVED BY
1	21/12/2015	Draft – Issued for Client Comments	BS
2	27/01/2016	Final	BS
3	11/02/2016	Final – revised to suit Hydrologic Consultant comments	BS

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Executive Summary

1. Executive Summary

Preliminary servicing investigations and assessments have been undertaken to establish the availability of services infrastructure in the vicinity of Lot 3599 Great Northern Highway, Muchea and their capacity to supply the lot once rezoned to 'Light Industrial.' Findings of these investigations, as well as consultation with the appointed Hydrologic Consultant, include the following;

- No Water Corporation water infrastructure in the vicinity of the site therefore the use of rainwater tanks and bottled water is likely to be the most viable option for potable water supply.
- No Water Corporation wastewater infrastructure in the vicinity of the site therefore the use of on-site wastewater treatment and disposal methods is likely to be the most viable option.
- The implementation of a 1:5yr ARI infiltration basin and swales is being investigated by the appointed Hydrologic Consultant. Stormwater from larger storm events will be conveyed via overland flow from Lot 3599 to the existing public stormwater drainage system.
- ATCO Gas do not have infrastructure near the site and as such, the use of non-permanent gas supply such as gas bottles is to be considered.
- The existing access / egress point to Lot 3599 is situated within the northbound Great Northern Highway deceleration lane. This situation is not ideal however due to the size, orientation and arrangement of Lot 3599, options for "improving" this are limited.
- Lot 3599 has an existing Low Voltage service fed from overhead power cables on Brand Highway. Due to the rezoning of the land, the nominated required load is assumed to increase and the existing service is required to be upgraded.
- Lot 3599 is currently served by an existing Telstra connection fed from Brand Highway with no anticipated upgrades required. There are no known plans for NBN rollout in the Muchea area.

Introduction

2. Introduction

Wood & Grieve Engineers have been commissioned by Atom Ant Earthmoving to provide a Servicing Report detailing the civil servicing implications and risks associated with the rezoning of Lot 3599 Great Northern Highway, Muchea from 'Rural' to 'Light Industrial.'

Servicing investigations have been undertaken to establish the availability of the existing services infrastructure in the area and their capacity to supply the proposed rezoned Lot.

Where existing infrastructure has proved insufficient to meet the needs of the Lot, infrastructure extensions/upgrades as well as alternative servicing options have been identified. The following advice is based on information provided by Atom Ant Earthmoving and other appointed Consultants as well as correspondence with the Shire of Chittering and the service authorities in the area.

Existing Site Conditions

3. Existing Site Conditions

Lot 3599 forms a site of approximately 7,800m^2 (as measured from aerial imagery) and is bound by Great Northern Highway to the east, Brand Highway to the north and undeveloped land to the west and south. According to the Landgate WA Atlas: Shared Land Information Planning, the site elevation ranges from approximately RL 52 - 53m AHD (Australian Height Datum).

Preliminary geotechnical desktop investigation of the site indicates that the surface geology is likely to comprise of pebbly silt of the Guildford formation. Previous experience with this geological unit suggests that the fines component of the soils is more likely to behave like a clay and would probably have an undeveloped site classification of S or M. It is understood that the lot owner has installed a base course medium to the surface of a portion of Lot 3599. This hardscaping will alter the way in which the lot drains and should be further captured within the Stormwater Management Plan.

The Department of Water; Perth Groundwater Atlas indicates that groundwater levels present at the site are at approximately 48m AHD, which is within 4m to 5m of the existing ground surface level. Note that these levels are based on 2003 Groundwater Contours as the Groundwater Atlas does not show information for the historical maximum groundwater contours over Lot 3599. Preliminary advice from the appointed Hydrologic Consultant indicates the groundwater was measured on site in December 2015 as being within approximately 1.3m of the surface level. This level is more likely to represent the maximum summer groundwater level that is present at the site, however further monitoring of the groundwater bore is recommended to measure the winter/spring peak in 2016. The Hydrologic Consultant suggests that the maximum winter groundwater level is likely to be approximately 0.5m below natural surface level, or possibly as high as at natural surface.

The Landgate WA Atlas: Shared Land Information Planning provides an unclassified Acid Sulfate Soils (ASS) risk for the area containing Lot 3599, as such it is reasonable to assume due to the nature of the proposed works that the ASS risk is considered to be low. There is a large area of moderate to low ASS risk within 500m to the west as well as an area of high to moderate ASS risk approximately 2,000m to the southwest of Lot 3599. Further geotechnical assessment of the soil conditions on site is highly recommended, including investigation of the depth to potential Acid Sulfate Soils for the provision of internally reticulated services and building footings.

Further geotechnical investigation of the site is highly recommended at the next phase of the development to accurately assess the soil and groundwater conditions, with the implications of the site conditions having a large bearing on stormwater drainage and import fill requirements for the creation of developing a site suitable for light industrial activity.

4. Water

There is currently no Water Corporation water infrastructure adjacent to Lot 3599 that is able to be directly connected to the site. The closest Water Corporation water main to the site is a 150mm diameter P-12 main approximately 10km to the south within the Great Northern Highway road reserve in Bullsbrook. The existing Water Corporation network in the Muchea/Bullsbrook area is displayed in Appendix 1. Connection to this existing water main would require significant offsite works and is not considered to be a feasible option in providing potable water to the site.

The Water Corporation has also advised that there is no future planning to extend the existing water infrastructure from Bullsbrook to Muchea. This is not to say this will not be undertaken at some point in the future, however the Water Corporation's current future planning has not included these works. Please refer to Appendix 2 for email confirmation from the Water Corporation.

An alternative water source for the site is likely to be required given the lack of Water Corporation infrastructure in the vicinity. It is understood that an existing groundwater bore that services the site is currently utilised on site for domestic use (such as toilet, laundry, shower, etc.) but not for drinking water. A number of rainwater tanks that are fixed to the shed on the property are utilised for drinking water. The current Department of Water (DoW) 'Licence to Take Water' allows for 650kL to be extracted from the bore annually. The demand for the proposed usage of Lot 3599 is unknown at this stage but should be quantified to ensure sufficient volume of water is available annually.

The use of rainwater tanks is believed to be the most viable and cost efficient solution for providing potable water to the site. Given that the land is proposed to be rezoned only at this point in time, there is no need to upgrade the existing rainwater catchment arrangement. At such stage where there is a clear direction as to what the future use of the site will entail, an analysis of the required water supply to the site can be undertaken to recommend the number of tanks required as well as the most effective way of storing and utilising collected rainwater internally.

5. Wastewater / Sewer

There is currently no Water Corporation wastewater infrastructure adjacent to Lot 3599 that is able to be directly connected to the site. The closest Water Corporation sewer main to the site is approximately 10km to the south within the Great Northern Highway road reserve in Bullsbrook. The existing Water Corporation network in the Muchea/Bullsbrook area is displayed in Appendix 1. Connection to this existing sewer main would require significant offsite works and is not considered to be a feasible option in providing a wastewater disposal service to the site.

The Water Corporation has also advised that there is no future planning to extend any existing wastewater infrastructure from Bullsbrook to Muchea. This is not to say this will not be undertaken at some point in the future, however the Water Corporation's current future planning has not included these works. Please refer to Appendix 2 for email confirmation from the Water Corporation.

A number of constraints are present at the site that restricts the options for wastewater disposal. Given that connection to the closest existing Water Corporation infrastructure is not considered viable, on-site wastewater treatment and disposal options must be considered. Possible on-site treatment and disposal processes, as detailed in the Muchea Employment Node – Water Management Strategy document, could involve the following;

- Treatment of wastewater in Aerobic Treatment Units (ATUs)
- Secondary treatment in evaporation ponds or infiltration ponds
- Use of treated water as irrigation

The use of septic tanks and leach drains is not considered to be a feasible option for wastewater treatment and disposal due to the high groundwater levels present. The sensitivity of the Ellenbrook catchment is particularly critical given that this catchment is considered to be the most polluting of the Swan River. Due to the observed high groundwater level at the site, environmentally approved clean sand fill may be imported to the site to be placed below any evaporation or infiltration ponds to increase the distance between groundwater levels and surface levels. Further detailed geotechnical investigation of the site is recommended to determine the permeability, Phosphorus Retention Index (PRI) and chemical uptake capacity of the existing ground conditions and to better understand the existing conditions so that more detailed recommendations regarding wastewater disposal can be made.

The appointed Hydrologic Consultant for this site has been contacted in regards to the Stormwater Management Plan that has been prepared, who has offered the following comments:

- The location and design of the treated wastewater irrigation infiltration system is to be placed separate to the stormwater bioretention basin and to take into account the existing groundwater levels and infiltration rates.
- The stormwater bioretention system is to have its own subsoil and thus will limit groundwater rise beneath the basin to within 0.30m of the basin invert.

6. Stormwater and Groundwater Management

The appointed Hydrologic Consultant has prepared a Stormwater Management Plan (JDA Consultant Hydrologists, 2016) which includes details regarding the management of stormwater in accordance with Shire guidelines as well as management of the groundwater conditions. WGE have been advised that the appointed Hydrologic Consultant has investigated the existing environment (surface water, groundwater, soils and PRI, infiltration capacity, wetland mapping, etc.) and that the following apply to Lot 3599;

- For drainage basin sizing, Shire policy (LPP 16 Roads & Drainage) identifies that drainage for "other development" is to be "in accordance with water sensitive design principles to satisfaction of Council's CEO", and states "outside town sites within the Ellen Brook Pallus Plain – appropriate collection and on-site disposal, [to be] designed for 1:5 year ARI rainfall event."
- For stormwater management, a 1:5yr ARI bio-retention basin has been sized using infiltration modelling software, taking into consideration the shallow groundwater table, measured hydraulic conductivity, and existing soil profile. The bio-retention basin will be placed in the down-gradient portion of the lot along the western boundary. For events greater than the 1:5yr ARI, flow is to be released via a spillway to flow westwards over the adjacent lot via the predevelopment overland flow path towards the creek south of the Study Area. Consistent with water sensitive design, the bio-retention basin treats stormwater runoff. Depending on final industrial use, if applicable, fuel oil and grease treatment may be required prior to entering the bio-retention basin and chemicals storage and handling is to take place in a separate containment area.
- Due to seasonal peak groundwater in the area (peak winter level within 0.5 m of the natural surface) and potential for groundwater to rise post-development, subsurface drainage is proposed beneath the bio-retention basin to control the peak groundwater level to ensure the bio-retention basin empties between rainfall events. As the existing soils have high PRI >20, and stormwater is also treated during infiltration through bio-retention basin, subsoil flow is considered treated. The subsurface drainage will discharge downstream to the road side drain south of Brand Highway.

Draining of the site internally is likely to incorporate capture of stormwater from hardstand areas by a swale arrangement, discharging into the 1:5yr ARI basin. Captured water could potentially be utilised for industrial use in the yard, such as for wash down bays. There is potential to reduce the total water to be retained by the bio-retention basin (and hence its size) by installing wash-down storage tanks or rainwater tanks. These tanks will need to be regularly emptied within 48 hours after a rainfall event to ensure the void space is available for the next storm event.

Considering the high groundwater level measured on site in December 2015 and the expected maximum groundwater level being at or within 0.5m of the natural surface level, it is expected to be difficult to infiltrate the 5 year ARI (Average Recurrence Interval) runoff. The appointed Hydrologic Consultant has recommended further monitoring of groundwater levels at the bore installed on the property, preferably monthly during the seasonal peak period (typically August to October) in 2016 to confirm the peak groundwater level for detailed design purposes.

From a civil servicing perspective, the interaction between stormwater and wastewater treatment/disposal is considered to be the most critical aspect relating to the site. As mentioned in Section 5, the appointed Hydrologic Consultant has identified a number of approaches that should be considered for the design of wastewater treatment / disposal and stormwater disposal infrastructure. For more detailed information in regards to stormwater management of the site, please refer to the mentioned Stormwater Management Plan.

Gas

7. Gas

There is currently no ATCO Gas Reticulation infrastructure or similar adjacent Lot 3599 that will provide service to the site. We are yet to receive any preliminary advice from ATCO regarding planning for the Muchea area, however it is believed that the closest ATCO infrastructure is located approximately 10km to the south in Bullsbrook. Connection to this existing main would require significant offsite works and is not considered a feasible option for Lot 3599.

An alternative gas source for the site is via the use of gas bottles. The delivery and transport of gas bottles to the site is an additional expense that must be considered, however this is deemed more feasible than the significant offsite works required to connect to existing infrastructure.

8. Roadworks

Historic aerial imagery indicates that the existing Great Northern Highway / Brand Highway intersection was upgraded in 2009 / 2010 to its current configuration. This intersection is assumed to be adequate for any potential minor increase to traffic generated by the rezoning of Lot 3599 to 'light industrial.'

Lot 3599 currently has the access/egress point located within the turning deceleration lane of the Great Northern Highway (northbound) which is not typically standard practice. The orientation and size of Lot 3599 combined with the length of the turning lane dictates limited alternatives on the Great Northern Highway. Similarly with the location to the intersection, access/egress options are limited on Brand Highway. These constraints make it problematic to provide a "standard" access/egress point in line with local authority and Main Roads requirements and consultation with a Traffic Engineer may be necessary.

As Lot 3599 is nominated to remain as a single lot once rezoned, any internal roads constructed in the future will be considered private. If the lot is subdivided in the future, the local roads will need to conform to the Shire of Chittering's standards and guidelines.

The current concept alignment of the proposed Perth to Darwin Highway (as part of the Main Roads WA 'Northlink WA' project) will not impact on Lot 3599. The current concept alignment shows the proposed road to be located to the west of Lot 3599, with the road reserve width and associated batters located a sufficient distance from Lot 3599 therefore we believe that these works will have no significant impact on Lot 3599. WGE has been advised that once the Perth to Darwin Highway is constructed, it is likely that both the Brand and Great Northern Highways will be downgraded from highways to local distributor roads.

9. Power

9.1 Existing Infrastructure

After analysing Western Power's DFIS (Distribution and Facilities Information System) system (see Appendix 3), Nearmap and DBYD plans, it has been noted that there are existing LV (Low Voltage) and HV (High Voltage) overhead cables fronting Lot 3599 on Brand Hwy and existing LV and HV underground cables fronting part of the lot along Great Northern Hwy.

There are also existing overhead power lines on the opposite side of Great Northern Hwy.

As per the attached LV map, it should be noted that Lot 3599 appears to currently already have an existing service, fed from the existing poles along Brand Hwy. Western Power has advised that the current approximate load of this service to Lot 3599 is 1kVA. Please note this is approximate only, as the specific load cannot be determined without having Western Power load log the transformer which can take up to 4 weeks.

9.2 Maximum Demand

Western Power's Underground Distribution Scheme (UDS) policy details that all new land developments are provided with an authority point of connection via an underground power service. Where the lot is intended to be utilised as Commercial or Light Industrial, a minimum load allocation of 200kVA per hectare is to be applied as stated in the UDS manual (Section 5.3.2.3).

Based on a lot size of 7800m2, which is approximate only as measured via aerial imagery, the new load allocation is expected to be 156kVA.

9.3 Western Power Methodology

The increase in load as a result of rezoning of the lot to Light Industrial will entail a DQA (Design Quotation Application) to Western Power and may fall under the DLVCHS (Distribution Low Voltage Connection Headworks Scheme) policy as it is not a subdivision, just a load increase.

The DLVCHS is a $ per kVA rate applied based on the increased load. Please see web address below for further information on this policy.

http://www.westernpower.com.au/electrical-contractors-distribution-low-voltage-connection-headworks-scheme.html

If required, there are some Western Power estimations of costs available for these load upgrades, however it is unknown exactly how the lot will be serviced as it is not determined if there is any capacity in the surrounding network until application. If there is no available capacity, a substation site may be required.

Disclaimer

It should be noted that due to the dynamic nature of Western Power's network, infrastructure requirements and connection points referred above may differ when applications are placed in the future. It is encouraged to undertake a planning study closer to the date of proposed load uptake to determine if the existing network has the capacity to take on the development load.

10. Communications

10.1 Existing Infrastructure

An analysis of Telstra's DBYD (Dial Before You Dig) information has been conducted in order to determine the location of the existing Telstra network to service the development. It is noted that there is an existing Telstra network surrounding the site which consists of pit and pipe along the south of Brand Highway and to the west of Great Northern Highway.

As per the attached Telstra DBYD information (Appendix 4), it should be noted that Lot 3599 appears to currently already have an existing service, fed from the existing pit along Brand Highway.

The closest NBN services in proximity to the site are located in Bullsbrook, approximately 10km to the south. There are no current known plans for the roll out of NBN services to the Muchea area.

10.2 Initial Conceptual Solutions

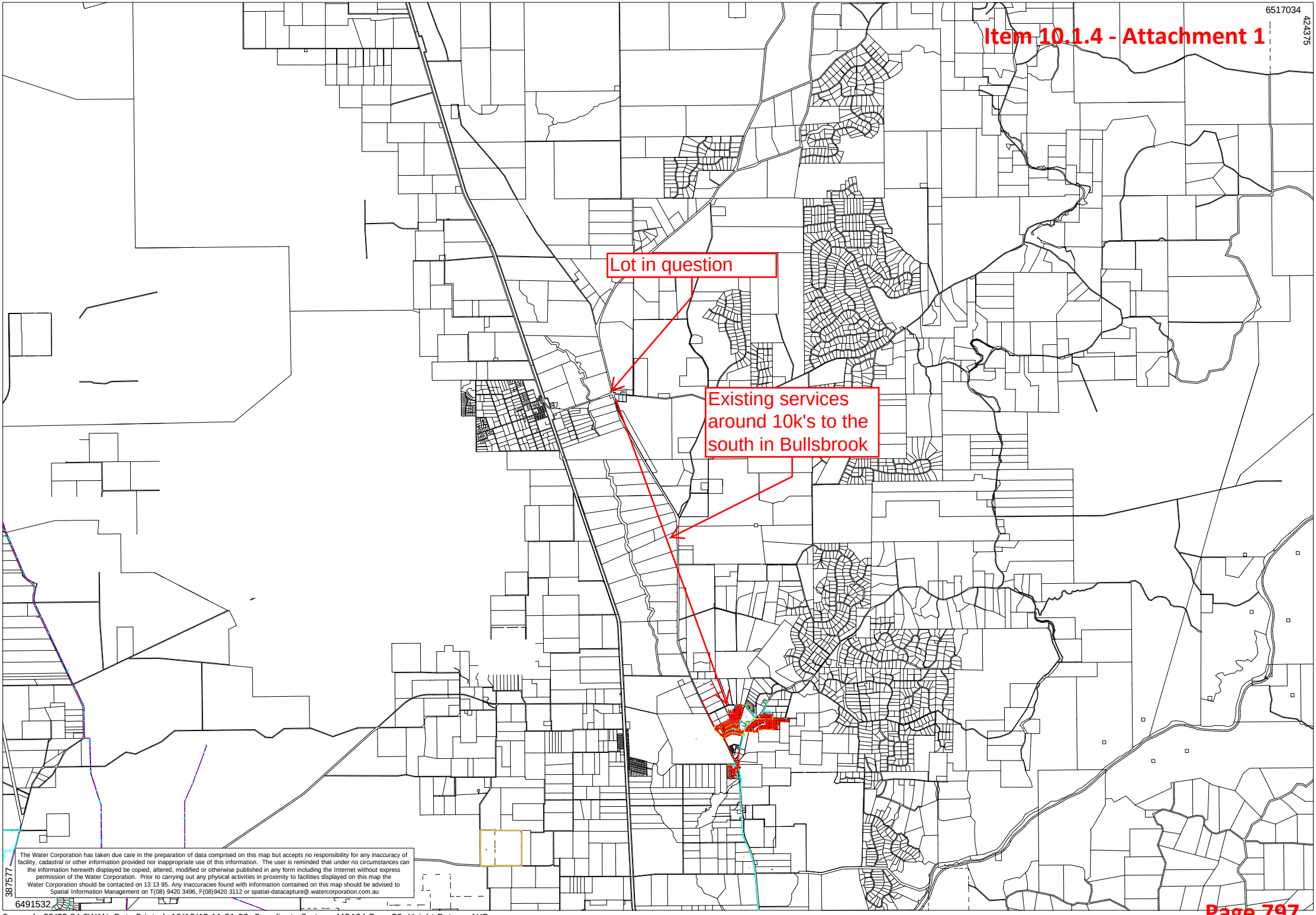
Based on the current lot yield we have assumed that Lot 3599 will not require any extra pit and pipe as the site appears to already have an existing service.

Disclaimer

It should be noted that due to the dynamic nature of Telstra's network and infrastructure requirements, the advice provided above may differ as we cannot guarantee the accuracy of the information provided on the Telstra DBYD plans.

Appendix 1

EXISTING WATER CORPORATION INFORMATION



The Water Corporation has taken due care in the preparation of data comprised on this map but accepts no responsibility for any inaccuracy of facility, cadastral or other information provided nor inappropriate use of this information. The user is reminded that under no circumstances can the information herewith displayed be copied, altered, modified or otherwise published in any form including the Internet without express permission of the Water Corporation. Prior to carrying out any physical activities in proximity to facilities displayed on this map the Water Corporation should be contacted on 13 13 95. Any inaccuracies found with information contained on this map should be advised to Spatial Information Management on T(08) 9420 3496, F(08)9420 3112 or spatial-datacapture@.watercorporation.com.au

Screen bg35/22.24 SWAN Date Printed: 10/12/15 11:51:06 Coordinate System: MGA94 Zone 50 Height Datum: AHD

Appendix 2

WATER CORPORATION EMAIL CORRESPONDENCE

Mitchell Catlin

Subject: FW: Lot 3599 Great Northern Highway, Muchea - Water Corporation Planning Information Request

From: Rick Harrison [mailto:Rick.Harrison@watercorporation.com.au]
Sent: Thursday, 10 December 2015 12:38 PM
To: Mitchell Catlin
Cc: Clay Ullrich
Subject: RE: Lot 3599 Great Northern Highway, Muchea - Water Corporation Planning Information Request

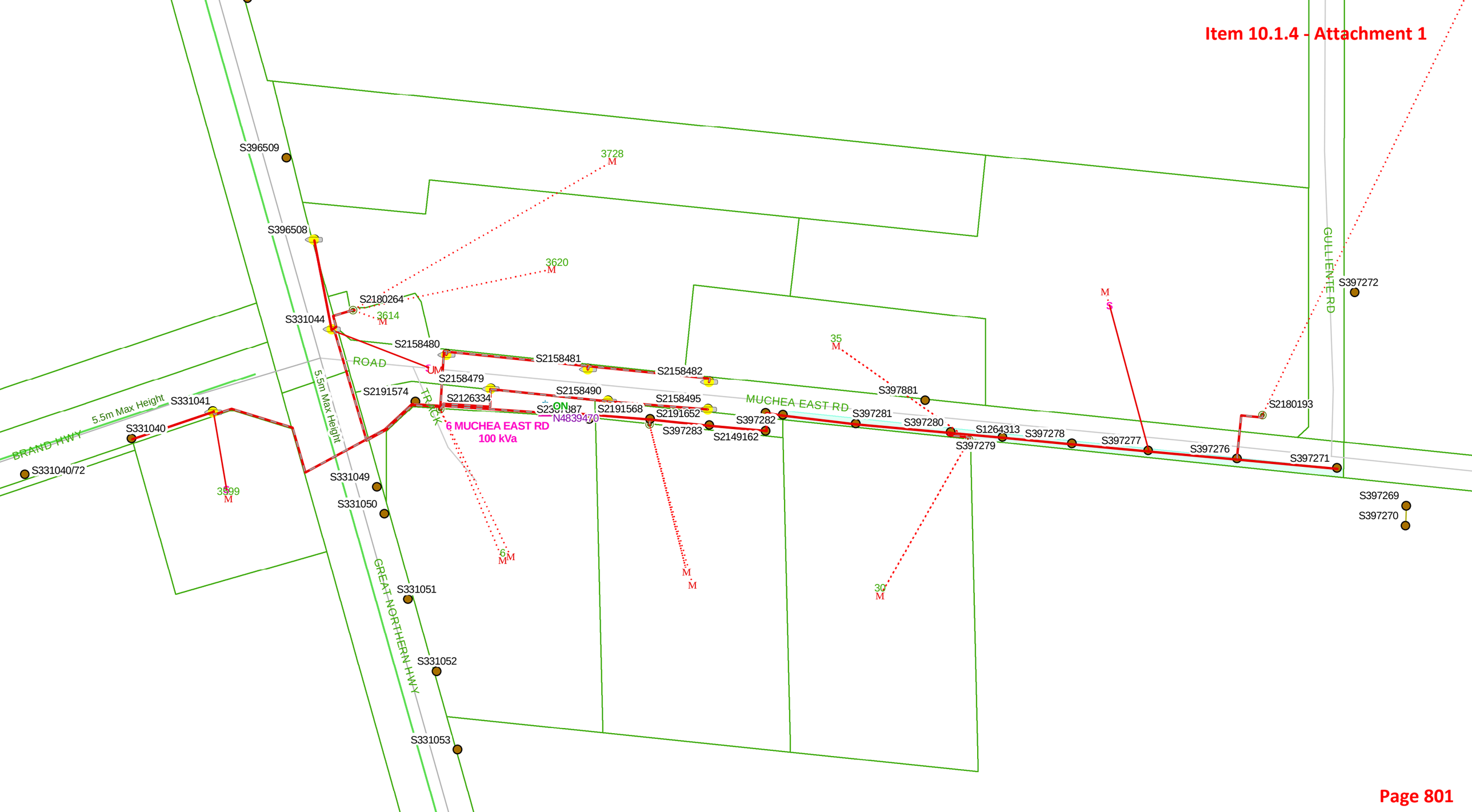
Hi Mitchell,

There are no current plans to extend the IWSS to Muchea.

Regards,
Rick Harrison
A/ Team Leader, Land Servicing
Water Corporation
T: (08) 9420 2076

Appendix 3

WESTERN POWER DFIS MAPS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GULLIENTE RD
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S331040
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3899
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S331049
S331050
5.5m Max Height
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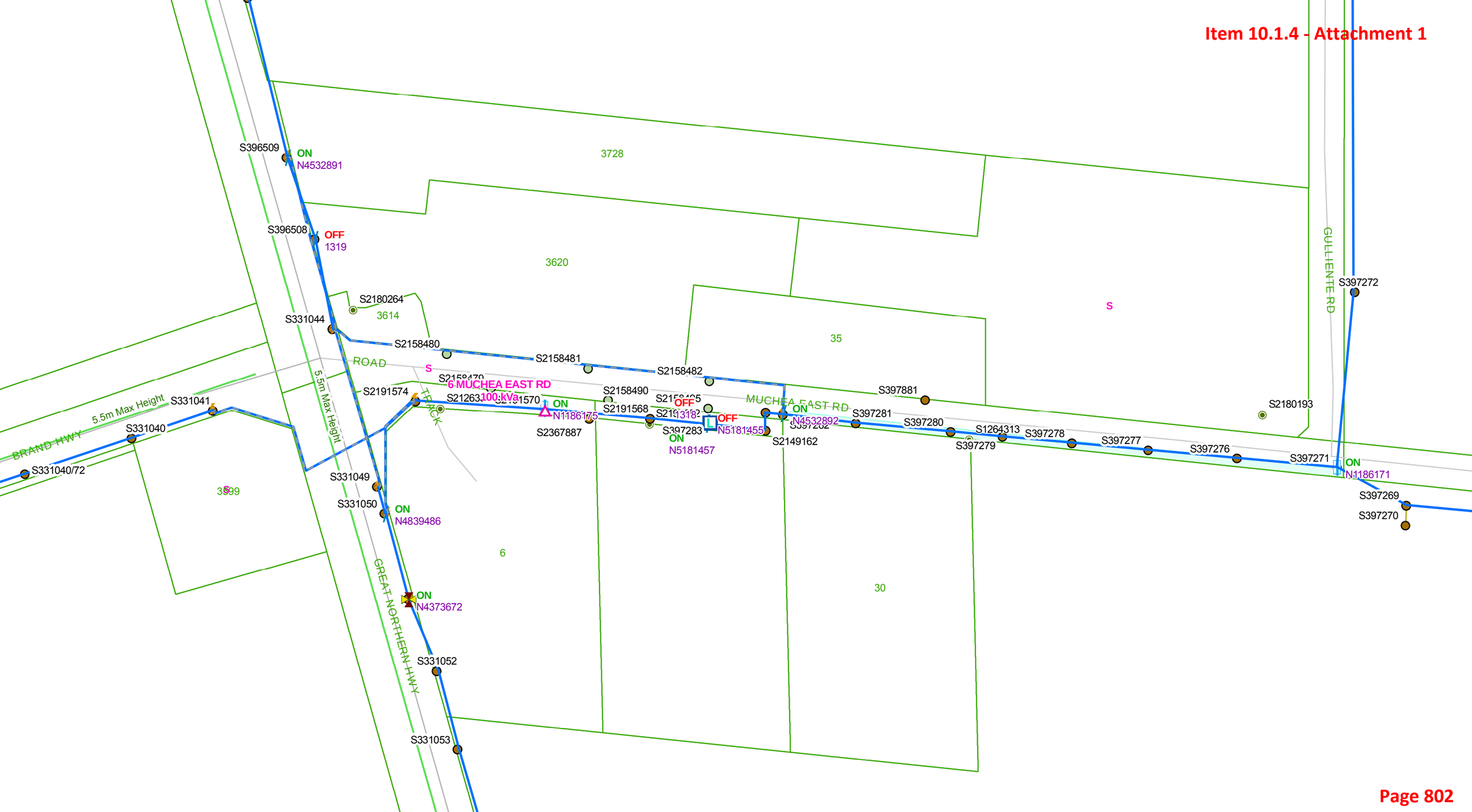
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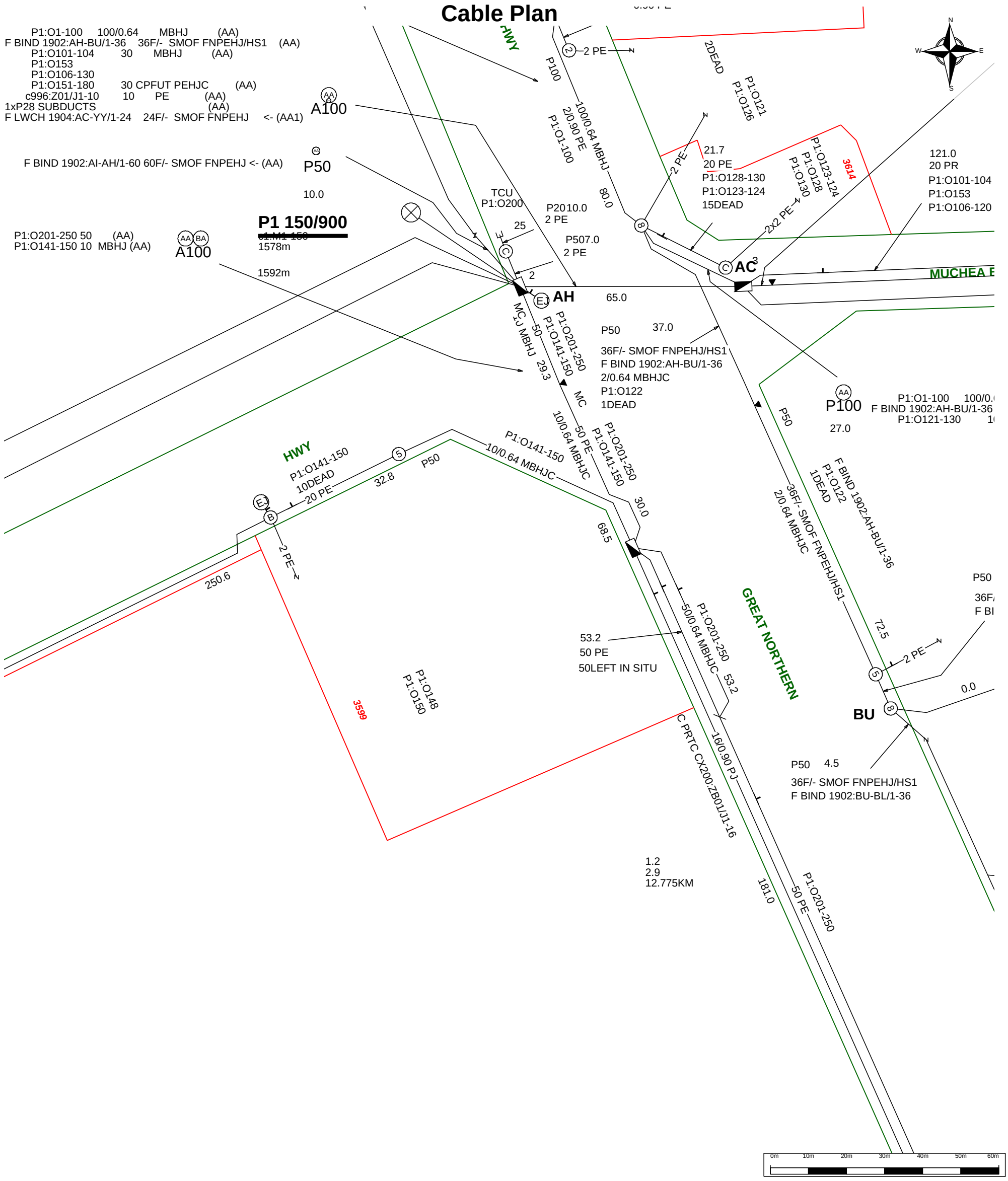
Appendix 4

EXISTING TELSTRA INFORMATION

Cable Plan



Telstra	For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556	
Generated On 20/11/2015 10:53:31	
Sequence Number: 49261420	
CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.	

WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

Please read and understand the information supplied in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

Appendix C – Stormwater Management Strategy

Atom Ant Earthmoving

3599 Great Northern Highway Muchea

Shire of Chittering

Stormwater Management Strategy

February 2016

JDA Consultant Hydrologists

DISCLAIMER

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Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by JDA and the Client without first obtaining a prior written consent of JDA, does so entirely at their own risk and JDA denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed with the Client.

JDA does not take responsibility for checking landscape and engineering plans attached to this report for accuracy or consistency with this report.

This Report is based on the current edition of Australian Rainfall & Runoff – A Guide to Flood Estimation (Engineers Australia, 1987).

Engineers Australia released a partial update to ARR in December 2015. The completed version of ARR may include different design methods and data for flood estimation in Australia including rainfall intensity, rainfall temporal patterns, rainfall runoff coefficients as well as a guideline for taking into account the effect of climate change on design rainfall and hence design floods depending on projected design life of land development. The revised version of ARR may include information which may require this Report to be revised.

QUALITY ASSURANCE

JDA provides quality assurance through all aspects of the company operation and is endorsed to AS/NZS ISO 9001:2008 Quality Assurance Certification, with third party certification to Bureau Veritas.

Document Version No.	Issue Date
J6120a	09 February 2016

	Name	Signature	Date
Author	Joycelyn Siew and Wendy Green		09 February 2016
Checked by	Wendy Green		09 February 2016
Approved by	Jim Davies		09 February 2016

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1. EXECUTIVE SUMMARY

Lot M1606 or 3599 Great Northern Highway, Muchea, is a 0.78 ha property located in the southwest quadrant of the intersection of Brand Highway and Great Northern Highway, and very close to the future Perth to Darwin National Highway. To support rezoning of the single small Lot (without subdivision) to 'Light or General Industry', a basic level Stormwater Management Strategy is required by the Shire of Chittering.

This Stormwater Management Strategy includes analysis of the existing site characteristics plus both Stormwater and Groundwater Management due to the presence of shallow groundwater.

This Stormwater Management Strategy demonstrates that for a lot zoned Light or General Industry, that stormwater and groundwater quantity and quality management using water sensitive urban design principles is achievable in a single shallow bio-retention basin along the western boundary of the lot with subsurface drainage. For rezoning purposes, the basin meets sizing criteria set by *Shire of Chittering Local Planning Policy No. 16: Roads and Drainage* (Shire of Chittering, 2007), which also meets DoW (2009) criteria. Adoption of a Bio-retention basin is also consistent with *Muchea Employment Node Structure Plan* (WAPC, 2011).

2. INTRODUCTION

Lot M1606 or 3599 Great Northern Highway, Muchea, is a 0.78 ha property located in the southwest quadrant of the intersection of Brand Highway and Great Northern Highway (Figure 1), herein referred to as the Study Area.

The Study Area is currently zoned 'Agriculture Resource' under the *Shire of Chittering Town Planning Scheme No. 6*. To support rezoning of the single small Lot (without subdivision) to 'Light or General Industry', a basic level Stormwater Management Strategy and a Servicing Report is required by the Shire of Chittering.

Current land use includes a domestic residence and gravel parking area for heavy vehicles.

This Stormwater Management Strategy includes analysis of the existing site characteristics plus both Stormwater and Groundwater Management due to the presence of shallow groundwater. This report supports rezoning of the property to Light or General Industry.

The Servicing Report has been prepared by Wood and Grieve Engineers (2016).

2.1 Planning Context

The Lot is located within the Muchea Employment Node in the Shire of Chittering and is guided by the following documents:

- *Muchea Employment Node Structure Plan* (WAPC, 2011);
- *Water Management Strategy: Muchea Employment Node* (Connell Wagner, 2008) did not include the Lot, but was written to accompany the Structure Plan (WAPC, 2011) and can be used for information;
- *Shire of Chittering Local Planning Policy No. 16: Roads and Drainage* (Shire of Chittering, 2007).

2.2 Proposed PDNH Highway

The Perth Darwin National Highway (PDNH) is proposed to link the intersection of Reid and Tonkin Highways to the Great Northern Highway in Muchea. Engineering drawings for the PDNH were provided by Main Roads to JDA, but are not included in this report due to a signed confidentiality agreement. The proposed PDNH alignment, also available on the North Link WA website, is shown on Figure 1.

Design of the PDNH is still in concept stage and subject to funding. Currently, the PDNH is funded up to Brand Highway just west of the Lot. Depending on funding approval for the project north of Brand Highway, PDNH may terminate at Brand Highway as an intersection, or continue as a flyover to link up with Great Northern Highway (North Link WA, *pers. comm.*; Appendix A). This could impact on the downstream flow path of any Lot runoff, addressed in Section 4.4.

3. EXISTING SITE CHARACTERISTICS

3.1 Climate

The climate is Mediterranean, characterised by hot dry summers and mild wet winters. The long term annual average rainfall (1912 – 2013) is 747.5 mm at the Muchea Tree Farm BoM station (9029), with 79% of rainfall occurring between May and September (Figure 2). However, the short term annual average rainfall (1981 – 2013) is 667.4 mm, 11% lower than the long term average (Figure 2).

Average annual pan evaporation for Muchea is approximately 1950 mm (Luke *et al.*, 1988).

3.2 Topography

Topography is shown in Figure 3. The land slopes gently westwards, and site elevations are approximately 50.5 to 52.0 mAHD. The Lot has been filled with a layer of hardstanding gravel which generally follows the natural topography slope westwards, with a slight grade applied toward the south of the Lot.

3.3 Soils, PRI, Hydraulic Conductivity & ASS

For a majority of the site, gravel has already been imported for hardstanding and vehicle movement, as the existing ground would have been winter waterlogged prior to importation of gravel.

Surface geology at this site, prior to placement of hardstanding gravel, was classed as pebbly silt, described as “strong brown, silt with common fine to occasionally coarse grained, sub-rounded laterite quartz, heavily weathered granite pebbles, some fine to medium-grained quartz sand, of alluvial origin” (Figure 4; Geological Survey of WA, 1984).

On 3 December 2015, JDA installed a hand augered borehole MW1 (Figure 5) on site on the natural soil, beyond the hardstand gravel. Soil was sub-rounded sand of very fine to medium grain to 0.8 m depth, underlain by sub-rounded to sub-angular laterite with clay. Clay content increased with depth, becoming a sandy clay at 1.5 m depth. A detailed bore log is attached in Appendix A.

On-site borehole permeameter testing by JDA (Figure 5) at 0.35 m and 0.8 m depth identified soil hydraulic conductivities as presented in Table 1. Hydraulic conductivity is expected to be much lower during winter when the water table rises up to near surface. Field results of the borehole permeameter tests are included in Appendix C.

Soil samples were taken at depth from the permeameter test hole and tested for phosphorus content (Olsen test method) and Phosphorus Retention Index (PRI). Results are presented in Table 1, and laboratory reports are included in Appendix D. Soil samples had low phosphorus concentrations and very high PRI, indicating excellent capacity for adsorption of phosphorus in stormwater.

TABLE 1: HYDRAULIC CONDUCTIVITY, OLSEN PHOSPHORUS AND PRI OF SOIL

Location (MGA Zone 50)		Depth below Natural Surface (m)	Soil Description	Hydraulic Conductivity K (m/day)	PRI	Phosphorus (Olsen test) (mg/Kg)
Easting	Northing					
0404642	6505932	0.35	Grey/brown very fine to coarse sand	3.4	21.2	3.1
		0.8	Red/brown clayey laterite.	2.0	110.0	5.0

Department of Environment and Regulation (2014) ASS mapping shows no risk of acid sulphate soils within 3 m of the natural soil surface of the property.

3.4 Wetlands

The Lot and surrounding area is classified as a palusplain, meaning the land is a seasonally waterlogged flat (Hill *et al*, 1996), and is mapped as Multiple Use management category wetland which does not preclude development (Figure 4).

3.5 Surface Hydrology

There are no waterways traversing the Lot. There is a non-perennial creek about 85 m south of the lot which flows into the Ellen Brook (Figure 1).

Existing and adjacent external catchments shown on Figure 3 and Table 2 are based on existing topography, intersection engineering drawings provided by Main Roads (Appendix E), and visual confirmation during site visit on 3 December 2015.

Stormwater runoff from the Study Area currently flows east to west, with sheet flow across the boundary to the neighbouring lot and south-west into the non-perennial tributary of Ellen Brook (Figure 3). Estimated peak flows modelled in XP Storm for the 1, 5 and 100 year ARI events are reported in Table 2.

The adjacent external catchment area drains initially to the road side drain or pervious reserve area. The minor gravel filling of the Study Area lot would prevent rainfall events overflowing from the east across the Lot. The existing Brand Highway road side drain continues westwards until it discharges to Ellen Brook (Figure 3).

TABLE 2: CATCHMENTS AND PEAK FLOW

Catchment	Study Area	External Catchment
Area (ha)	0.78	0.46
EIA[1] (ha)	0.39	0.23
1 Year ARI Critical Duration (hrs) Peak Flow (m^3/s)	 1 0.020	 1 0.013
5 Year ARI Critical Duration (hrs) Peak Flow (m^3/s)	 1 0.038	 1 0.024
100 Year ARI Critical Duration (hrs) Peak Flow (m^3/s)	 1 0.078	 1 0.049
Outflow direction	Sheet flow westward to adjacent lot, then south-west to Ellen Brook	Brand Hwy south road side drain, west to Ellen Brook

Note: 1. Equivalent Impervious Area (EIA) = runoff coefficient (0.5) x area

3.5.1 Water quality

The Ellen Brook Catchment is the largest and one of eight priority subcatchments in the Swan Canning Catchment. Water quality in Ellen Brook is considered unacceptable and management of this is addressed by the *Local Water Quality Improvement Plan: Ellen Brook Catchment* (Swan River Trust, 2009a) and *Swan Canning Water Quality Improvement Plan* (Swan River Trust, 2009b).

As part of water quality monitoring for the Ellen Brook Catchment, surface water samples have been collected by Department of Water (DoW) from the creek at sample site EBN10 just south of the Lot during flow, usually between July and October each year (Figure 5). Median concentrations of key nutrient components since 2005 are summarised in

Table 3. TN and TP values are below the long-term Healthy Rivers Action Plan (HRAP) target values (Swan River Trust, 2009b).

TABLE 3: MEDIAN CONCENTRATIONS AT DOW SURFACE SAMPLING POINT EBN10 2005-2015

Component	Concentration (mg/L)	HRAP[1] Long-Term Targets (SRT, 2009b)
TN	0.54	1.0
NOx_N	0.04	N/A
NH3_N	0.066	N/A
TKN	0.495	N/A
TP	0.009	0.1
FRP	0.005	N/A

1. Healthy River Action Plan (HRAP).

3.6 Groundwater

A shallow groundwater bore MW1 was installed on the Lot by JDA on 3 December 2015, located in the lower lying western edge of the site where imported gravel was not present (Figure 5). After water levels in the bore had recovered after augering, a reading was taken at 1.35 m below natural surface (approximately 50 mAHD).

The nearest DoW Bore GD20 is located 0.66 km away along Gulliente Rd with elevation about 10m higher than the Study Area (Figure 5). Surface geology and wetland classification is the same as the study area (Figure 4). From GD20 historical data, groundwater level generally peaks in the months of August to September. JDA measured groundwater level in bore GD20 on 3 December 2015 at 4.49 m below natural surface (57.3 mAHD). Maximum groundwater level in this bore was measured by DoW at 61.35 mAHD on 18 July 1996, only 0.13 m below the natural surface of 61.48 mAHD, consistent with the palusplain wetland mapping.

In the Study Area, the average peak winter groundwater level is expected to come close to, or at, the natural surface (within 0.5 m below natural surface). JDA recommends further monitoring of the groundwater bore water levels during the groundwater peak period from August to September in 2016 to clarify if the winter groundwater level is below or at the natural surface.

3.7 Existing Infrastructure

There are existing buildings on the lot, including a house and a large shed, and compacted gravel surface suitable for hardstanding and vehicle movement.

Existing drinking water supply for the property is currently serviced by three rainwater tanks attached to the large shed, and the house is also equipped with a rainwater tank. Existing wastewater treatment is via a septic tank with leach drain set in a mound of sand in the south-western corner of the lot.

There is a production bore located on the Lot which draws from the Perth-Leederville aquifer. Licence no. GWL181970(1) entitles 650 kL of water abstraction per year for domestic and garden use. The licence is valid to 25 November 2025. Current domestic use includes toilet, laundry and shower and is unsuitable for drinking due to salt content (*pers. comm.,* Charmagne Cassar).

4. STORMWATER AND GROUNDWATER MANAGEMENT

4.1 Design Criteria

The following documents were considered with regard to design criteria and water sensitive urban design principles:

- *Shire of Chittering Local Planning Policy No. 16: Roads and Drainage* (Shire of Chittering, 2007)
- *Stormwater Management Manual for Western Australia* (DoW, 2004-2007); and *Decision Process for Storwmater Management in WA* (DoW, 2009), which is a replacement of the chapter of same name within the Stormwater Management Manual.
- DoW (2006) Water Quality Protection Note 52. Stormwater Management at Industrial Sites.
- *Muchea Employment Node Structure Plan* (WAPC, 2011).

The key criteria relevant to this site are summarised in Table 4.

TABLE 4: STORMWATER AND GROUNDWATER MANAGEMENT CRITERIA

	Guiding Document	Criteria	Compliance
Water Quality Management and Quantity Management (Flood protection)	*LPP 16* (Shire of Chittering, 2007)	Drainage required as a result of road construction or other development is to be provided by the subdivider and/or developer in accordance with water sensitive design principles, to the satisfaction of Council's CEO as follows: Outside town sites within the Ellen Brook Palus Plain – appropriate collection and on-site disposal of stormwater, with drainage designed for **one in five year ARI** rainfall events.	*YES. see note 1*
	DoW (2009);	Retain/Treat the 1yr ARI 1hr on site.	YES, Treatment Bio-retention Storage.
	DoW (2009); [DoW (2006)]	Manage run-off from constructed impervious areas for greater than 1yr 1hr ARI events up to 100 yr ARI events in landscaped retention or detention areas [discharge ≤ pre-development peak flows]. Runoff into waterways and wetlands shall be by overland flow paths across vegetated surfaces.	100yr ARI: YES; peak runoff over spillway is < predevelopment peak flow, and is via existing overland rural vegetated flow path. 5yr ARI: Exceeds Criteria; 5yr is contained within bio-retention basin onsite as per Shire LPP 16.[1]
	DoW (2009)	Protect the built environment from flooding and waterlogging. Management of seasonal peak groundwater levels though a controlled groundwater level (CGL) to take into consideration the environment.	YES, infiltration/recharge occur during most of year when groundwater levels have not reached 0.3m of basin invert. Subsoils beneath bio-retention system (at CGL grading from 50 mAHD) where treated water outlets to road drain.
	DoW (2006)	Controlled release points should be built into any stormwater retention basin to avoid embankment failures under extreme rainfall conditions.	YES, spillway included for bio-retention basin, set at 50.74 mAHD (subject to survey).
Water Quality	*Muchea Employment Node Structure Plan* (WAPC, 2011)	Treatment in bioretention basin.	Treatment in bioretention basin.
Industrial Water Quality	*DoW (2006)*	If applicable land use, Fuel oil and grease removal required prior to release to stormwater system. Chemicals storage and handling in separate containment area.	YES. For these potential uses refer to DoW (2006) or similar Shire Policy.

Note 1: For demonstration of capability for rezoning purposes, the basin has been sized to retain up to the 5 yr ARI storm event as per the Shire of Chittering (2007) Local Planning Policy. Typically a bio-retention basin is sized for 2% of the impervious connected area (a 1yr ARI 1hr duration storm or 15mm assuming 0.5m depth). Thus, if a reduced drainage area is required during the building phase, it is recommended the Shire consider acceptance of alternative bio-retention sizing to be for a 1yr 1hr duration storm (15mm), and detention of greater ARI to predevelopment flow rates in a landscaped basin as per DoW (2009).

4.2 Groundwater Management

Due to the shallow depth of maximum groundwater in the study area (peak winter level within 0.5 m below natural surface), subsoil drainage is proposed to provide a controlled groundwater level (CGL) in the western portion of the Lot under the proposed stormwater bioretention basin. The CGL is also required to prevent rise in groundwater post-development due to additional runoff captured and infiltrated in the basin.

During summer when groundwater level is low, recharge to the groundwater will occur. Subsoils will only flow when the groundwater rises above the CGL.

The proposed subsoil location is shown on Figure 7, with the outlet daylighting to the Brand Highway road side drain, approximately 70m west of the Study Area. Subsoils should be laid beneath the Bioretention Basin at a maximum invert level of 50 mAHD (in the south), with a 1:1000 grade assumed northwards under the basin, and then west to the outlet. The invert level of the outlet into the road side drain is proposed to be approximately 49.84 mAHD, subject to survey. Site inspection, and contours indicate the road drain grades westward to Ellen Brook. JDA assumes that the road side drain is free draining between storms, and hence the proposed subsoils will be able to convey away any treated flows following the storm event.

The bioretention basin provides water quality treatment of stormwater, plus the existing soils have high PRI (21.2, see Table 1), so any subsoil outflow will be considered treated water.

The bioretention system has its own subsoil and thus will not cause additional groundwater mounding compared to predevelopment.

The Servicing Report (WGE, 2015) proposes treated wastewater drip irrigation or similar, which can be utilised to irrigate turf or garden. The location and design of the wastewater irrigation infiltration system is to be separate to the bioretention basin. The design of the treated wastewater irrigation system should take into account existing groundwater and infiltration rates.

4.3 Stormwater Management

A bioretention basin is proposed along the western boundary of the Lot (Figure 7), sized according to criteria outlined in section 4.1.

The bioretention basin invert is shallow, set at 50.3 mAHD, in order to provide a minimum 0.3 m above the proposed subsoils at inverts shown in Figure 7. The bio-retention system is to be planted with vegetation according to Monash (2011) *Vegetation Guidelines for stormwater biofilters in the south-west of Western Australia*.

The existing natural surface of the lot is graded from east to west such that the eastern edge of the basin is at least 50.7 mAHD, and the western side is approximately 50.5mAHD. A bund is required on the western side of the basin with spillway height of 50.74 mAHD to provide the required storage capacity in the basin (Figures 7 and 8). The Lot should be graded towards the basin, with the eastern edge of the basin at 50.76 mAHD.

Storms greater than the 5 yr ARI to 100yr ARI will overflow the bund or spillway westwards, across the adjacent lot along the predevelopment flow path towards the creek. JDA has modelled the basin with a 2 m wide spillway with an invert of 50.74 mAHD.

4.3.1 Infiltration Modelling Results

Sizing of the bioretention basin was based on modelling for the 1 and 5 year ARI events in infiltration model MODRET with model parameters and results included in Appendix F.

The design storms modelled are based on the methodology in Australian Rainfall and Runoff (Engineers Australia, 1997) and are assumed to be spatially uniform across the catchment. Storm durations modelled ranged between 10 minutes to 72 hours, and results for the critical storm durations are reported.

A soil hydraulic conductivity K of 3.4 m/day was adopted, based on JDA field permeameter test results. The 100 year ARI event and spillway was modelled in XP-Storm.

The proposed bioretention basin details and model results are summarised in Table 5.

TABLE 5: BIORETENTION BASIN DETAILS AND MODELLING RESULTS

	Lot Bioretention Basin
Catchment Details	
Total Area (ha)	0.78
EIA[1] (ha)	0.51
Basin Details	
Invert (mAHD)	50.3
Base Width (m)	8
Base Length (m)	65
Base Area (ha)	0.05
Top Base Area (ha)	0.08
Side Slopes	1:4
Spillway/Bund Crest	
Crest level (mAHD)	50.74
Spillway Width (m)	2
1 Year ARI (1 Hr)	
Runoff Volume (m^3)	77
Flood Storage (m^3)	41
Flood TWL (mAHD)	50.38
Water Depth (m)	0.08
Top Water Level Area (ha)	0.06
5 Year ARI	
Critical Duration (hrs)	72
Runoff Volume (m^3)	520
Flood Storage (m^3)	290
Flood TWL (mAHD)	50.74
Water Depth (m)	0.44
Top Water Level Area (ha)	0.08
100 Year ARI	
Critical Duration (hrs)	6
Runoff Volume (m^3)	430
Flood Storage (m^3)	290
Flood TWL (mAHD)	50.76
Water Depth (m)	0.46
Top Water Level Area (ha)	0.08
Spillway Peak Outflow (m^3/s)	0.013

Note: 1. Equivalent Impervious Area (EIA) = runoff coefficient x area

The 1 and 5 year ARI events are completely retained on-site and treated/infiltrated. The 100 year ARI event is detained and released via a spillway at a peak flow rate of 0.013 m^3/s, less than the pre-development flow rate of 0.049 m^3/s.

4.3.2 Conclusion and Considerations for Detailed Design

The modelled basin takes up approximately 10% of the Lot. This meets the Shire of Chittering (2007) LPP 16, and more than meets the required area for water quality and water sensitive design purposes as specified in DoW (2009) and Muchea Employment *Node Structure Plan* (WAPC, 2011). The basin takes up a relatively large area, but this might be acceptable depending on future land use (eg. warehouse or petrol station). If required at detailed design phase, this area could be reduced by considering alternative design criteria as discussed in Section 4.1 foot note (sizing to 1yr 1hr (15mm) with events above this allowed to overflow at predevelopment rates).

Alternatively, installing and directing rainwater to either wash-down storage tanks or rainwater tanks with available void space could reduce runoff to the basin by increasing the initial loss. The tank void space capacity would have to be regularly emptied within 48 hours to ensure the void space is available for the next rainfall event.

The ultimate industrial use is not known. If the ultimate use is to involve fuel, oil and grease or storage of chemicals, additional design requirements to manage these contaminants as per Section 4.1 with reference to either DoW (2006) Water Quality Protection Note 52, or equivalent Shire policy, will be required. For example, an oil and grease separator prior to discharge of runoff to the bio-retention basin, or a separate bunded chemical containment area may be required.

Further groundwater level monitoring in the groundwater bore installed by JDA during the seasonal peak period in 2016 is recommended, and can be used to confirm basin infiltration model assumptions in final detailed design.

4.4 Future Perth to Darwin National Highway

Current plans (subject to funding) are for the PDNH to be constructed as a bridge over Brand Highway. This would allow the creek and the Brand Highway road side drain to flow under the bridge as in the pre-development scenario. The stormwater management strategy in this report is based on this configuration.

If terminating at Brand Highway instead, the PDNH will intercept runoff from the adjacent landholding, including the study area runoff, as well as the Brand Highway road side drain. It is assumed any future works for the PDNH will include drainage designed to accommodate existing drainage flows.

5. CONCLUSIONS AND RECOMMENDATIONS

This report demonstrates the Study Area can support industrial use in terms of stormwater and groundwater management consistent with water sensitive design principles and current Shire of Chittering Policy requirements.

Due to the estimated high groundwater in the area, subsoils are proposed to control the groundwater level. A bioretention basin has been sized that meets the design criteria identified in Section 4.1, but is relatively large (approximately 10% of Lot area) due to the site constraints and Shire of Chittering design criteria for retention of 5yr ARI. This basin size may be acceptable to lot owners depending on the ultimate land use. The basin size could be reduced by considering wash-down storage tanks or rainwater tanks during the detailed design phase, or if acceptable to the Shire, alternative sizing criteria consistent with water sensitive design (1yr 1hr) as discussed in section 4.3.2.

JDA recommends further monitoring of groundwater levels in Bore MW1, monthly during the seasonal peak period (typically August – October) in 2016 to confirm peak groundwater level for consideration during detailed design phase.

6. REFERENCES

Connell Wagner (2008) *Water Management Strategy: Muchea Employment Node*. Report for Department of Planning and Infrastructure. April 2008.

DoW (2004-2007) *Stormwater Management Manual for Western Australia*. Perth: Department of Water.

DoW (2006) Water Quality Protection Note 52. Stormwater Management at Industrial Sites.

DoW (2009) *Decision Process for stormwater management in WA*

Engineers Australia (1997) *Australian Rainfall and Runoff – A Guide to Flood Estimation*. ACT: The Institution of Engineers, Australia.

Geological Survey of WA (1984) 1: 50 000 Environmental Geology Map - Muchea (1935-II, 2035-III).

Hill, A.L., Semeniuk, C.A., Semeniuk, V. & Del Marco, A. (1996) *Wetlands Of The Swan Coastal Plain Volume 2a*, Wetland Mapping, Classification And Evaluation.

Luke, G.L., Burke, K.L. & O'Brien, T.M. (1988). *Evaporation data for Western Australia – technical report 65.* Perth: W.A. Department of Agriculture, division of resource management.

Monash (2011) *Vegetation Guidelines for stormwater biofilters in the south-west of Western Australia*.

Shire of Chittering (2007) *Shire of Chittering Local Planning Policy No. 16: Roads and Drainage*.

Swan River Trust (2009a) *Local Water Quality Improvement Plan*. September 2009.

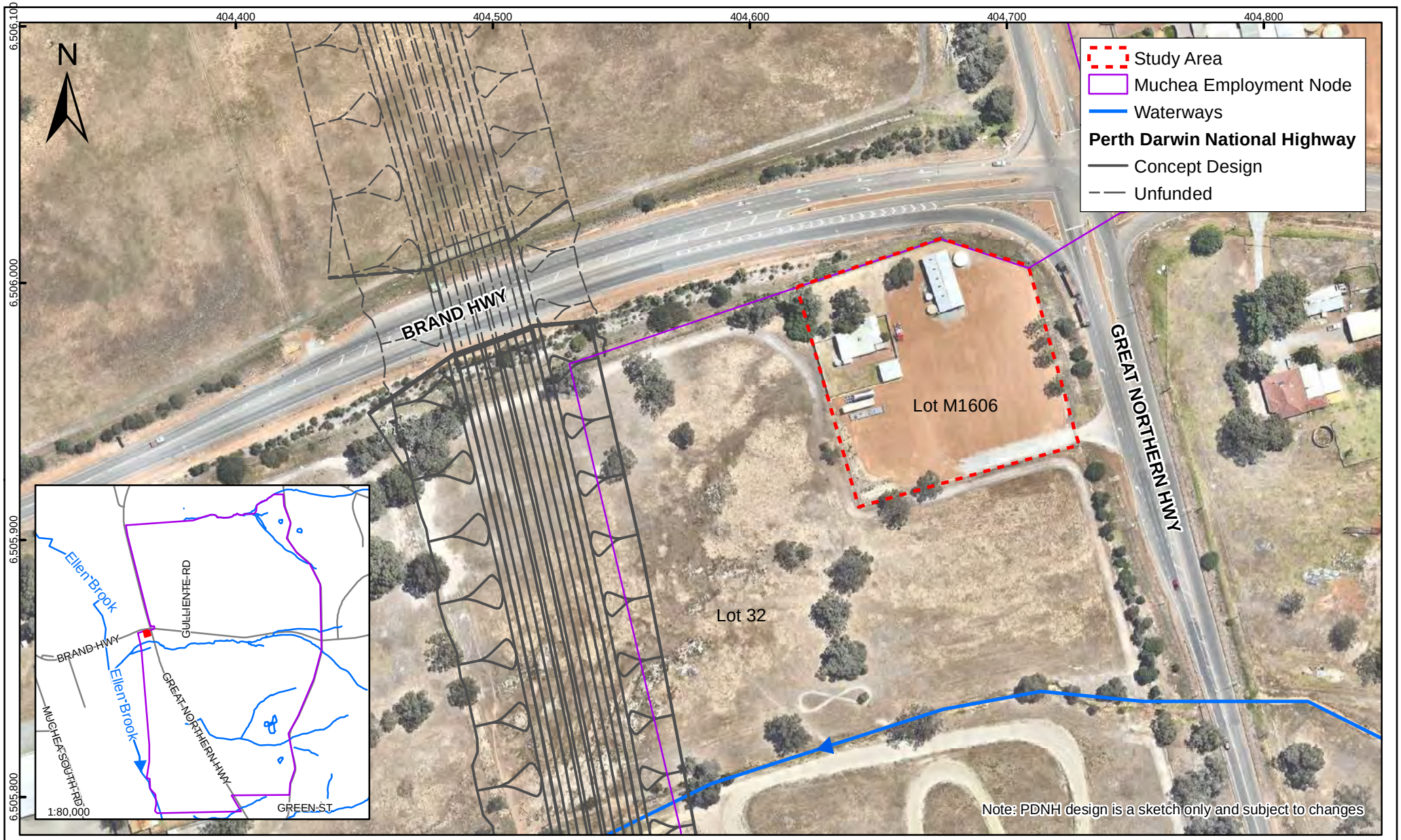
Swan River Trust (2009b) *Swan Canning Water Quality Improvement Plan*. December 2009.

WAPC (2008) *Better Urban Water Management*. Perth: Western Australian Planning Commission.

WAPC (2011) *Muchea Employment Node Structure Plan*. Perth: Western Australian Planning Commission.

Wood and Grieve Engineers (2016) *Lot 3599 Great Northern Highway, Muchea: Preliminary Servicing Report*. In preparation.

FIGURES



Data Source: Nearmap (2015) 21 November 2015; North Link WA (2015) PDNH Design; WAPC (2011) Muchea Employment Node

Coordinate System: GDA 94, Zone 50

Job No. J6120
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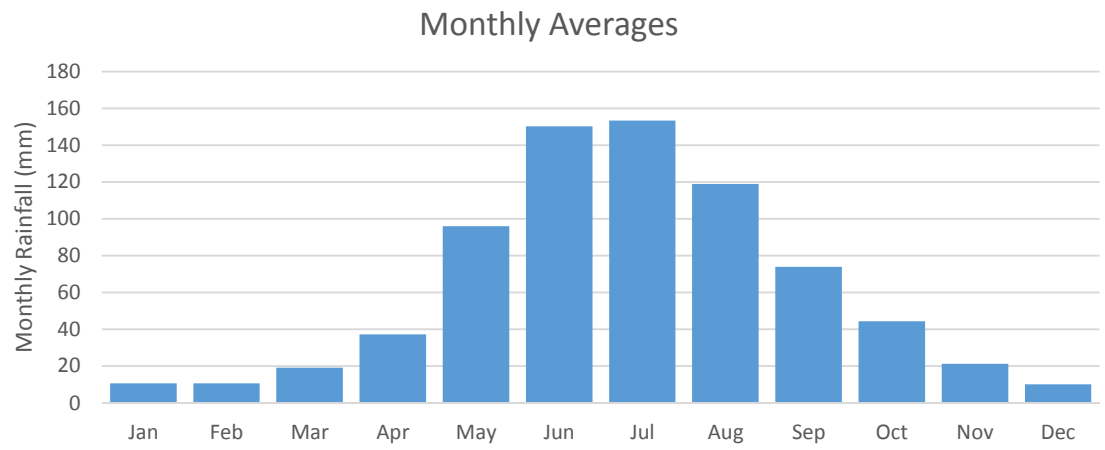
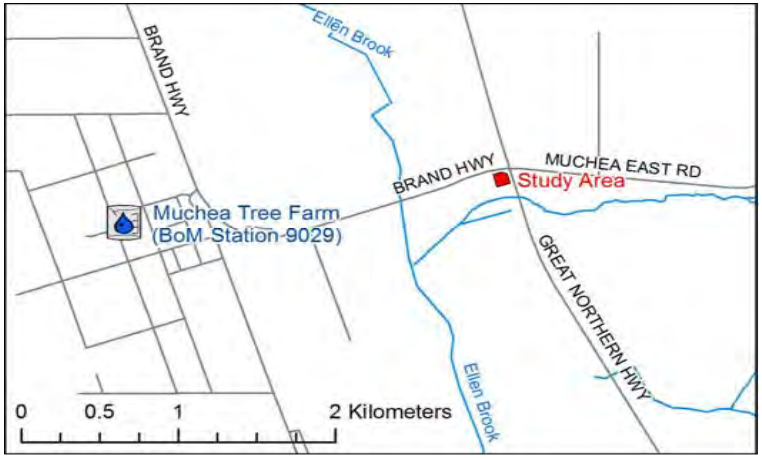
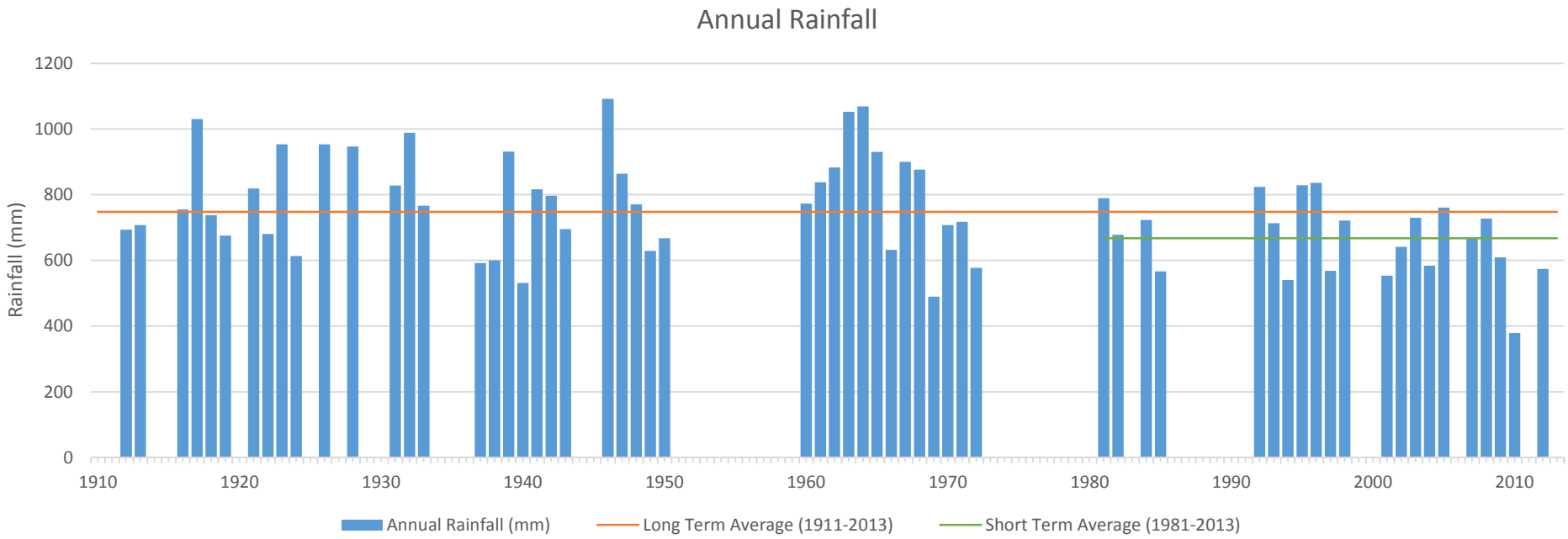
3599 Great Northern Highway, Muchea: Stormwater Management Strategy
Figure 1: Location Plan







Data Source: BoM (2015) Muchea Tree Farm (Station 9029)

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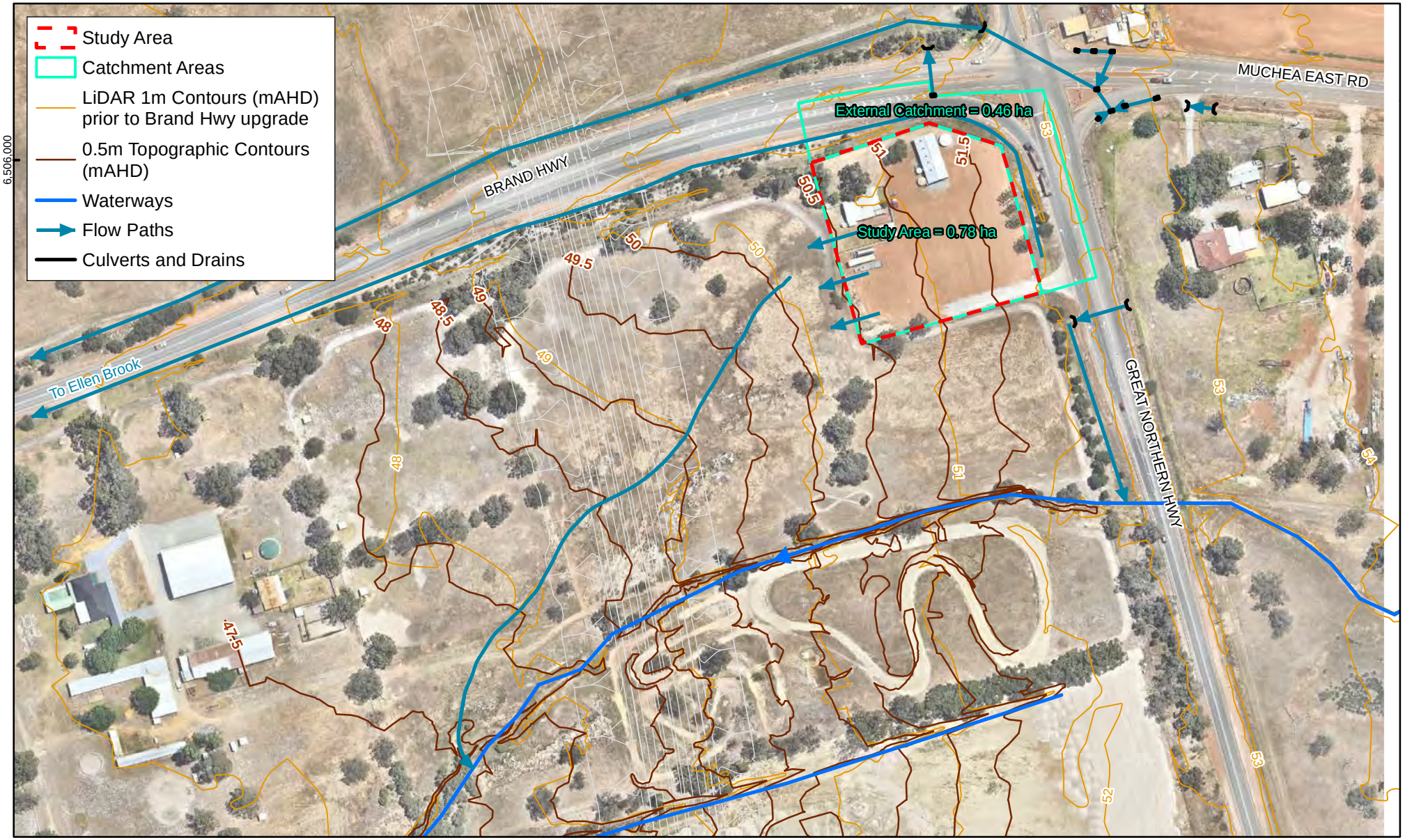
Figure 2: Bureau of Meteorology Rainfall Data



Data Source: Nearmap (2015) 21 Nov 2015; DoP (2008) LiDAR Topography; North Link WA (2015) Topographic Contours & PDNH Design

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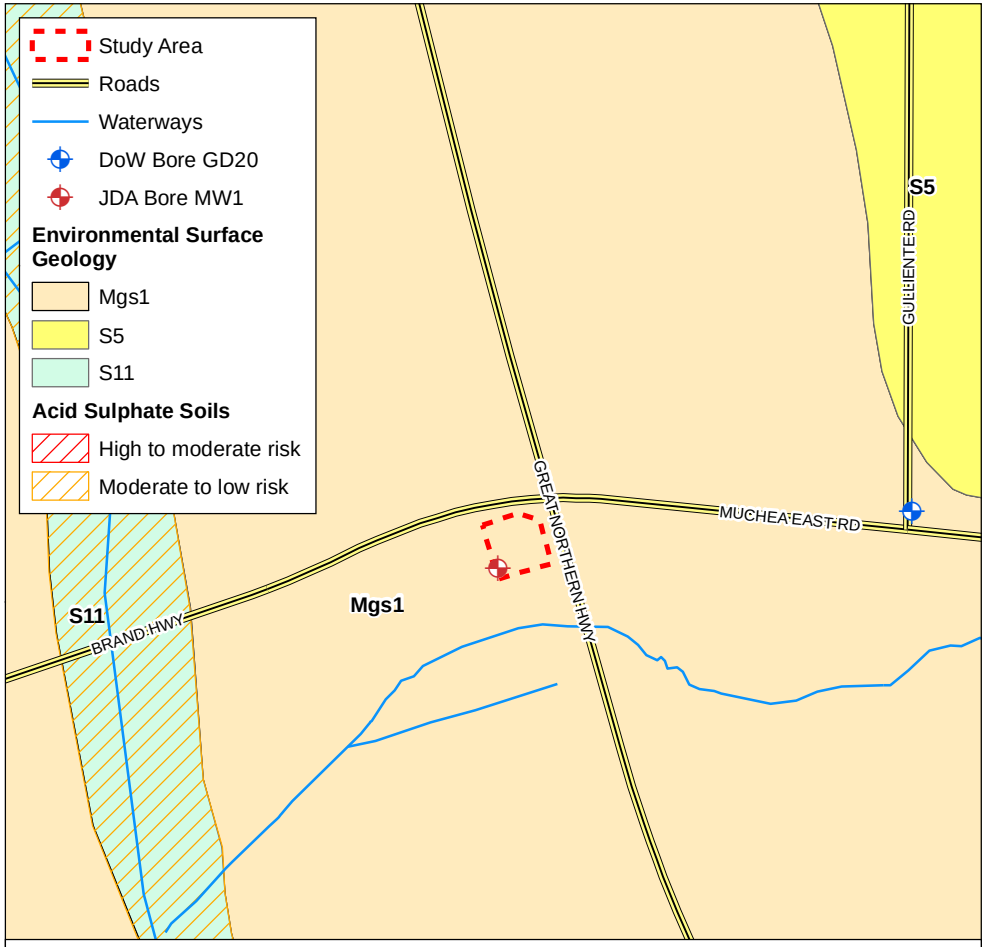
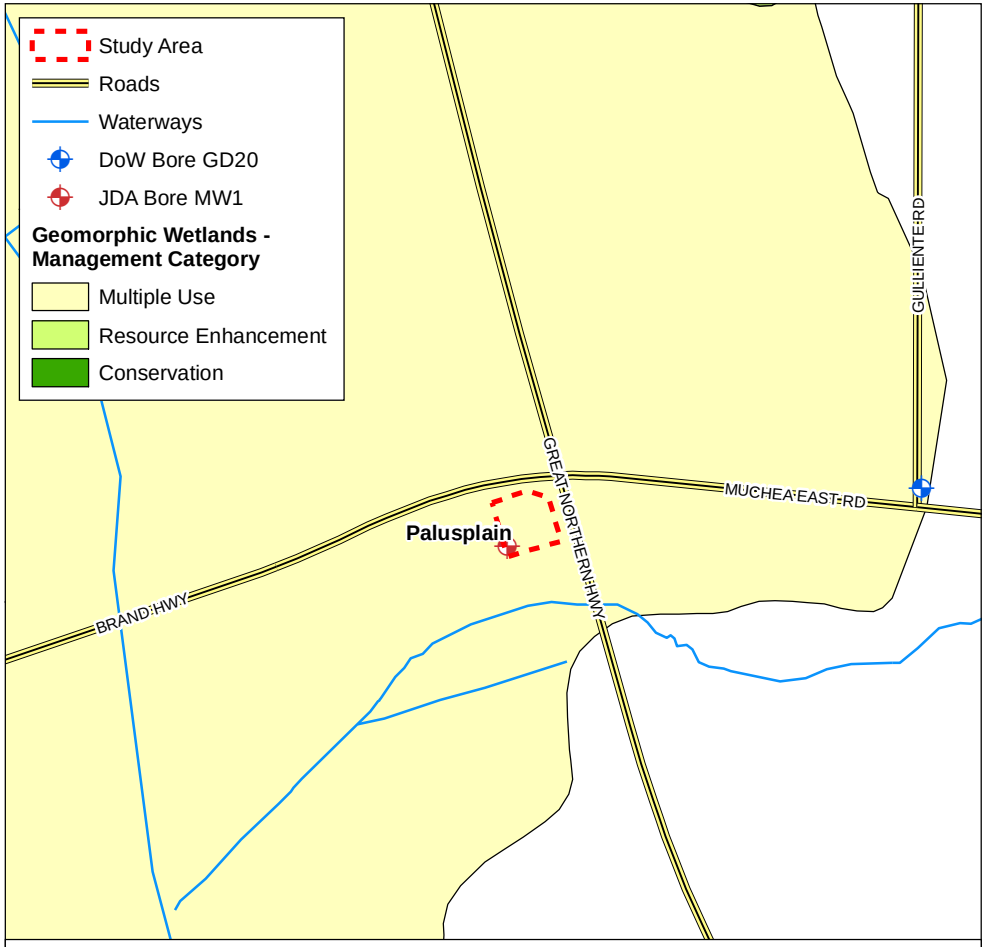
Figure 3: Topography, Existing Surface Water and Catchments





Environmental Surface Geology

Mgs1: PEBBLY SILT - strong brown, silt with common fine to occasionally coarse grained, sub-rounded laterite quartz, heavily weathered granite pebbles, some fine to medium-grained quartz sand, of alluvial origin

S5: SAND - very pale brown, medium to coarse-grained, well sorted, little fines, sub-angular to rounded quartz and feldspar, of colluvial origin

S11: SAND - light grey, medium grained, sub-angular to rounded quartz and feldspar, moderately sorted

Acid Sulphate Soil Risk Mapping

No ASS risk identified within 3 m of natural soil surface within Study Area.

Management Categories

Multiple Use: Wetlands with few remaining important attricutes and functions. Does not preclude development.

Wetland Classification

Palusplain: Seasonally waterlogged flat (Hill et al., 1996)

Data Source: Geological Survey of WA (1984) 1: 50 000 Environmental Geology Series - Muchea; DER (2014) ASS Mapping; DEC (2013) Gemorphic Wetlands

Coordinate System: GDA 94, Zone 50

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0 100 200 300 400 Meters

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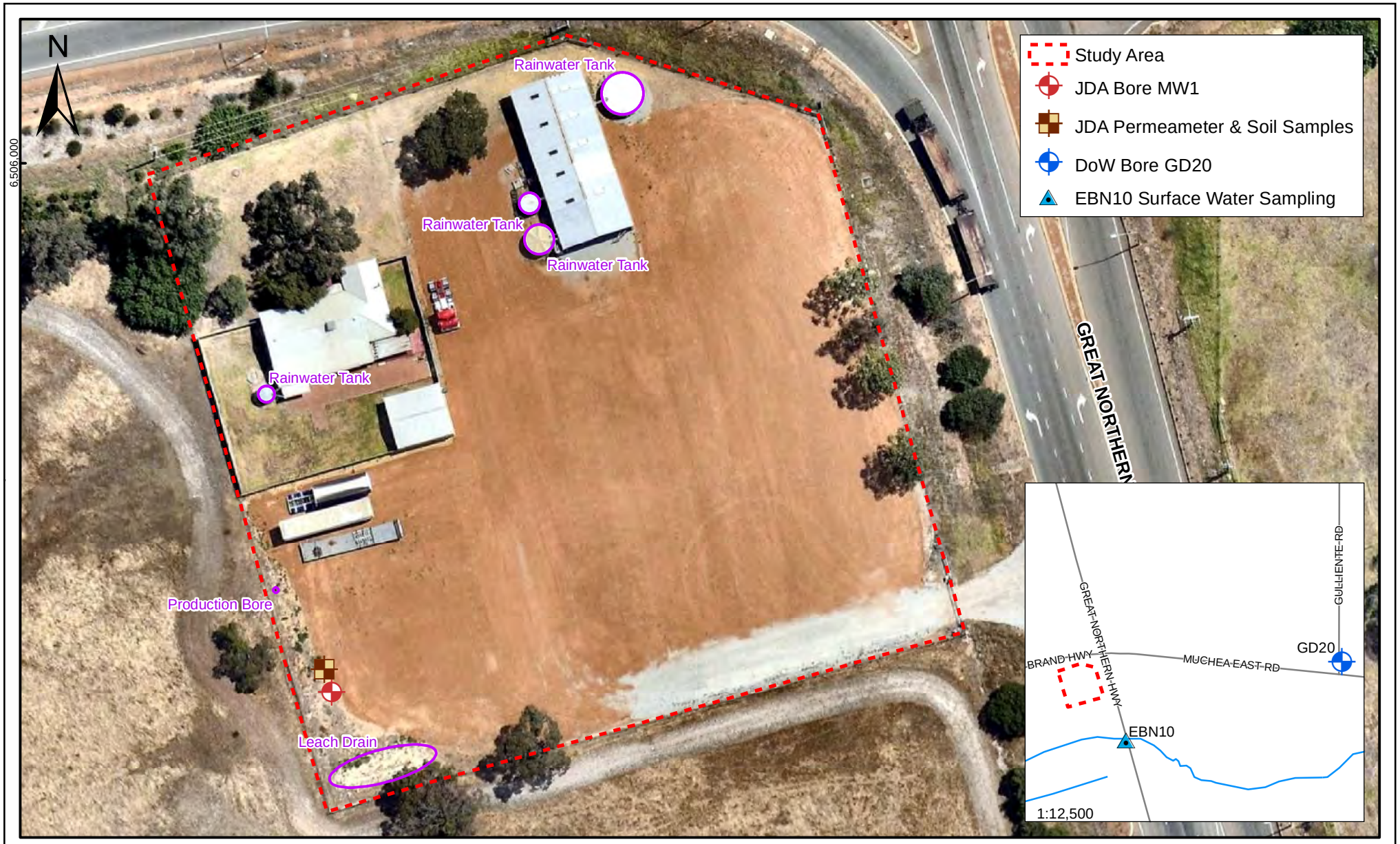
Figure 4: Surface Geology, Acid Sulphate Soils and Wetland Mapping



Data Source: Nearmap (2015) 21 Nov 2015

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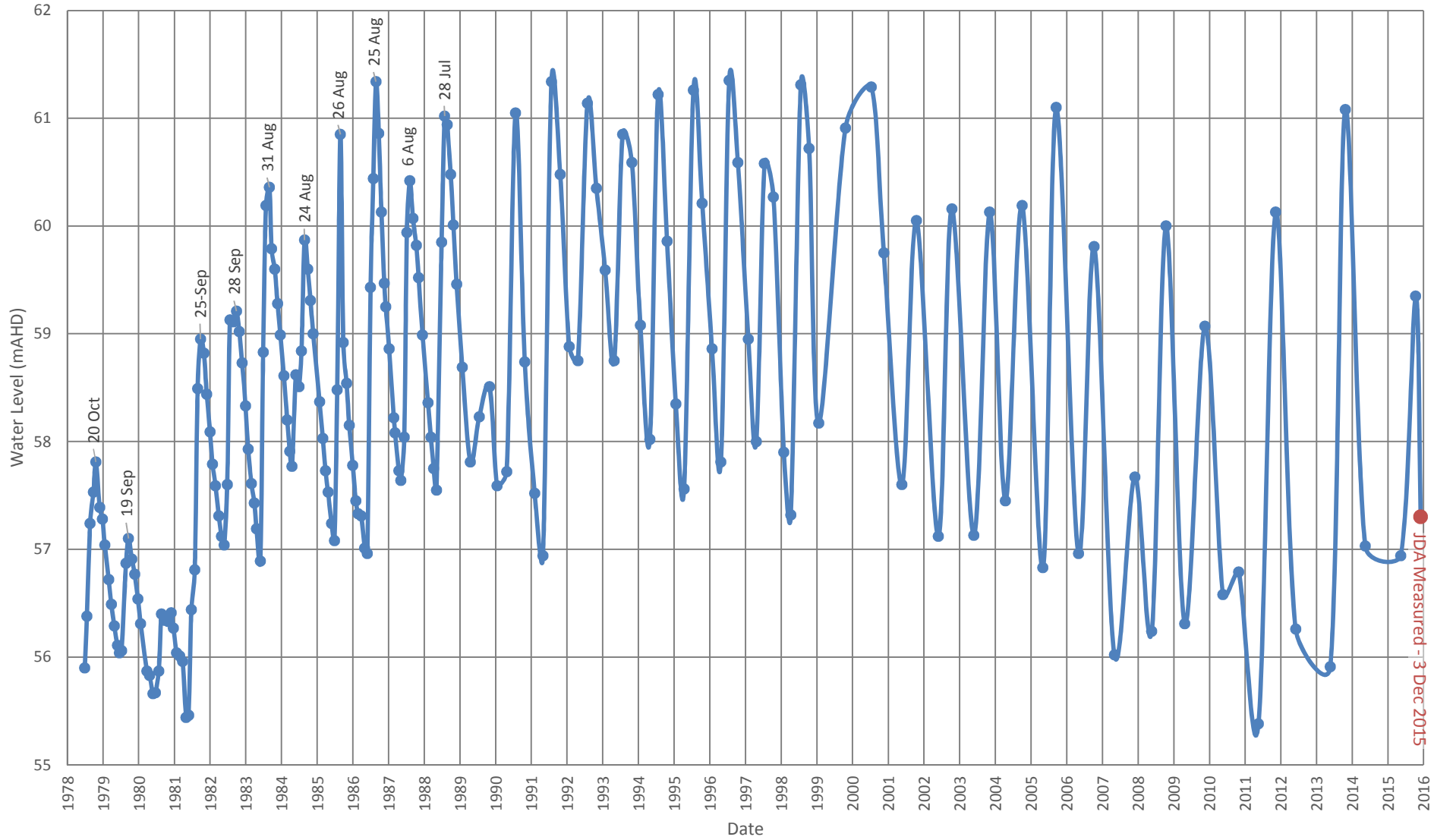
Figure 5: Sampling Locations and Existing Infrastructure



Data Source: DoW (2015) Bore GD20 Water Levels

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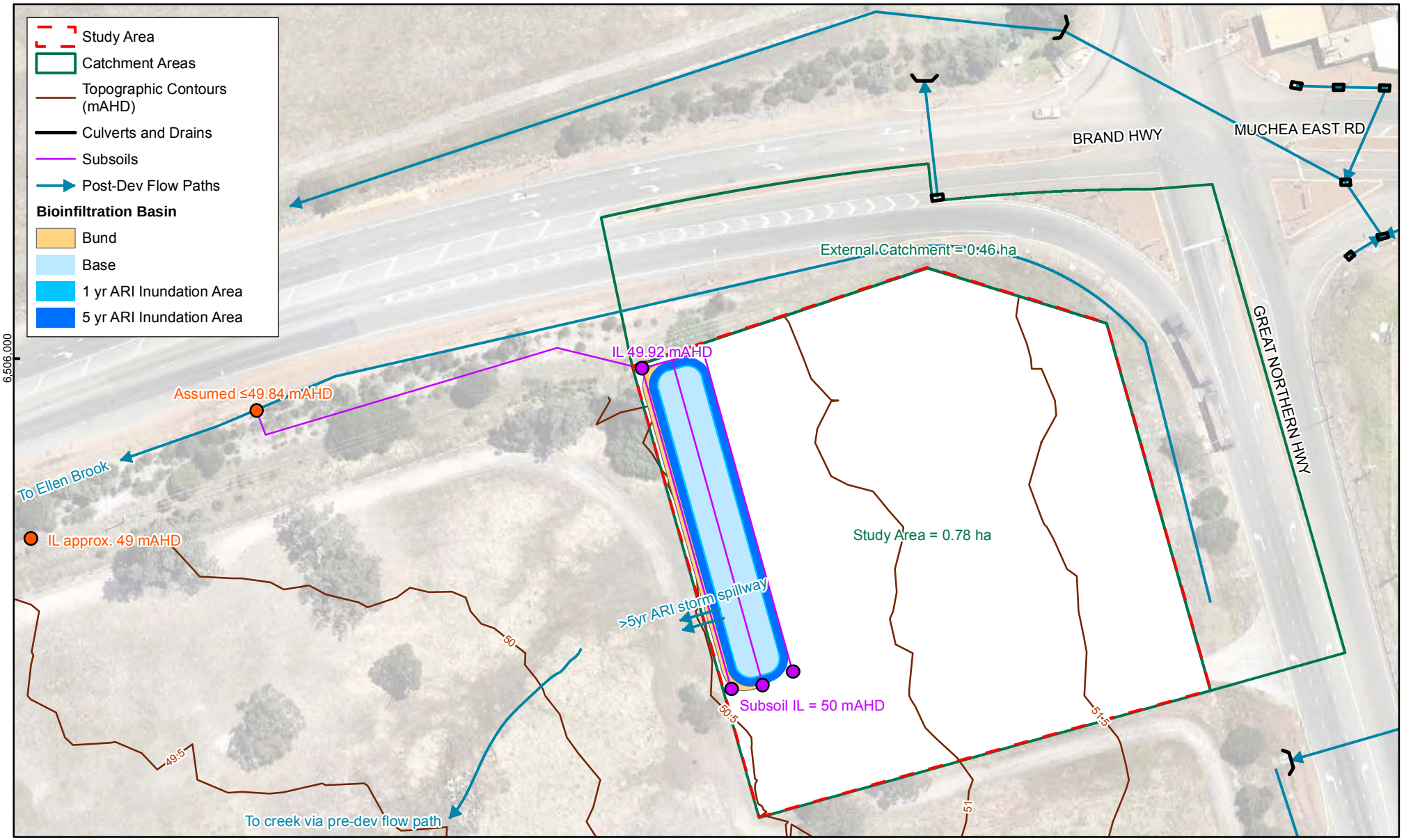
Figure 6: DoW Bore GD20 Time Series



Data Source: Nearmap (2015) 21 Nov 2015; DoP (2008) LiDAR Topography; North Link WA (2015) Topographic Contours & PDNH Design

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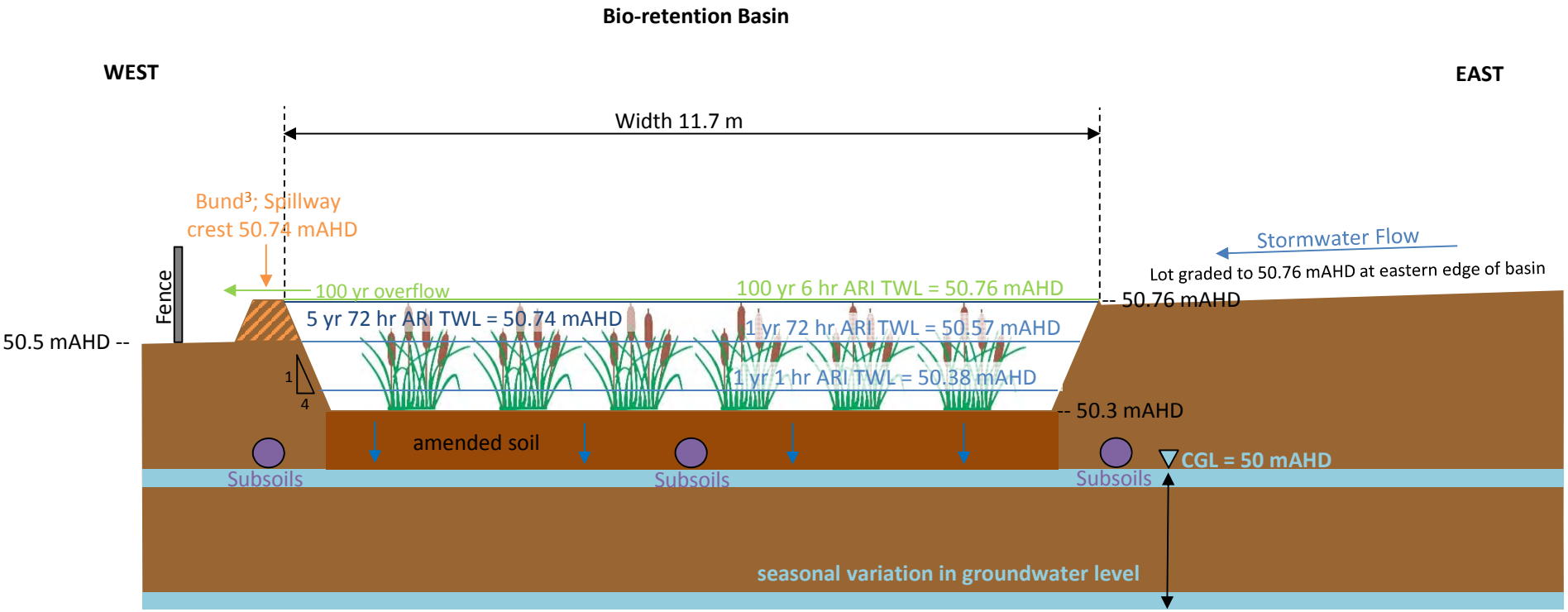
3599 Great Northern Highway, Muchea: Stormwater Management Strategy
Figure 7: Stormwater and Groundwater Management Strategy



Note:
1. Basin and bund side slopes are 1:4
2. JDA modelled approx. 2m wide spillway at 50.73 mAHD for erosion control. Engineer to specify spillway details and bund height above spillway during detailed design.
3. Biorentention Basin to be planted consistent with Monash (2011) *Vegetation guidelines for stormwater biofilters in the south-west of Western Australia (practice note).*
4. All levels subject to survey
5. Figure not to scale

Job No. J6120

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Atom Ant Earthmoving
3599 Great Northern Highway, Muchea: Stormwater Management Strategy
Figure 8: Bioretention Basin Design

APPENDIX A

North Link WA Correspondence

Joycelyn Siew

From: Info Northlink <info@northlinkwa.com.au>
Sent: Wednesday, 23 December 2015 10:40 AM
To: Joycelyn Siew
Subject: Re: North Link Engineering Drawings

Hi Joycelyn,

I was just writing an email to you when I received this.

With regards to your clarification below, I have checked that with our engineer and confirm that it is a calculated maximum. Data was taken from various sources such as our field surveys done in October 2014, WaterCorp and Department of Water's existing wells.

Also following on from our email sent yesterday, we would like to advise that this project is currently only funded up to Brand Highway. The interchange north of existing Brand Highway, including the Brand deviation is unfunded. We are waiting for a funding decision from Infrastructure Australia on additional funds for the alignment north of Brand Highway. If the project does not receive additional funding for north of Brand Highway, PDNH becomes an intersection at Brand Highway. There would not be a bridge at that intersection.

I hope the above helps clarify your query.

Please let us know if you require any further information.

Regards,
Jessica

From: Joycelyn Siew <Joycelyn@jdahydro.com.au>
Sent: Tuesday, 22 December 2015 2:08 PM
To: Info Northlink
Subject: RE: North Link Engineering Drawings

Hi Jessica,

Thanks for the drawings.

I just have one question if you could assist me further: The plans show an “existing groundwater profile”. Do you know when this groundwater was mapped (what month were the groundwater levels measured) or if it’s a calculated maximum/AAMGL?

Regards,

Joycelyn Siew
Engineering Hydrologist
JDA

APPENDIX B

JDA Bore Log

JDA Consultant Hydrologists
Suite 1, 27 York Street
Subiaco WA 6008
Tel: 9388 2436
Fax: 9381 9279

LITHOLOGICAL LOG

Client: Atom Ant Earthmoving
Project: Lot 3599 Great Northern Hwy, Muchea: SMS
Bore location: Lot 3599 Muchea
Datum: GDA 1994 MGA Zone 50 E 0404643 N 6505929

Job No: J6120
Hole commenced: 3/12/2015
Hole completed: 3/12/2015
Logged by: DB/JS

Bore Name: MW1
Driller and drill type: Hand Auger
Hole diameter: 100 mm Casing Diam: 50 mm

Total Depth: 1.80 m
R.L. TOC: mAHD
Natural Surface: ~51 mAHD

Depth (m)	BORE CONSTRUCTION	GRAPHICAL LOG	LITHOLOGICAL LOG: LITHOLOGY	COLOUR	GRAIN SIZE	SORTING	GRAIN SHAPE	MOISTURE	COMMENTS
0.1 m, 0.2 m, 0.3 m, 0.4 m, 0.5 m			Sand	Grey/brown	VF-M	Moderate	Sub R	Dry	Organics (Roots) Some gravel in sample
0.6 m, 0.7 m, 0.8 m			Sand	Brown	VF-M	Poor	Sub R	Dry	Still organics (roots)
0.9 m, 1.0 m, 1.1 m			Laterite	Red/Orange	Gravel	Poor	Sub R/Sub A	Moist	Material broke apart when augered. Cemented layer.
1.2 m, 1.3 m, 1.4 m, 1.5 m			Laterite	Red/Orange	Gravel	Poor	Sub R/Sub A	Moist	Some clay coating gravel grains.
1.6 m			Sandy clay	Red/Orange	VF-M	Poor	Sub R/Sub A	Moist	Minor gravel grains still present
1.7 m			Sandy clay	Red/Brown	VF-M	Poor	Sub R	Saturated	Sub A gravel grains present - hard material (dark red)
1.8 m			Sandy clay	Red/Brown	VF-M	Poor	Sub R	Saturated	Increasing grey clay content, hard material (dark red)
1.9 m, 2.0 m									

Gravel
Sand
Clayey Sand
Sandy Clay
Clay
Coffee Rock
Bentonite

Grain Size	Sorting	Grain Shape	Moisture
Fine	Poor	Angular	Dry
Medium	Moderate	Subangular	Moist
Coarse	Well	Subrounded	Saturated
Very coarse	Very well	Rounded	
Gravel		Well rounded	

Date	3/12/2015
Total Depth	1.79 mBNS
Stick Up	0.31 m
Water Level	1.66 mBTOC

NOTES: 1.4 m slotted

APPENDIX C

Borehole Permeameter Testing Results

BOREHOLE PERMEAMETER TESTING RESULTS

J6120 - Lot 3599 Great Northern Highway Muchea Infiltration Testing

User to enter

Basin 1

Location: 0404643 mE 6505932 mN Date: 3/12/2015 Staff: JS & DB

Depth: 0.35 m

r = radius of hole (cm)

H = height of water in hole (cm)

C = based on H/r ratio

q = steady state infiltration rate (cm^3/s)

(q is based on the cross sectional area of tube **15.2**cm^2 for 4.4cm)

Ks = saturated Hydraulic Conductivity

Rep 1

r =	8
H =	3.2
H/r =	0.4
C=	0.2853

Time (sec)	Level (cm)	Diff (cm)
0	72.9	0
10	74	1.1
20	75.2	1.2
30	76.3	1.1
40	77.6	1.3
50	78.5	0.9
60	79.3	0.8
70	80.5	1.2
80	81.4	0.9
90	82.5	1.1
100	83.4	0.9
110	84.5	1.1
120	85.5	1
130	86.7	1.2
140	87.7	1
150	89	1.3
	Average	1.07

Rep 2

r =	8
H =	3.2
H/r =	0.4
C=	0.2853

Time (sec)	Level (cm)	Diff (cm)
0	90.3	0
10	91.7	1.4
20	92.6	0.9
30	93.5	0.9
40	94.3	0.8
50	95.5	1.2
60	96.6	1.1
70	97.7	1.1
80	98.8	1.1
90	99.9	1.1
100	101	1.1
110	102	1
120	103.1	1.1
130	104.2	1.1
140	105.3	1.1
150	106.4	1.1
	Average	1.07

Rep 3

r =	8
H =	3.2
H/r =	0.4
C=	0.2853

Time (sec)	Level (cm)	Diff (cm)
0	107.5	0
10	108.7	1.2
20	109.8	1.1
30	110.9	1.1
40	112	1.1
50	113.2	1.2
60	114.5	1.3
70	115.7	1.2
80	116.8	1.1
90	117.9	1.1
100	119.1	1.2
110	120.3	1.2
120	121.4	1.1
130	122.3	0.9
140	123.4	1.1
150	124.5	1.1
	Average	1.13

q =	1.63 cm^3/s	**q =**	1.63 cm^3/s	**q =**	1.72 cm^3/s
Ks =	0.0038 cm/s	**Ks =**	0.0038 cm/s	**Ks =**	0.0040 cm/s
Ks (m/day)	**3.31**	**Ks (m/day)**	**3.31**	**Ks (m/day)**	**3.49**

Average Ks from 3 Repitions = **3.37 (m/day)**

* Extracted from Soilmoisture Guelph Permeameter manual/calculator

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121(H_2/a)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

C =	0.2853

BOREHOLE PERMEAMETER TESTING RESULTS

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User to enter

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Location: 0404643 mE 6505932 mN Date: 3/12/2015 Staff: JS & DB

Depth: 0.8 m

r = radius of hole (cm)

H = height of water in hole (cm)

C = based on H/r ratio

q = steady state infiltration rate (cm^3/s)

(q is based on the cross sectional area of tube **15.2**cm^2 for 4.4cm)

Ks = saturated Hydraulic Conductivity

Rep 1

r =	9
H =	1
H/r =	0.1111111
C=	0.1096

Time (sec)	Level (cm)	Diff (cm)
0	62.2	0
10	62.9	0.7
20	63.6	0.7
30	64.1	0.5
40	64.6	0.5
50	65	0.4
60	65.5	0.5
70	66	0.5
80	66.5	0.5
90	66.9	0.4
100	67.5	0.6
110	67.9	0.4
120	68.4	0.5
130	68.9	0.5
140	69.3	0.4
150	69.9	0.6
	Average	0.51

q = 0.78 cm^3/s

Ks = 0.0025 cm/s

Ks (m/day) **2.16**

Rep 2

r =	9
H =	1
H/r =	0.1111111
C=	0.1096

Time (sec)	Level (cm)	Diff (cm)
0	70.4	0
10	70.8	0.4
20	71.3	0.5
30	71.8	0.5
40	72.2	0.4
50	72.7	0.5
60	73.2	0.5
70	73.6	0.4
80	74.1	0.5
90	74.6	0.5
100	75	0.4
110	75.4	0.4
120	75.9	0.5
130	76.3	0.4
140	76.8	0.5
150	77.2	0.4
	Average	0.45

q = 0.69 cm^3/s

Ks = 0.0022 cm/s

Ks (m/day) **1.91**

Rep 3

r =	9
H =	1
H/r =	0.1111111
C=	0.1096

Time (sec)	Level (cm)	Diff (cm)
0	77.7	0
10	78.1	0.4
20	78.6	0.5
30	79.1	0.5
40	79.5	0.4
50	80	0.5
60	80.3	0.3
70	80.8	0.5
80	81.2	0.4
90	81.6	0.4
100	82.1	0.5
110	82.5	0.4
120	83	0.5
130	83.4	0.4
140	83.9	0.5
150	84.3	0.4
	Average	0.44

q = 0.67 cm^3/s

Ks = 0.0021 cm/s

Ks (m/day) **1.85**

Average Ks from 3 Repitions = **1.98 (m/day)**

* Extracted from Soilmoisture Guelph Permeameter manual/calculator

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
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Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

C =	0.1096

APPENDIX D

CSBP Soil & Plant Laboratory Report

67059
JDA Consultant Hydrologists

Soil & Plant Analysis Laboratory

CSBP

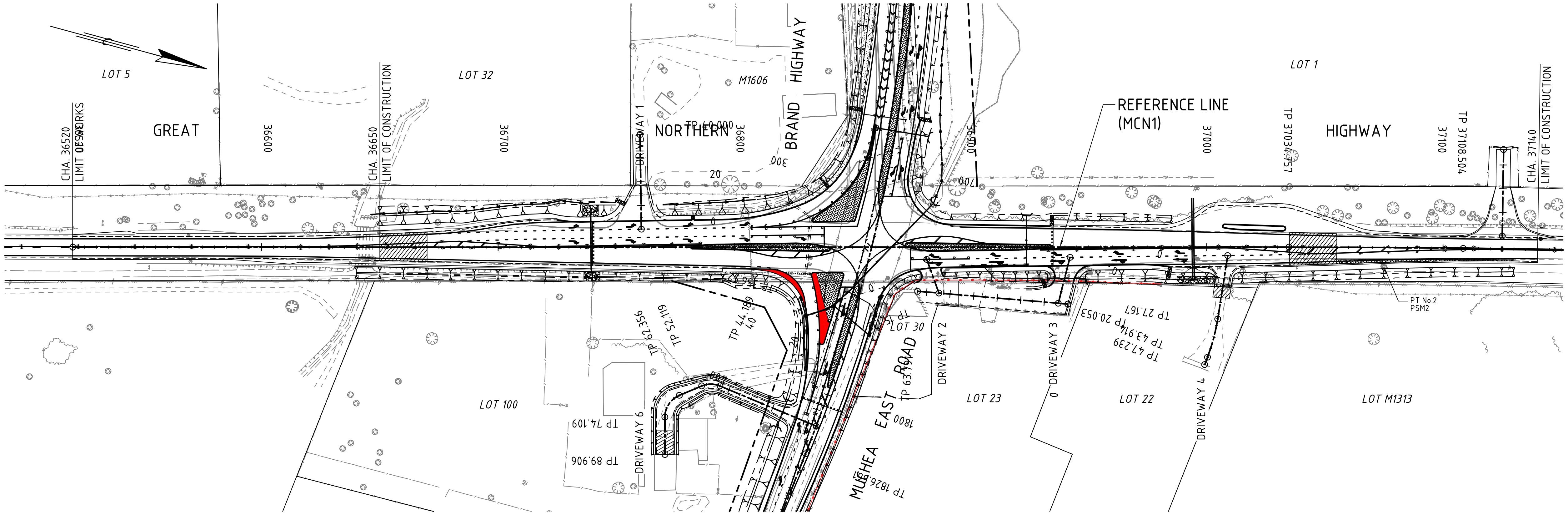
ANALYSIS REPORT

Generated: 5/01/2016 12:42:35 PM

	Lab No	J1S15160	J1S15161
	Name	P1	P1
	Code	3/12/15	3/12/15
	Customer	JDA	JDA
	Depth	35-80	80-100
Phosphorus Olsen	mg/Kg	3.1	5.0
Phosphorus Retention Index		21.2	110.0

APPENDIX E

Main Roads Engineering Drawings – Great Northern Highway/Brand Highway Intersection



PLAN

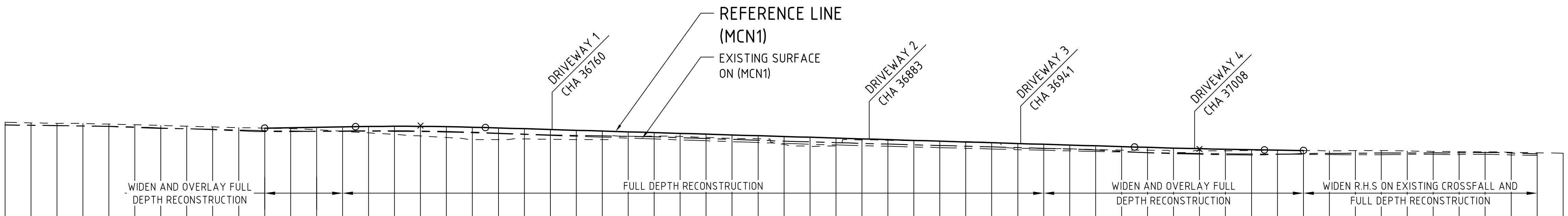
SCALE 1:1000

NOTES

1. FOR DRAINAGE DETAILS REFER TO DRG No's 200810-2046 TO 200810-2056.
2. FOR TYPICAL DRIVEWAY DETAILS REFER TO DRG No's 200810-2065.

LEGEND

- PEDESTRIAN RAMP
- LEVEE
- PROPOSED ROAD RESERVE BOUNDARY
- CULVERT AND No (C-01)
- CULVERT - EXISTING
- CULVERT - FLOW DIRECTION
- INDEPENDENTLY GRADED 'G' DRAIN
- INDEPENDENTLY GRADED TABLE DRAIN
- LIMIT OF ASPHALT
- PT No. STATION No. — ROAD REFERENCE MARK
- EXISTING ALIGNMENT TO BE REHABILITATED
- BLEND AREA
- ROCK PROTECTION
- BRICK PAVING
- WIDEN ON EXISTING CROSSFALL



DATUM 50.0

CHAINAGE MCN1	EXISTING MCN1	DESIGN MCN1	+CUT/-FILL
36550	53.669		
36560	53.644		
36570	53.628		
36580	53.623		
36590	53.598		
36600	53.573		
36610	53.545		
36620	53.517		
36630	53.489		
36640	53.463	53.463	-0.000
36650	53.442	53.442	-0.001
36660	53.420	53.458	-0.038
36670	53.380	53.474	-0.094
36680	53.319	53.491	-0.171
36690	53.258	53.506	-0.247
36700	53.198	53.512	-0.314
36710	53.140	53.510	-0.371
36720	53.081	53.499	-0.417
36730	53.000	53.478	-0.477
36740	53.000	53.449	-0.449
36750	53.026	53.419	-0.393
36760	53.013	53.389	-0.376
36770	53.000	53.359	-0.359
36780	53.001	53.329	-0.329
36790	53.128	53.299	-0.172
36800	53.137	53.269	-0.133
36810	53.123	53.239	-0.117
36820	53.084	53.209	-0.126
36830	53.046	53.179	-0.133
36840	53.034	53.149	-0.116
36850	52.811	53.119	-0.309
36860	52.744	53.089	-0.346
36870	52.771	53.059	-0.289
36880	52.985	53.029	-0.045
36890	52.973	52.999	-0.027
36900	52.957	52.969	-0.013
36910	52.944	52.939	0.004
36920	52.920	52.909	0.010
36930	52.890	52.879	0.011
36940	52.661	52.849	-0.188
36950	52.655	52.819	-0.164
36960	52.641	52.789	-0.148
36970	52.616	52.759	-0.143
36980	52.597	52.729	-0.133
36990	52.590	52.699	-0.110
37000	52.529	52.672	-0.143
37010	52.572	52.648	-0.077
37020	52.568	52.627	-0.060
37030	52.581	52.609	-0.029
37040	52.589	52.594	-0.005
37050	52.579	52.579	0.000
37060	52.569	52.569	
37070	52.574	52.574	
37080	52.577	52.577	
37090	52.561	52.561	
37100	52.545	52.545	
37110	52.536	52.536	
37120	52.527	52.527	
37130	52.511	52.511	
37140	52.491	52.491	
37150	52.475	52.475	

HORIZONTAL MCN1: TANGENT | CURVE RIGHT RADIUS 5000m | TANGENT

SUPERELEVATION LEFT: BLEND TO EXIST | 3% CROSSFALL | 40m TRANSITION | 2% CROSSFALL | 40m TRANSITION | 3% CROSSFALL | BLEND TO EXIST

SUPERELEVATION RIGHT: BLEND TO EXIST | 3% CROSSFALL | 40m TRANSITION | 2% CROSSFALL | 40m TRANSITION | 3% CROSSFALL | BLEND TO EXIST

VERTICAL MCN1									
GRADE	+0.162%				-0.300%		-0.150%		
CHA	36650	36685	36710	36735	36985	37010	37035	37050
ELEV	53.442	53.499	53.539	53.464	52.714	52.639	52.602	52.579
LVC			50			50		
K VALUE			108.3			333.3		

PROFILE

VERTICAL 1:100
HORIZONTAL 1:1000

ROAD REFERENCE MARK

PT No	STATION NUMBER	CO-ORDINATES EASTING	CO-ORDINATES NORTHING	LEVEL
1	PSM1	67214.411	304384.532	53.878
2	PSM2	66968.006	305281.962	52.051

SCALE 1:1000 / 1:100

MICROFILM DATE

A1

No.	DATE	DESCRIPTION	APPROVED
0	May-10	AS CONSTRUCTED	E.FOURIE

M:\Design\CADD\3__Working\DP01F\DRG\200810-2001.dwg 24 June 2010

METADATA

GROUND SURVEY STANDARD: P.C.G 94
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE:
HEIGHT DATUM: A.H.D

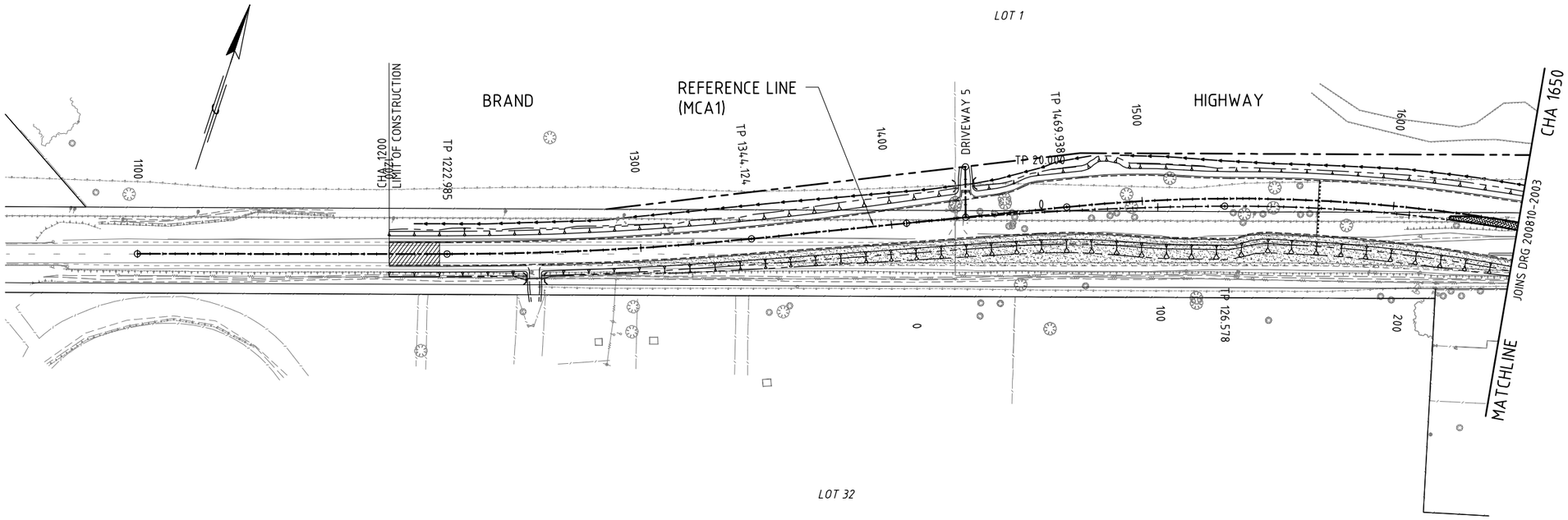
NAMES PRINTED IN FULL	SIGNATURES AND DATE
DRAWN E.BRAJER	VERIFIED / REVIEWED S. SHAW 25/11/08
DESIGNED E.BRAJER	DESIGN MANAGER D. SULLIVAN 25/11/08
CHECKED E. FOURIE	ALLIANCE MANAGER M. SUTTON 25/11/08
	PROJECT DIRECTOR N. FOX 25/11/08

Government of Western Australia
mainroads WESTERN AUSTRALIA
CONSTRUCTION AND MAINTENANCE SERVICES
WHEATBELT NORTH REGION
PEEL TERRACE NORTHAM 6401
Telephone (08) 9622 4777 Fax (08) 9622 3767
LOCAL AUTHORITY (502) SHIRE OF CHITTERING

GREAT NORTHERN HIGHWAY H006
MUCHEA TO WUBIN PROJECT

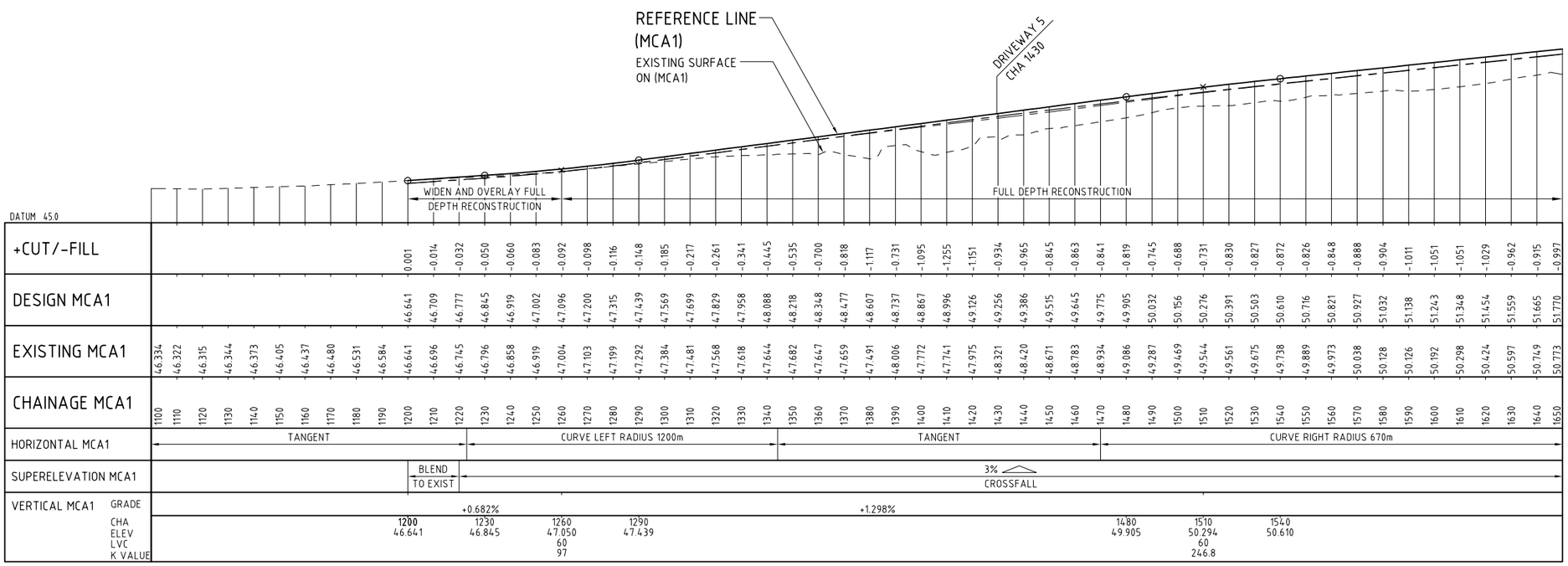
DESIGN PACKAGE 1 - SLK 36.52 TO SLK 37.14
PLAN AND PROFILE
GREAT NORTHERN HIGHWAY - CHA.36520 TO CHA.37140 MCN1

DRAWING STATUS: AS CONSTRUCTED
DRAWING No. 200810-2001
REV 0



PLAN

SCALE 1:1000



PROFILE

VERTICAL 1:100
HORIZONTAL 1:1000

NOTES

1. FOR DRAINAGE DETAILS REFER TO DRG No's 200810-2046 TO 200810-2056.
2. FOR TYPICAL DRIVEWAY DETAILS REFER TO DRG No's 200810-2065.

LEGEND

- PEDESTRIAN RAMP
- LEVEE
- PROPOSED ROAD RESERVE BOUNDARY
- C-01 CULVERT AND No
- CULVERT - EXISTING
- CULVERT - FLOW DIRECTION
- INDEPENDENTLY GRADED 'G' DRAIN
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- PT No. STATION No. ROAD REFERENCE MARK
- EXISTING ALIGNMENT TO BE REHABILITATED
- BLEND AREA
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- BRICK PAVING
- WIDEN ON EXISTING CROSSFALL

SCALE 1:1000 1:100

MICROFILM DATE

A 1

No.	DATE	DESCRIPTION	APPROVED
0	May-10	AS CONSTRUCTED	E.FOURIE

M:\Design\CADD\3_Working\DP01F\DRG\200810-2002.dwg 24 June 2010

METADATA

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DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE:
HEIGHT DATUM: A.H.D

NAMES PRINTED IN FULL	SIGNATURES AND DATE
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DESIGNED E.BRAJER	DESIGN MANAGER D. SULLIVAN 25/11/08
CHECKED E. FOURIE	ALLIANCE MANAGER M. SUTTON 25/11/08
	PROJECT DIRECTOR N. FOX 25/11/08

Access Alliance

Government of Western Australia
mainroads WESTERN AUSTRALIA
CONSTRUCTION AND MAINTENANCE SERVICES
WHEATBELT NORTH REGION
PEEL TERRACE NORTHAM 6401
Telephone (08) 9622 4777 Fax (08) 9622 3767
LOCAL AUTHORITY (502) SHIRE OF CHITTERING

GREAT NORTHERN HIGHWAY H006

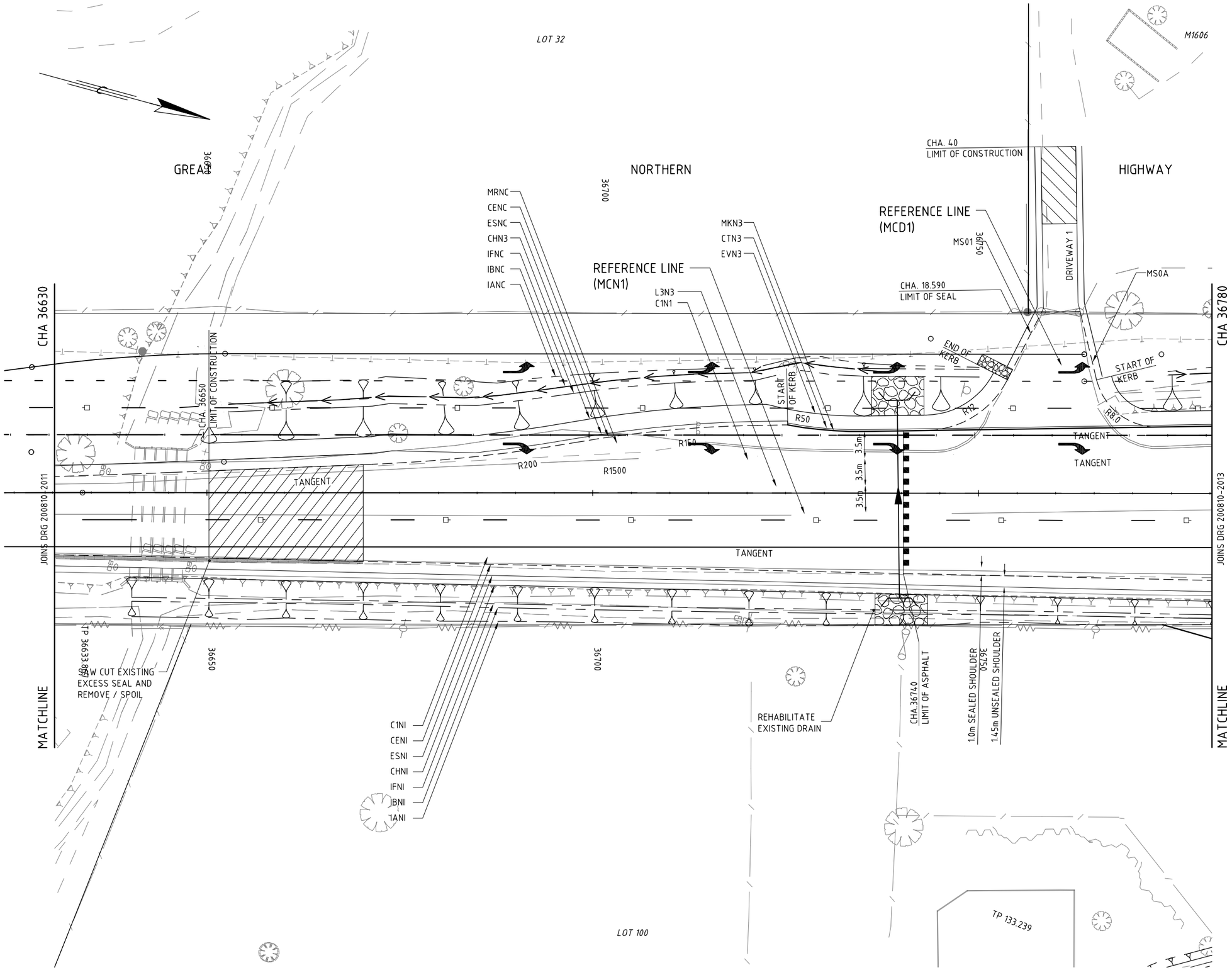
MUCHEA TO WUBIN PROJECT

DESIGN PACKAGE 1 - SLK 36.52 TO SLK 37.14

PLAN AND PROFILE

BRAND HWY / MUCHEA EAST ROAD - CHA.1200 TO CHA.1650 MCA1

DRAWING STATUS	DRAWING No.	REV
AS CONSTRUCTED	200810-2002	0



PLAN

SCALE 1:250

NOTES

1. ALL KERBING TO BE SEMI-MOUNTABLE TYPE SM-1 OR TYPE SM-2(X) IN ASPHALT AREAS UNLESS OTHERWISE SHOWN.
2. FOR DRAINAGE DETAILS REFER TO DRG No's 200810-2046 TO 200810-2056.
3. FOR TYPICAL DRIVEWAY DETAILS REFER TO DRG No's 200810-2056.

LEGEND

- PEDESTRIAN RAMP
- LEVEE
- PROPOSED ROAD RESERVE BOUNDARY
- C-01 CULVERT AND No
- CULVERT - EXISTING
- CULVERT - FLOW DIRECTION
- INDEPENDENTLY GRADED 'G' DRAIN
- INDEPENDENTLY GRADED TABLE DRAIN
- LIMIT OF ASPHALT
- PT No. STATION No. ROAD REFERENCE MARK
- EXISTING ALIGNMENT TO BE REHABILITATED
- BLEND AREA
- ROCK PROTECTION
- BRICK PAVING
- WIDEN ON EXISTING CROSSFALL

SCALE 1:250

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No.	DATE	DESCRIPTION	APPROVED
0	May-10	AS CONSTRUCTED	E.FOURIE

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METADATA

GROUND SURVEY STANDARD: P.C.G 94
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
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HEIGHT DATUM: A.H.D

NAMES PRINTED IN FULL	SIGNATURES AND DATE
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DESIGNED E.BRAJER	DESIGN MANAGER D. SULLIVAN 25/11/08
CHECKED E. FOURIE	ALLIANCE MANAGER M. SUTTON 25/11/08
	PROJECT DIRECTOR N. FOX 25/11/08

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LOCAL AUTHORITY (502) SHIRE OF CHITTERING

GREAT NORTHERN HIGHWAY H006

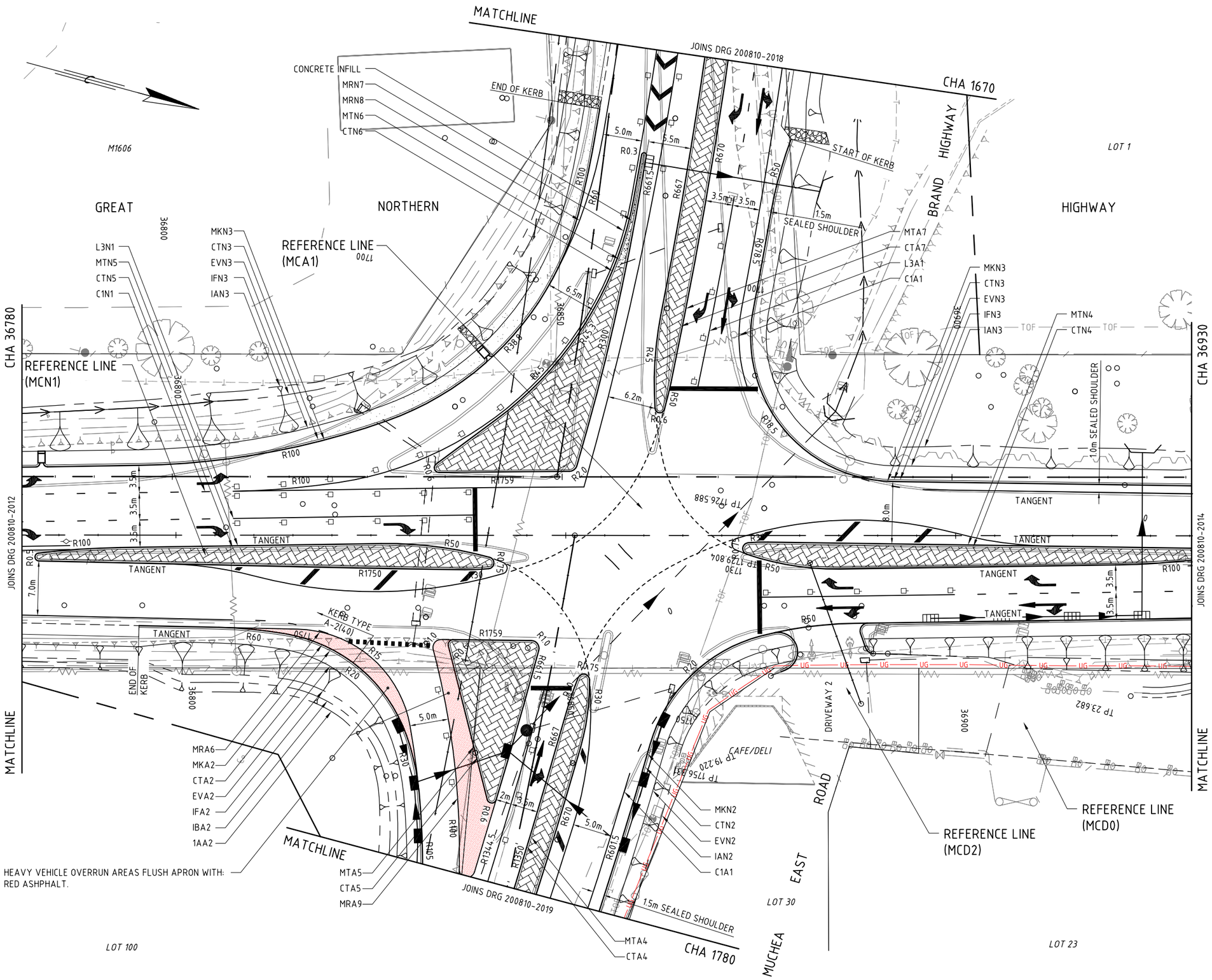
MUCHEA TO WUBIN PROJECT

DESIGN PACKAGE 1 - SLK 36.52 TO SLK 37.14

INTERSECTION DETAILS - SHEET 2 OF 12

GREAT NORTHERN HIGHWAY

DRAWING STATUS	DRAWING No.	REV
AS CONSTRUCTED	200810-2012	0



PLAN

SCALE 1:250

NOTES

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3. FOR TYPICAL DRIVEWAY DETAILS REFER TO DRG No's 200810-2065.
4. ALL BRICK PAVING HERRING BONE PATTERN (SANDALFORD HANDMADE PAVERS) WITH SEPERATE HEADER COURSE (CAVERSHAM HANDMADE PAVERS) SOURCE: MIDLAND BRICKS

LEGEND

- PEDESTRIAN RAMP
- LEVEE
- PROPOSED ROAD RESERVE BOUNDARY
- C-01 CULVERT AND No
- CULVERT - EXISTING
- CULVERT - FLOW DIRECTION
- INDEPENDENTLY GRADED 'G' DRAIN
- INDEPENDENTLY GRADED TABLE DRAIN
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- BLEND AREA
- ROCK PROTECTION
- BRICK PAVING
- WIDEN ON EXISTING CROSSFALL

SCALE 1:250 — A1

No.	DATE	DESCRIPTION	APPROVED
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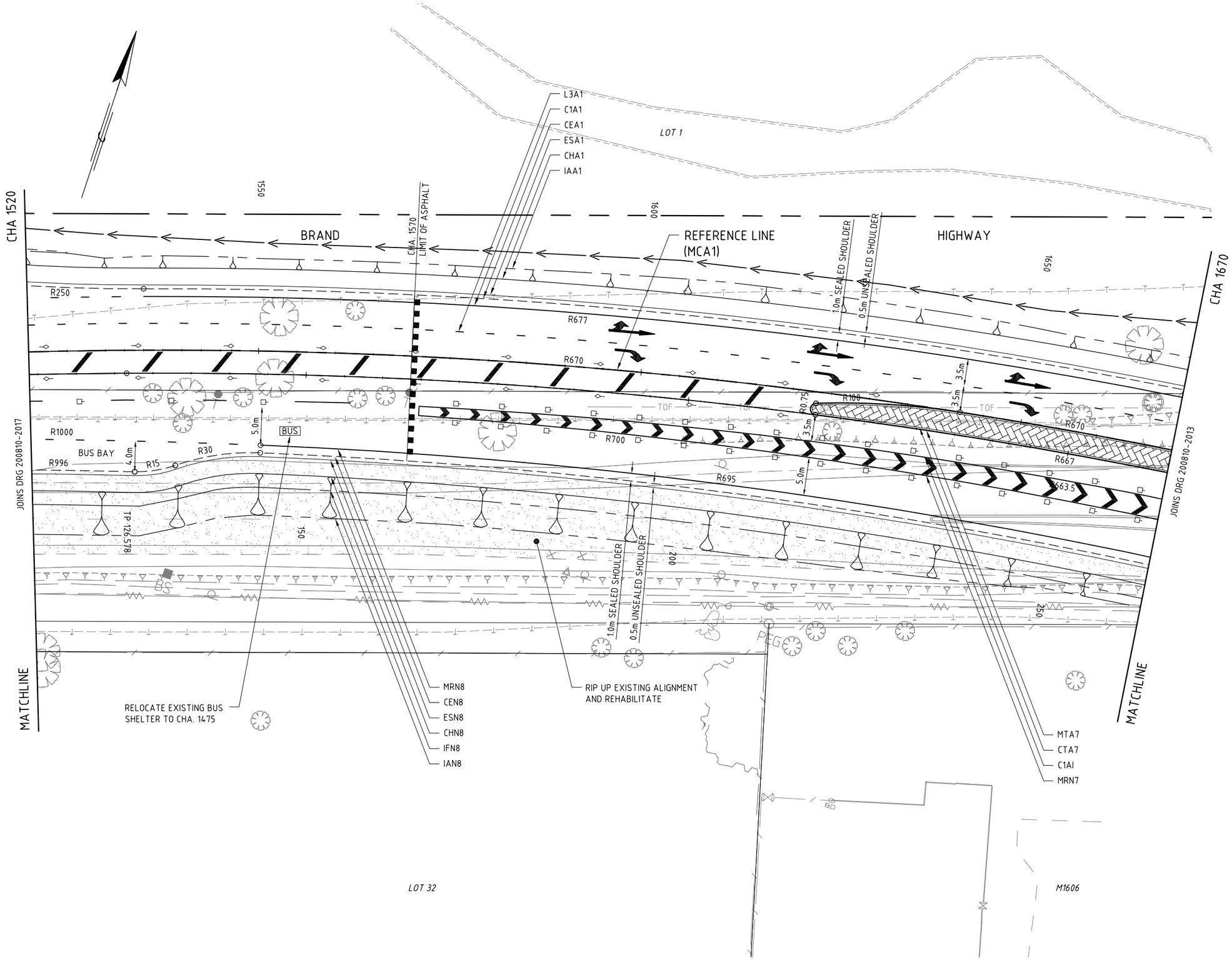
MUCHEA TO WUBIN PROJECT
DESIGN PACKAGE 1 - SLK 36.52 TO SLK 37.14
INTERSECTION DETAILS - SHEET 3 OF 12
GREAT NORTHERN HIGHWAY

DRAWING STATUS	DRAWING No.	REV
AS CONSTRUCTED	200810-2013	0



PLAN

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NOTES

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2. FOR DRAINAGE DETAILS REFER TO DRG No's 200810-2046 TO 200810-2056.
3. FOR TYPICAL DRIVEWAY DETAILS REFER TO DRG No's 200810-2065.

LEGEND

- PEDESTRIAN RAMP
- LEVEE
- PROPOSED ROAD RESERVE BOUNDARY
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- BLEND AREA
- ROCK PROTECTION
- BRICK PAVING
- WIDEN ON EXISTING CROSSFALL

SCALE 1:250 — 0 2.5m 5 7.5 10 12.5 15 17.5 20 22.5 25 27.5 30 32.5 35 37.5

MICROFILM DATE

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	PROJECT DIRECTOR N. FOX 25/11/08

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GREAT NORTHERN HIGHWAY H006

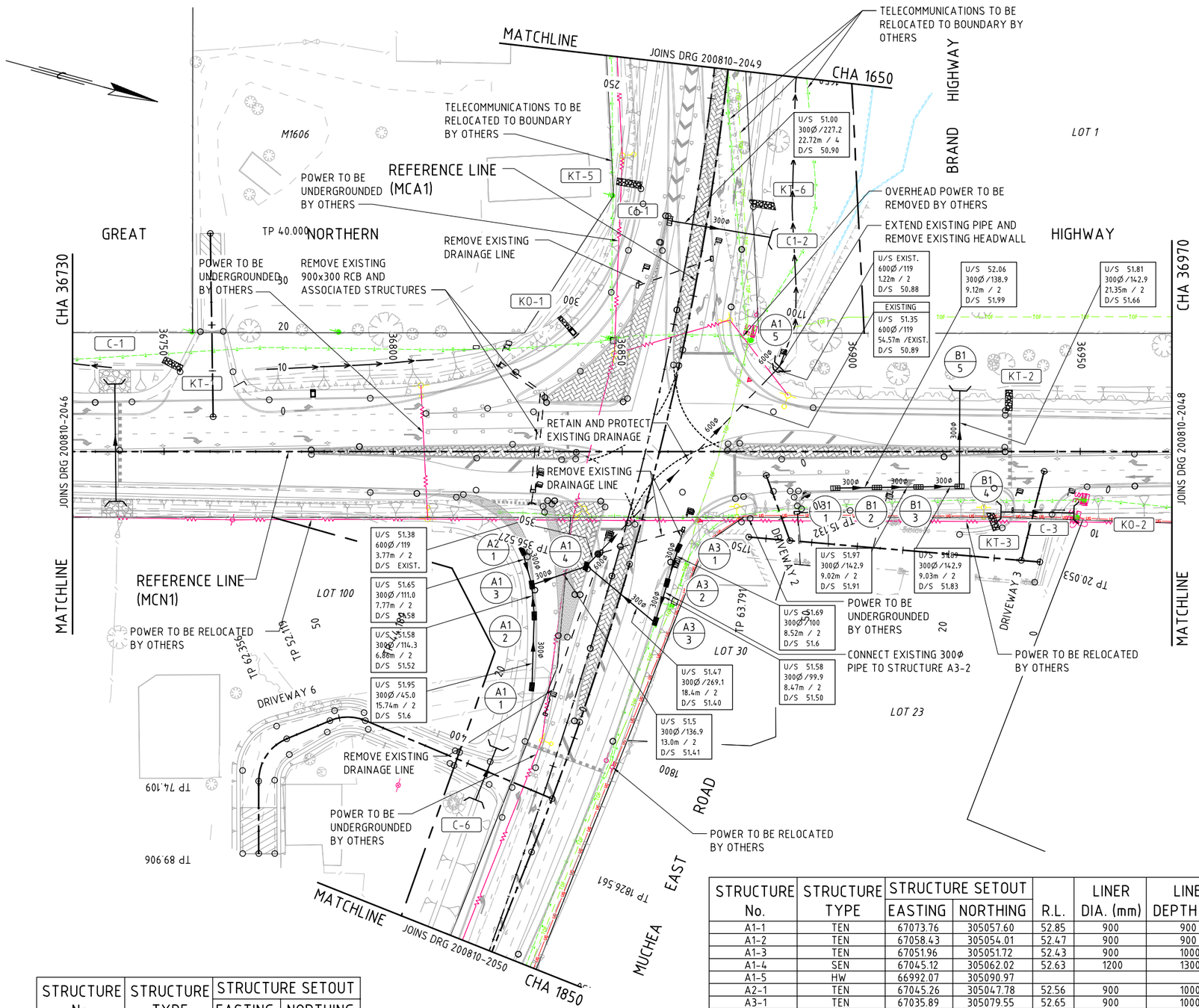
MUCHEA TO WUBIN PROJECT

DESIGN PACKAGE 1 - SLK 36.52 TO SLK 37.14

INTERSECTION DETAILS - SHEET 8 OF 12

BRAND HIGHWAY

DRAWING STATUS	DRAWING No.	REV
AS CONSTRUCTED	200810-2018	0



STRUCTURE No.	STRUCTURE TYPE	STRUCTURE SETOUT EASTING	STRUCTURE SETOUT NORTHING
KO-1	KO - TYPE 1	66997.19	305046.42
KO-2	KO - TYPE 1	66997.87	305169.30
KT-1	KT	67027.38	304964.75
KT-2	KT	66988.41	305141.06
KT-3	KT	67013.42	305146.53
KT-4	KT	66991.87	305194.01
KT-5	KT	66962.54	305051.63
KT-6	KT	66959.88	305076.34

STRUCTURE No.	STRUCTURE TYPE	STRUCTURE SETOUT EASTING	STRUCTURE SETOUT NORTHING	R.L.	LINER DIA. (mm)	LINER DEPTH (mm)	COMMENT
A1-1	TEN	67073.76	305057.60	52.85	900	900	
A1-2	TEN	67058.43	305054.01	52.47	900	900	
A1-3	TEN	67051.96	305051.72	52.43	900	1000	
A1-4	SEN	67045.12	305062.02	52.63	1200	1300	EXTEND EXISTING 600Ø PIPE AND REMOVE EXISTING PIT
A1-5	HW	66992.07	305090.97				INSTALL PRECAST ENDWALL WITH 300mm HEADWALL
A2-1	TEN	67045.26	305047.78	52.56	900	1000	
A3-1	TEN	67035.89	305079.55	52.65	900	1000	
A3-2	TEN	67044.40	305079.10	52.59	900	1100	
A3-3	TEN	67052.87	305078.86	52.64	1200	1200	
B1-1	TGT	67014.94	305109.82	52.81	900	800	
B1-2	TGT	67012.42	305118.59	52.78	900	900	
B1-3	TGT	67009.93	305127.26	52.76	900	900	
B1-4	TGT	67007.44	305135.94	52.74	900	1000	
B1-5	HW	66986.84	305130.33				INSTALL PRECAST ENDWALL WITH 300mm HEADWALL
C1-1	TGT	66967.67	305059.05	51.90	900	900	
C1-2	HW	66965.37	305081.65				INSTALL PRECAST ENDWALL WITH 300mm HEADWALL

NOTES

1. REMOVAL OF EXISTING PIPES TO INCLUDE ALL ASSOCIATED HEADWALLS, MANHOLES AND GULLY / SIDE ENTRY PITS.
2. REFER TO DRG No. 200710-2096 TO 200710-2098 FOR KERB OPENING AND OFF ROAD DRAINAGE DETAILS.
3. SERVICES SHOWN ARE INDICATIVE ONLY AND THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL SERVICES PRIOR TO ANY EXCAVATION WORK.
4. RELOCATION OF TELSTRA SERVICES WILL BE UNDERTAKEN BY TELSTRA. REFER TO TELSTRA DRAWINGS SKETCH A AND B.
5. RELOCATION OF WESTERN POWER SERVICES WILL BE UNDERTAKEN BY WESTERN POWER. REFER TO WESTERN POWER DRAWINGS GP012928 - SHEET 1 TO 4.

LEGEND

- PROPOSED ROAD RESERVE BOUNDARY
- U/S 24.98 / 300Ø/362 / 29.00m / 2 / D/S 24.90 — UPSTREAM INVERT (m) / PIPE DIAMETER (mm) / GRADE (1 IN m) / LENGTH (m) / PIPE CLASS / DOWNSTREAM INVERT (m)
- EXISTING CULVERT
- C-1 — CULVERT - FLOW DIRECTION AND No.
- KO-9 — KERB OPENING AND No.
- KT-2 — KERB TERMINATION AND No.
- B1/1 — DRAINAGE STRUCTURE NUMBER
- PROPOSED S.E.P. WITH DEFLECTOR SLAB
- PROPOSED GULLY GRATE
- BLEND AREA
- LIMIT OF ASPHALT
- PT No. / STATION No. — ROAD REFERENCE MARK
- ROCK PROTECTION
- PROPOSED MANHOLE
- TABLE DRAIN BLOCK
- EXISTING STORMWATER
- NEW STORMWATER PIPE FLOW DIRECTION
- INDEPENDENTLY GRADED DRAIN
- DRAIN
- T — TELSTRA
- TOF — TELSTRA FIBRE OPTIC
- OVER HEAD POWER
- UG — UNDER GROUND POWER
- W — WATER
- WC — WATER - LOCATION DETERMINED FROM WATER CORPORATION PLANS BUT NOT EVIDENT FROM FIELD SURVEY
- EU — PROPOSED NEW WP CABLE

WARNING

BEWARE OF UNDERGROUND SERVICES

The location of underground cables are approximate only and their exact position should be checked on site. No guarantee is given that all existing cables and services are shown. Locate all underground cables and services before commencement of work. Refer to Worksafe Regulation 3.21.

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No.	DATE	DESCRIPTION	APPROVED
0	May-10	AS CONSTRUCTED	E.FOURIE

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	PROJECT DIRECTOR N. FOX 25/11/08

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GREAT NORTHERN HIGHWAY H006
MUCHEA TO WUBIN PROJECT
DESIGN PACKAGE 1 - SLK 36.52 TO SLK 37.14
DRAINAGE AND SERVICES-SHEET 2 OF 7
GREAT NORTHERN HIGHWAY

DRAWING STATUS: AS CONSTRUCTED
DRAWING No.: 200810-2047
REV: 0

APPENDIX F

MODRET Modelling Results

MODRET - Summary Results

Job: J6120

Date : 8/02/2016

Performed by : JS

Basin: Lot M1606 Bioretention

Catchment Area 1	0.78	ha
EIA	0.51	ha
Top Elevation	50.75	mAHD
Base Elevation	50.3	mAHD
Base Length	65	m
Base Width	8	m
Depth	0.45	m
Batter	1:4	
K_H	3.4	m/day
K_V	3.4	m/day
Av Effective Storage Coeff	0.2	
Groundwater Level	50	mAHD
Base of Impervious Layer	48.7	mAHD

Stage Volume relationship		
Stage (mAHD)	Volume (m^3)	Area (m^2)
50.30	0	520
50.35	27	549
50.40	55	579
50.45	85	609
50.50	116	639
50.55	149	670
50.60	183	701
50.65	219	732
50.70	256	764
50.75	295	796

Duration	1 Yr ARI			5 Yr ARI		
	Peak Level (mAHD)	Volume (m^3)	Total Runoff (m^3)	Peak Level (mAHD)	Volume (m^3)	Total Runoff (m^3)
1hr	50.38	41	77	-	-	-
72hr	50.57	161	333	50.74	289	522

Intensity-Frequency-Duration Table

Location: 31.575S 116.000E NEAR.. Muchea Issued: 7/1/2016

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

Average Recurrence Interval

Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	55.9	74.2	98.9	117	142	179	211
6Mins	52.1	69.2	92.0	109	131	166	196
10Mins	41.6	55.0	72.6	85.2	103	129	151
20Mins	29.0	38.2	49.5	57.6	68.9	85.5	99.8
30Mins	23.0	30.1	38.8	44.8	53.3	65.8	76.5
1Hr	15.1	19.6	24.9	28.6	33.8	41.4	47.8
2Hrs	9.72	12.6	15.8	18.1	21.2	25.8	29.7
3Hrs	7.49	9.69	12.1	13.8	16.2	19.6	22.5
6Hrs	4.81	6.21	7.72	8.74	10.2	12.3	14.1
12Hrs	3.09	3.99	4.92	5.56	6.46	7.76	8.85
24Hrs	1.98	2.55	3.13	3.52	4.08	4.89	5.56
48Hrs	1.24	1.59	1.94	2.18	2.52	3.01	3.41
72Hrs	.912	1.17	1.43	1.60	1.85	2.21	2.50

(Raw data: 20.26, 4.12, 1.21, 36.34, 6.95, 1.99, skew=0.67, F2=4.81, F50=16.72)

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Appendix D – Traffic Assessment

SHAWMAC

CONSULTING CIVIL & TRAFFIC ENGINEERS, RISK MANAGERS.

Project:	Transport Statement, Lot 1606, Great Northern Highway (GNH), Muchea.
Client:	Whelans.
Author:	S Millen
Signature:	
Date:	5th February 2016
Version:	1

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Document Status.

Ver No.	Author	Reviewed by	Date	Issued for	Signature	Date
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1. Introduction and Background

1.1. Proponent

Whelans on behalf of its client (Charmayne Cassar) engaged Shawmac to assess the traffic impacts associated with the proposed rezoning of Lot 1606 located on the corner of Brand Highway and Great Northern Highway (GNH), Muchea within the Shire of Chittering.

1.2. Site Location and Land Use

The study area (site) location is shown **Figure 1.**

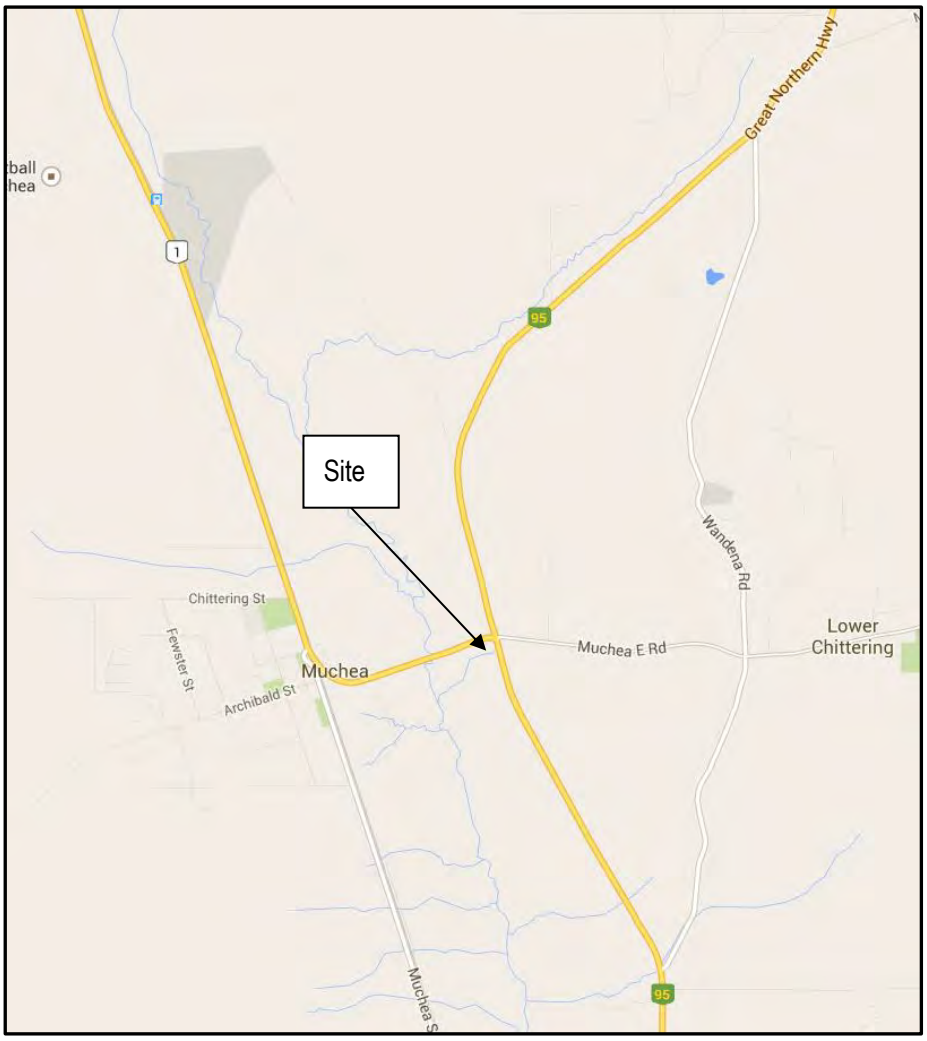

Figure 1- Local Context

The site is currently used for agricultural purposes in accordance with the Shire of Chittering Town Planning Scheme. The existing site together with the surrounding area is shown on the aerial photograph at **Figure 2**.

Figure 2 - Site Aerial Photograph

1.3. Referenced Information

In undertaking the study, the information listed below was referenced:

- Road and Traffic Authority (RTA), NSW "Guide to Traffic Generating Developments"
- Institute of Transportation Engineers "Trip Generation" and the Director General of Transport,
- South Australia Land Use Traffic Generation Guidelines, March 1987
- Austroads Guide to Road Design Part 4A – Unsignalised and signalised intersections.

2. Site Proposal

2.1. Regional Context.

The site is located within the Shire of Chittering approximately 40km from the Midland Townsite and 5km from the Muchea Townsite in the locality of Lower Chittering. It has direct street frontage to GNH and Brand Highway which are important transport routes that connect towns from Perth to Geraldton.

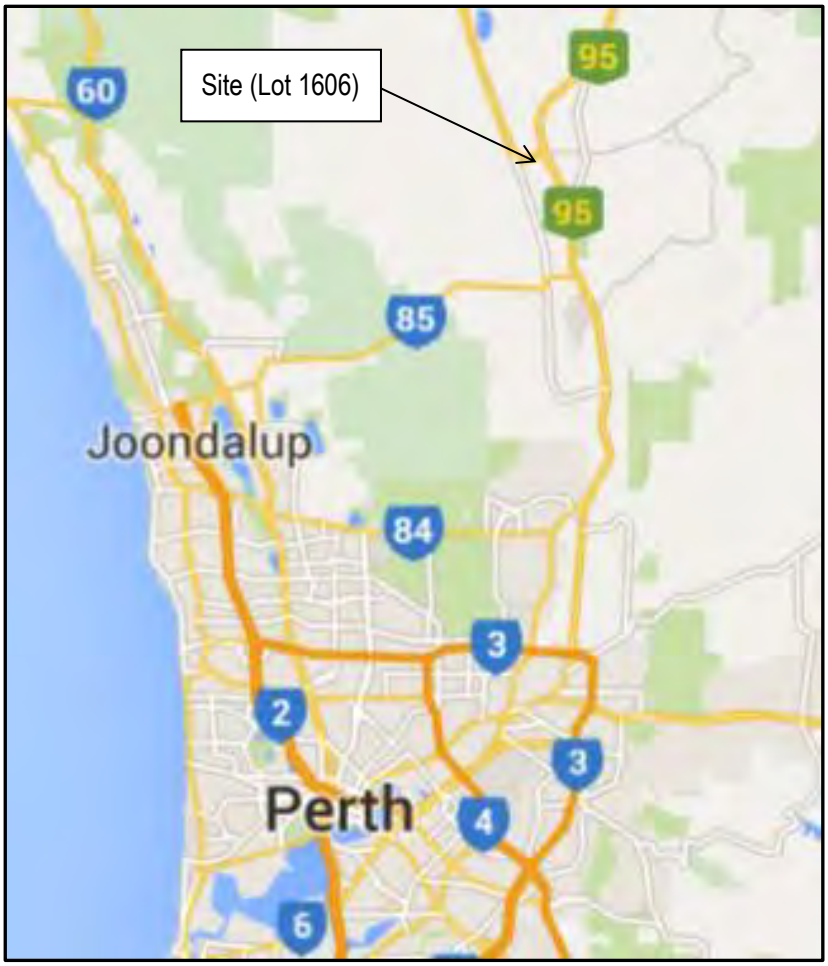

Figure 3 - Regional Context

2.2. Land Use

The site is approximately 7,794 m^2 in area and it is proposed to develop the site for Industrial use which will require rezoning it for industrial purposes as it is currently zoned for Agricultural Resources under the Shire of Chittering Town Planning Scheme No. 6, shown at **Figure 4**.

Figure 4 - Extract of Shire of Chittering Local Planning Scheme No 6

2.3. Major Attractors and Generators of Traffic

Access to the site is currently via GNH which is a Primary Distributor road and a major transport route. The main attractors and generators expected to influence traffic flows to and from the site are expected to predominately come from passing traffic, surrounding farming communities and towns such as Muchea, Gingin, Chittering and possibly Midland which are within a 50km radius of the site.

Figure 5 - Attractors and Generators

3. Existing Situation.

3.1. Existing Roads

Great Northern Highway (GNH)

GNH is classified as a Primary Distributor road that is under the care and control of MRWA. GNH at the site is described as a sealed and kerbed single carriageway road approximately 18m wide which has three northbound lanes consisting of one through lane, right turn pocket and left turn pocket and one southbound through lane. The opposing traffic lanes are separated by a hard medium and gravel shoulders and open road side drains are in place where the kerb terminates.

GNH has a posted speed of 110km/hr.

Traffic count data for GNH is shown on **Figure 11** at **Appendix A**.

Brand Highway

Brand Highway is classified as a Primary Distributor road that is under the care and control of MRWA. Brand Highway at the site is described as a sealed and kerbed single carriageway road approximately 20m wide which has two eastbound lanes consisting of a combination through and left turn lane and a dedicated right turn pocket and two westbound lanes consisting of a through lane and an acceleration lane. The opposing traffic lanes are separated by a hard medium and gravel shoulders and open road side drains are in place where the kerb terminates.

Brand has a posted speed of 110km/hr.

Traffic count data for Brand Highway is shown on **Figure 12** at **Appendix A**.

Muchea East Road

Muchea East Road is classified as a Regional Distributor Road that is under that care and control of the Shire of Chittering. Muchea East Road is described as a sealed single carriageway road approximately 18m wide which has two westbound lanes consisting of combination through lane, right turn pocket and left turn pocket and one eastbound through lane. The opposing traffic lanes are separated by a hard /painted medium and gravel shoulders and open road side drains are in place where the kerb terminates.

Muchea East Road has a posted speed limit of 100km/hr.

Traffic count data for Muchea East Road is shown on **Figure 13** at **Appendix A**.

3.2. Intersections

Figure 6 shows the current signalised intersection configuration.

Figure 6 - Intersection of GNH and Brand Highway

3.3. Road Hierarchy and Status

Figure 7 and **Figure 8** shows the Road Hierarchy and Restricted Access Vehicle categories for the road network adjacent to and around the site. **Table 1** below shows the permitted Prime Mover and trailer combinations for the haul route.

Table 1 - Prime Mover and Trailer Combinations

Road Name	Prime Mover and Trailer Combinations		Length	Max permitted mass
GNH, Brand Highway and Muchea East Road	Category 7		>27.5,≤36.5	107.5

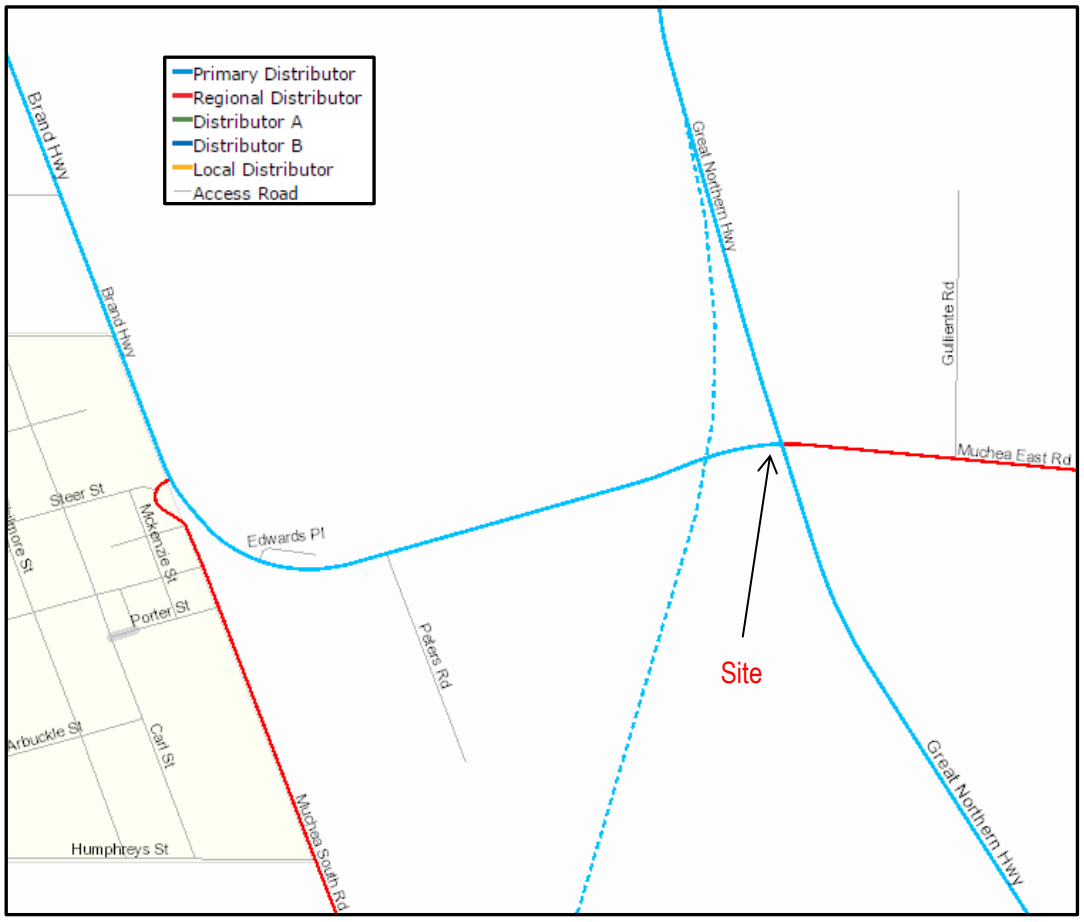

Figure 7- Road Hierarchy (Source MRWA)

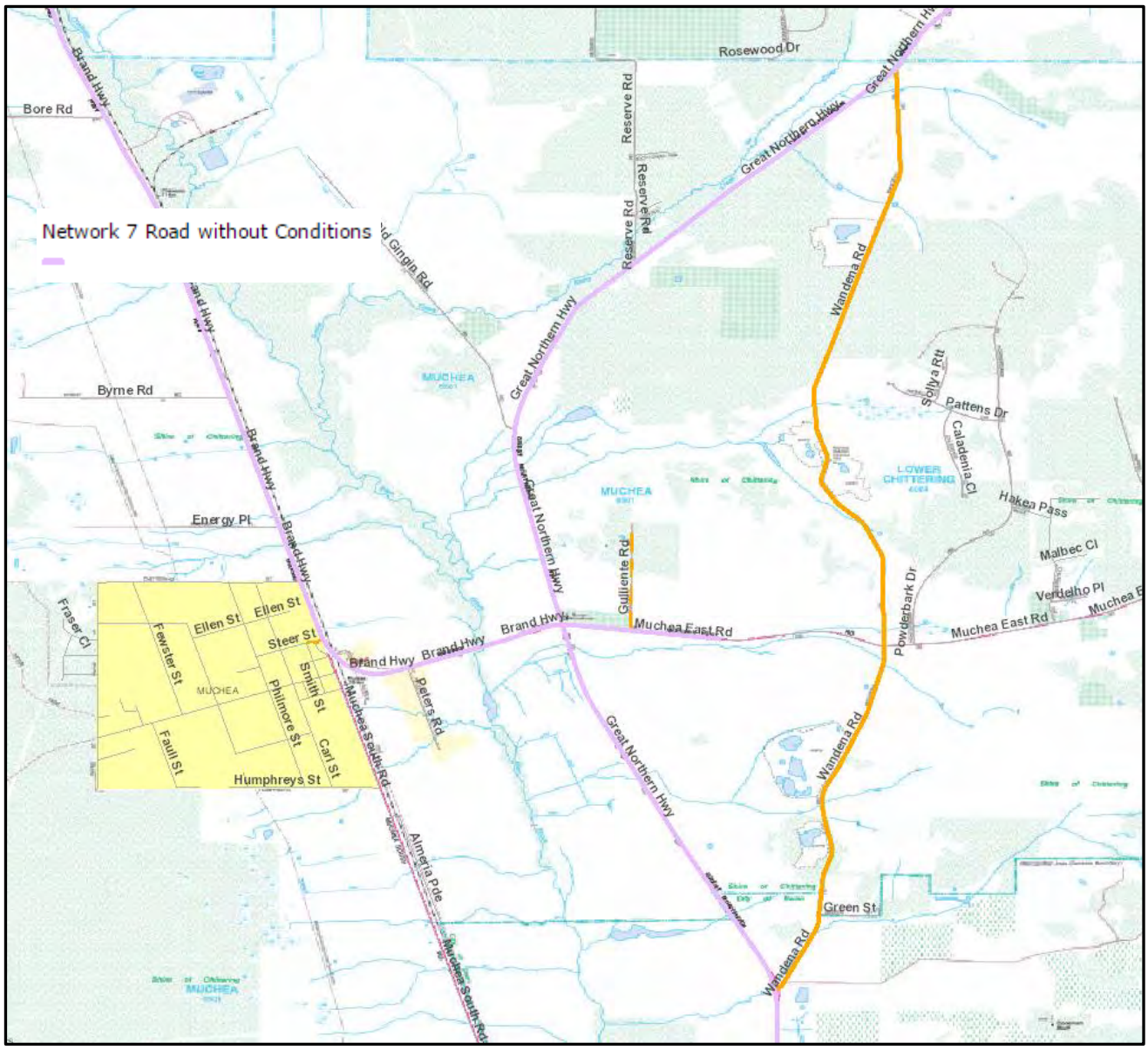

Figure 8 - RAV Network (Source MRWA)

3.4. Road Hierarchy vs Actual Flows

Table 2 details the comparison of flows against the maximum desirable flows under the MRWA Functional Hierarchy Criteria / Liveable Neighbourhood Guidelines.

Table 2 - Desirable Maximum Flow vs Actual Flows

Location and date of count.		Classification	*Desirable Max Traffic Volume (vpd)	Actual Daily Traffic Flows (vpd)
GNH	North of Wandena Road	Primary Distributor	15,000 vpd	7,160 vpd (June 2014)
Brand Highway	West of GNH	Primary Distributor	15,000 vpd	3,616 vpd (May 2015)
Muchea East Road	East of GNH	Regional Distributor	>100 vpd	975 vpd (Nov 2015)

*MRWA Road Hierarchy

The table above indicates that GNH, Brand Highway and Muchea East Road are currently operating in accordance with their desirable capacity.

4. Changes to Surrounding Transport Networks

The site will be affected by the Northlink WA project which involves a new 37 km section of highway to be constructed between the intersection of Reid Highway / Tonkin Highway and GNH / Brand Highway at Muchea. The first phase of the project is expected to begin mid 2016 with the second phase in late 2016 and completion in 2019.

Northlink will connect with Brand Highway to the North of the site as shown in Figure 9 and once complete, Brand Highway between GNH and Muchea will become a local road and downgraded to a regional distributor similar to Muchea East Road.

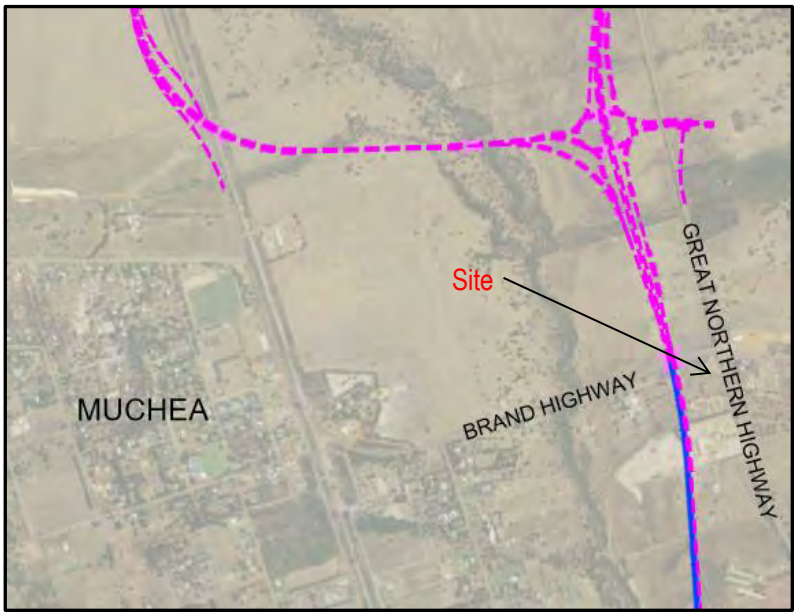

Figure 9 - Northlink (Source MRWA)

5. Assessment Years

The development is assessed on current network conditions.

6. Time Periods for Assessment

Assessment is based on both daily traffic and peak hour periods.

7. Development Generation and Distribution

7.1. Traffic Generation

In order to estimate the impact of traffic generated by the proposed development, the Road and Traffic Authority (RTA), NSW "Guide to Traffic Generating Developments", the Institute of Transportation Engineers "Trip Generation" and the Director General of Transport, South Australia Land Use Traffic Generation Guidelines, March 1987 were referred to. Potential flows from the site were calculated based on the site land use is shown in **Table 3** and **Table 4**.

Table 3 - Predicted Daily and Trip Generation

Land use	Generation rate			Unit	Quantum	Estimated Generation			Source
	ADT	AM Peak	PM Peak			ADT	AM Peak	PM Peak	
General Light Industrial	7.50	0.92	0.98	GFA ('00)	7794	585	72	76	ITE Guide
Total						**585**	**72**	**76**	

Table 4 - Predicted Peak Hour Trip Generation

Land use	Peak Distribution			
	AM Peak in	AM Peak out	PM Peak in	PM Peak out
General Light Industrial	63	9	9	67
Total	**63**	**9**	**9**	**67**

7.2. Traffic Distribution

Table 5 summarises the current estimated flows along Brand Highway, GEH and Muchea East Road and is based on an assumed distribution of 75% of traffic entering at exiting the site at the existing vehicle crossover and 25% exiting the site at a new vehicle crossover located on Brand Highway.

The traffic generated from the site has been allocated to the external road network as follows:

- Brand Highway westbound – 25% (exiting from the new crossover)
- Brand Highway eastbound – 25% (eastbound traffic access the exiting crossover)
- GEH southbound – 25% (southbound traffic will access the existing crossover)
- GEH northbound – 25% (northbound traffic will access the existing crossover)

The order of midblock traffic shown at **Table 5**.

Table 5 - Order of Midblock Traffic

Location	Daily	AM Peak	PM Peak
GEH Northbound	3,709 + 146 = 3,855	262 + 18 = 280	281 + 19 = 300
GEH Southbound	3,451 + 146 = 3,597	273 + 18 = 291	259 + 19 = 278
Brand Highway Eastbound	1,801 + 146 = 1,947	118 + 18 = 136	164 + 19 = 183
Brand Highway Westbound	1,815 + 146 = 1,961	129 + 18 = 147	141 + 19 = 160

Trip generation rates have been derived from counts at driveways fronting Brand Highway and GNH it is predicted that an additional 585 vpd will be generated by the proposed site with peak flows predicted to be 72 vph during the AM period and 76 vph during the PM period.

7.3. Road Hierarchy Vs Total Predicted Flows

A comparison of flows against the maximum desirable flows under the MRWA Functional Criteria / Liveable Neighbourhoods Guidelines indicate the following:

- GEH is an Primary Distributor Road and can carry up to 15,000 vpd;
- Brand Highway is an Primary Distributor Road and can carry up to 15,000 vpd; and
- Muchea East Road is a Regional Distributor Road and can carry in excess of 100 vpd.

When the guidelines are compared to the total predicted daily traffic volumes it indicates that the generated volumes can be accommodated within the current road configuration.

7.4. Impact on Intersections

The resultant increase in traffic generated by the site is expected to have minimal impact on the adjacent signalised intersection and it is expected that a decrease in traffic volumes will be experienced once construction of the Northlink road is complete.

7.5. Access Movements

The Australian Standard AS289.1:2004 recommends a gradient of 1 in 20 for vehicle crossovers and a review of the site suggests that this is achievable. Additionally vehicle crossovers will need to be sealed and constructed in accordance the Shire of Chittering requirements.

The exact location of site vehicle crossovers are not known at this stage however it is assumed that vehicle crossovers will be required for frontage along Brand Highway and GNH.

The existing vehicle crossover is located adjacent to the southern boundary of the site and is a full movement crossover. It is expected that this access will remain in place and be upgraded as part of any new development. Additional vehicle crossovers such as that proposed for frontage along Brand Highway will facilitate a left out movement only as shown in **Figure 10** and will need to be negotiated with MRWA.

Preliminary advice from MRWA regarding their access strategy for the site indicates that they would not support an additional access point.

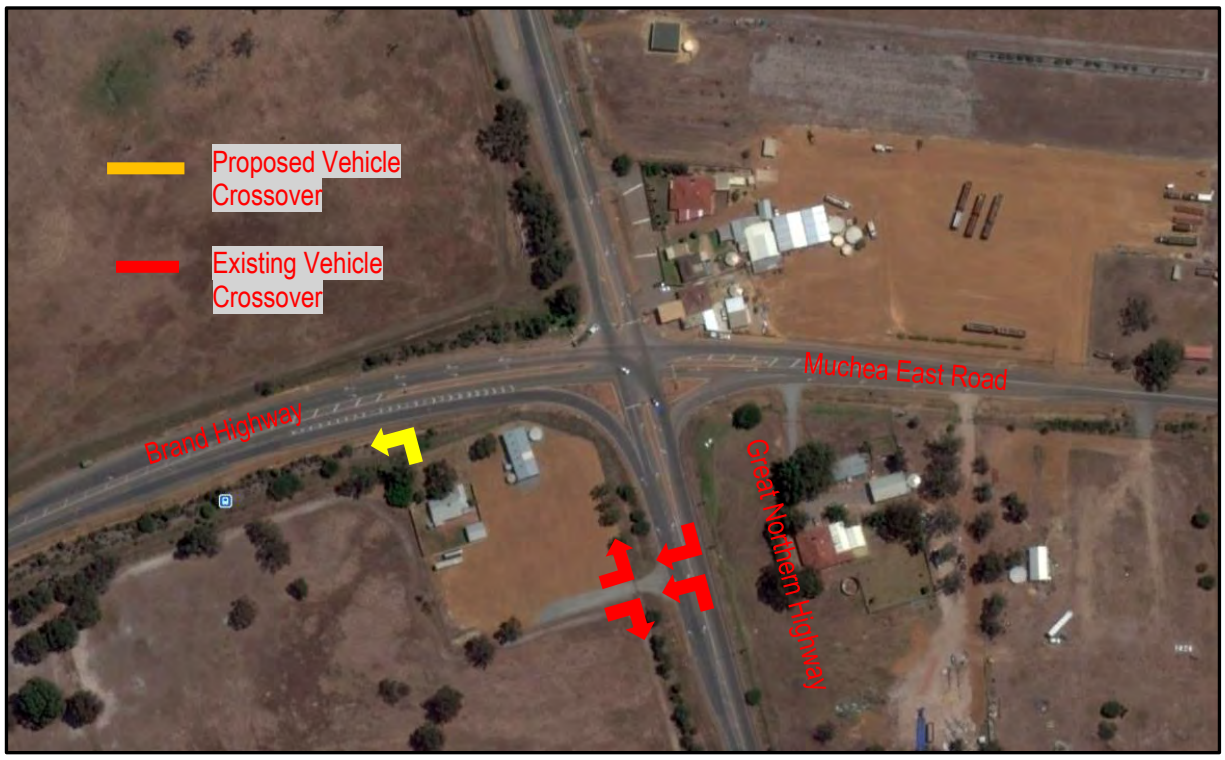

Figure 10 - Proposed Vehicle Crossover Locations

8. Conclusions

With respect to the rezoning application, the following is concluded;

- Under the development scenario the predicted generation from the site is 582 vehicles per day with an AM of 72 vph and a PM peak of 76 vph which is expected to be accommodated within the current road network;
- The existing vehicle crossover is expected to remain in place and be upgraded as part of any new development;
- Additional vehicle crossovers such as that proposed for frontage along Brand Highway will facilitate a left out movement only and is subject to MRWA approval; and
- All new vehicle crossovers will need to be negotiated with MRWA once a development application is made.

Appendix A – Traffic Counts

Weekly Volume by Hour

Traffic Flow:	**Directional**	Road Name:	**Great Northern Hwy (H006)**
Site No:	**6162**	Location Description:	**N of Wandena Rd (SLK 32.73)**
Date Range:	**04 Nov 2014 to 08 Nov 2014**	Count Type:	**Classification Counts**

Average Vehicle Volume																		
Hour	Mon		Tue		Wed		Thu		Fri		Sat		Sun		Mon - Fri		Mon - Sun	
	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
0000			30	17	8	12	10	42	16	28	23	28			16	25	16	25
0100			22	12	11	27	26	55	12	16	22	20			18	28	18	28
0200			10	35	12	33	1	49	9	15	10	19			8	33	8	33
0300			49	26	26	19	12	74	21	25	28	20			27	36	27	36
0400			100	38	85	57	69	59	54	46	77	23			77	50	77	50
0500			191	139	183	147	150	144	143	139	102	60			167	142	167	142
0600			287	196	304	228	253	213	203	179	129	95			262	204	262	204
0700			262	218	263	245	248	244	229	205	167	143			251	228	251	228
0800			239	254	211	293	235	241	207	303	207	198			223	273	223	273
0900			219	214	220	200	252	236	205	220	198	218			224	218	224	218
1000			216	207	207	217	173	196	232	247	242	231			207	217	207	217
1100			163	230	243	191	190	215	213	236	225	236			202	218	202	218
1200			178	165	189	163	181	183	191	255	266	171			185	192	185	192
1300			170	169	189	203	192	232	204	233	216	176			189	209	189	209
1400			190	203	182	218	221	278	241	281	196	186			209	245	209	245
1500			210	216	226	243	264	290	265	286	224	191			241	259	241	259
1600			227	231	227	246	253	287	303	271	162	191			253	259	253	259
1700			249	169	244	197	290	208	340	211	149	165			281	196	281	196
1800			248	139	204	135	214	143	260	183	118	122			232	150	232	150
1900			168	70	149	89	163	96	163	122	84	94			161	94	161	94
2000			99	65	85	54	90	70	121	83	61	74			99	68	99	68
2100			92	43	70	34	95	37	94	71	45	43			88	46	88	46
2200			46	48	67	31	39	19	75	50	30	27			57	37	57	37
2300			20	18	35	30	31	24	42	25	34	21			32	24	32	24
Total			3685	3122	3640	3312	3652	3635	3843	3730	3015	2752			3709	3451	3709	3451

Figure 11 - Traffic Counts - GNH North of Wandena Road (SLK 32.73) Directional

Weekly Volume by Hour

Traffic Flow:	**Directional**	Road Name:	**Brand Hwy (H004)**
Site No:	**6844**	Location Description:	**West of Great Northern Hwy (SLK 0.01)**
Date Range:	**13 May 2015 to 26 May 2015**	Count Type:	**Classification Counts**

Average Vehicle Volume																		
Hour	Mon		Tue		Wed		Thu		Fri		Sat		Sun		Mon - Fri		Mon - Sun	
	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W
0000	4	4	10	9	8	5	10	7	8	4	10	6	11	7	8	6	9	6
0100	5	6	4	4	6	5	5	4	9	5	8	5	8	2	6	5	6	4
0200	10	4	5	5	4	6	10	7	6	5	5	4	4	4	7	5	6	5
0300	2	7	8	9	8	8	8	4	8	6	7	12	4	4	7	7	6	7
0400	19	28	21	28	25	24	26	26	22	32	15	18	4	11	23	28	19	24
0500	40	67	51	68	52	73	43	70	35	59	20	36	12	26	44	67	36	57
0600	74	125	83	120	71	125	70	126	80	127	30	45	17	29	76	125	61	100
0700	109	121	92	126	104	120	105	121	114	110	63	67	52	79	105	120	91	106
0800	119	116	116	126	114	134	118	115	121	118	82	143	47	121	118	122	102	125
0900	110	149	110	124	107	122	109	120	123	130	103	118	77	157	112	129	106	131
1000	101	119	116	122	107	113	108	99	112	133	147	129	147	164	109	117	120	126
1100	98	123	112	114	101	115	107	112	116	127	121	118	119	172	107	118	111	126
1200	131	133	93	119	96	94	103	104	142	123	104	116	150	150	113	115	117	120
1300	119	108	122	122	109	98	132	111	159	118	107	103	205	110	128	111	136	110
1400	139	114	129	105	143	109	149	108	148	102	114	106	221	121	142	108	149	109
1500	151	134	150	127	176	124	156	127	153	137	105	85	181	100	157	130	153	119
1600	153	124	168	163	173	146	165	126	162	144	103	66	134	100	164	141	151	124
1700	127	105	154	126	115	107	154	131	160	148	88	83	131	84	142	123	133	112
1800	80	82	104	89	80	87	87	82	104	120	57	43	86	53	91	92	85	79
1900	42	45	58	50	51	51	55	59	72	63	36	29	47	27	56	54	52	46
2000	31	32	28	32	33	40	39	38	46	52	31	17	29	27	35	39	34	34
2100	19	28	20	19	18	29	19	25	52	25	30	21	19	14	26	25	25	23
2200	12	12	13	14	16	18	8	18	25	21	19	21	7	11	15	17	14	16
2300	10	12	7	7	8	10	10	11	15	14	13	9	6	8	10	11	10	10
Total	1705	1798	1774	1828	1725	1763	1796	1751	1992	1923	1418	1400	1718	1581	1801	1815	1732	1719

Figure 12 - Traffic Counts Brand Highway West of GNH (SLK 0.01) Directional

Weekly Volume by Hour

Traffic Flow:	**Directional**	Road Name:	**Muchea East Rd (5020004)**
Site No:	**15992**	Location Description:	**East of Great Northern Hwy (SLK 8.68)**
Date Range:	**24 Jun 2014 to 08 Jul 2014**	Count Type:	**Classification Counts**

Average Vehicle Volume																		
Hour	Mon		Tue		Wed		Thu		Fri		Sat		Sun		Mon - Fri		Mon - Sun	
	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W
0000	1	0	3	3	3	1	2	0	1	0	7	6	3	2	2	1	3	2
0100	0	0	1	0	0	0	1	0	0	1	5	5	2	1	0	0	1	1
0200	6	0	0	0	1	0	1	0	1	1	0	0	3	4	2	0	2	1
0300	2	0	9	2	2	1	0	2	5	0	1	1	0	2	4	1	3	1
0400	2	3	4	5	3	5	1	4	1	2	0	1	1	1	2	4	2	3
0500	2	5	7	10	12	12	5	5	6	5	3	3	3	4	6	7	5	6
0600	12	21	33	31	11	25	13	27	13	19	4	8	3	3	16	25	13	19
0700	55	34	65	51	33	34	25	33	18	31	11	12	12	14	39	37	31	30
0800	64	39	65	46	41	46	25	30	25	33	21	48	19	22	44	39	37	38
0900	29	44	42	48	23	39	20	24	27	29	33	27	38	31	28	37	30	35
1000	39	54	30	44	27	25	23	22	36	28	56	34	52	49	31	35	38	37
1100	33	43	31	56	22	25	23	27	31	27	37	34	46	48	28	36	32	37
1200	32	42	26	54	27	24	23	28	26	34	38	39	51	52	27	36	32	39
1300	40	51	26	34	24	26	28	23	26	35	40	29	39	54	29	34	32	36
1400	54	47	32	32	33	31	30	31	34	40	28	28	44	54	37	36	36	38
1500	44	50	34	38	31	39	24	29	31	49	31	30	35	50	33	41	33	41
1600	58	52	38	46	37	28	43	38	32	26	19	26	35	35	42	38	37	36
1700	54	45	49	42	31	19	40	35	29	35	24	24	25	34	41	35	36	33
1800	40	48	28	15	18	18	16	14	23	22	23	20	16	14	25	23	23	22
1900	16	17	19	7	10	7	20	11	20	9	16	14	7	8	17	10	15	10
2000	13	11	7	4	9	5	5	11	14	12	6	4	6	9	10	9	9	8
2100	6	5	5	12	8	5	3	2	15	12	7	7	6	3	7	7	7	7
2200	6	4	4	3	9	5	1	1	1	3	4	5	3	4	4	3	4	4
2300	5	4	2	2	4	2	2	1	3	2	3	5	2	3	3	2	3	3
Total	613	619	560	585	419	422	374	398	418	455	417	410	451	501	477	496	464	487

Figure 13 - Traffic Counts Muchea East Road (SLK 8.68) Directional

PLANNING AND DEVELOPMENT ACT 2005
RESOLUTION DECIDING TO AMEND A LOCAL PLANNING SCHEME

SHIRE OF CHITTERING
TOWN PLANNING SCHEME NO. 6
AMENDMENT NO. 60

RESOLVED that the Council, in pursuance of Section 72 of the Planning and Development Act 2005, amend the above local planning scheme by:

1. Reclassifying Lot M1606 Great Northern Highway, Muchea from "Agricultural Resource" to "Light Industry" and amending the Scheme Map accordingly.

3. Insert description of land 'No.2' within "Schedule 15 – Muchea Employment Node Special Control Area", into the Scheme as follows:

NO	DESCRIPTION OF LAND	CONDITIONS
2	Referred to as Muchea Industrial Precinct 3 West Lot M1606 Great Northern Highway	**4.5 Access and Egress** Notwithstanding the provisions of Schedule 2 – Zoning Table, access and egress where required from a major regional road must comply with Main Roads standards and requirements. Where lots are unable to comply with such standards, at the time of development, land uses shall be generally limited to the following: the following land uses are treated as 'P' use: – Storage – Warehouse – Landscape Supplies – Lunch Bar – Motor Vehicle Repair – Motor Vehicle, Boat and Caravan Sales – Open Air Display Properties with more than one road frontage shall have 'Showroom' as an additional 'P' use. All other 'P' uses listed in Table 2 in the 'Light

		Industrial' zone are treated as 'D' uses under the scheme. Uses listed as 'D' and 'A' in Table 2 in the 'Light Industrial' zone are unchanged. **4.6 Landscaping** In connection with any application for approval to commence development in any industrial zone, the Council shall require that such landscaping be provided as the Council sees fit in the interest of amenity and orderly and proper planning. Any landscaping required shall be provided in accordance with the provisions set out hereunder: a) The required landscaping shall cover a minimum of 10% of the total site area in a form approved by the Council. Such landscaping should include a landscaped area of not less than 3 metres wide adjoining all street boundaries; b) any landscaped area shall be separated from an adjacent vehicular area by a wall or kerb at least 150mm higher than the adjacent vehicular area or in some other manner be protected from vehicular damage; and c) Landscaped areas required by this policy shall be planted in accordance with an approved plan, and within 30 days of practical completion of the development, or any relevant part thereof, as determined by the Council or at such later time as may be agreed in writing by the Council.

The Amendment is standard under the provisions of the *Planning and Development (Local Planning Schemes) Regulations 2015* for the following reasons:

- The proposal is an amendment that is in line with reports given due regard for the future development of the area.

ADOPTION

Adopted by resolution of the Council of the Shire of Chittering at the Ordinary meeting of the Council held on the _____ day of _____ 2016.

_____
MAYOR

_____
CHIEF EXECUTIVE OFFICER

FINAL APPROVAL

Adopted for Final Approval by resolution of the Council of the Shire of Chittering on the _____

_____ day of _____ 2016 and the Common Seal of the Shire of

Chittering was hereunto affixed by the authority of a resolution of the Council in the presence of:

_____
MAYOR

_____
CHIEF EXECUTIVE OFFICER

Recommended/Submitted for Final Approval

_____
Delegated under S.16
of the PD Act 2005

_____
Date

Final Approval Granted

_____
Minister for Planning

_____
Date

Consultation for the Scheme Amendment was carried out in accordance with the *Planning and Development (Local Planning Scheme) Regulations 2015*.

Agency Submissions			
Submitter	**Comment**	**Proponent Response**	**Shire Officer Response**
Department of Environment Regulation	DER has no comment on the amendment in reference to regulatory responsibilities under the *Environment Protection Act 1986* and the *Contaminated Sites Act 2003.*	Not required.	Noted.
Department of Water	Assessed – no comments made		Noted.
Ellen Brockman Integrated Catchment Group	The Ellen Brockman Integrated Catchment Group has reviewed the above proposal and make the following comments: • The site has been used as a transport depot/light industrial area for over four decades and has had non-conforming use for much of that time. Formalisation of the planning status of this site is eminently sensible. • The Storm Water Management Strategy by JDA Hydrologists shows good understanding of the complexities of the Ellen Brook Palusplain and the water table level fluctuations. Based on the recommendation to monitor the bore to assess the water table during the winter of 2016 the Catchment Group would expect that at development approval the final design of the water disposal swale will reflect the findings of the monitoring report. • The amendment to the Local Planning Scheme fails to mention the Special Control Area but adheres to the principles of protection of the Ellen Brook as required.	• In accordance with the comments made the final design of the water disposal swale, at the planning approval stage, will be consistent with the findings of the winter 2016 water monitoring report. • The Amendment to the Local Planning Scheme has been updated to make mention of the Special Control Area (SCA) and the scheme amendments adherence to the SCA's principles of protection.	• Noted. • Noted. Proponent's response is noted.
Public Submissions			
Nil	•		