Stage 2 Site Investigation Report

Chapman, Section 45, Block 1 MU - Stage 2 SIR

50517005

Prepared for
Land Development Agency (LDA)

8th May 2017

Cardno
Shaping the Future

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03	08/09/16	Final Report	CA	JPS
04	20/03/17	Updated Layout - Final	CA	JPS
05	19/04/17	Updated Bushfire Report	CA	JPS
06	08/05/17	Final	CA	JPS

Buyers are required to undertake their own assessments of the site prior to purchasing the block or forwarding a Development Application with the Environment, Planning and Sustainable Development Directorate (EPSDD).

Executive Summary

Cardno has been engaged by the Land Development Agency (LDA) to undertake a Stage 2 Site Investigation Report (SIR) of the proposed development of a subdivided part of Block 1 Section 45 – Chapman. The purpose of the SIR is to assess the condition of the site for the information of the LDA and potential buyers. It is understood that the site is intended to be subdivided into a separate community facilities block not considered by this report (northern portion) and a modern medium density (multi-unit) housing development forming the subject of this report (southern portion). To distinguish between two site investigation reports undertaken for the subject block, this site investigation report is identified as MU for the proposed multi-unit site.

The multi-unit development of Block 1, Section 45 - Chapman, referred to herein as the subject site, is currently undeveloped. The subject site consists of dryland grass coverage consistent with typical undeveloped sites in the region. Approximately twenty trees are within or in close proximity to the subject site varying in quality from excellent to poor. Two of the twenty trees are regulated. The site gradually slopes from the south west corner of the block toward the Darwinia Terrace / Kathner Street intersection at grades between 3 and 5%. Existing swales are present through the subject site directing overland flows from upstream blocks such as Block 1, Section 46 and Block 2, Section 45.

Existing services information was obtained from service authority asset data, WAE information of the site and prescribed studies, which includes stormwater drainage, sewerage, water, telecommunications, electricity, gas, trees, service easement locations and other relevant information.

This report provides a preliminary investigation of the following existing conditions:

- Investigation of the following existing services:
  - Sewerage
  - Water
  - Stormwater Drainage
  - Overland Flows
  - Telecommunications
  - Gas Supply
  - Electrical and Street lighting
  - Easement and Setbacks
  - Verge works
  - Traffic, Parking and Access
  - Vegetation
  - Heritage
  - Environmental
  - ACTION Bus Routes
- Literature review of the following specialist investigations:
  - Tree Assessment Report; Redbox Design Group (July 2016)
  - Preliminary Environmental/Ecological Assessment; Robert Jessop (April 2013)
  - Bushfire Risk and Compliance Assessment; Bushfire Protection Planning & Assessment Services (April 2017)
  - Site Investigation Report, Block 1, Section 45, Chapman; Mott MacDonald Hughes Trueman (July 2012)
  - Overland Flow Investigations and Options Studies; Mott MacDonald Hughes Trueman (December 2012 to March 2014)
- Opportunities and Constraints
- Recommendations
- Drawings of Existing and Proposed Site Servicing

The proposed development site is not currently serviced by water, sewer or stormwater ties and will require new service ties constructed to the subject site. Communications and electrical mains are confirmed to have capacity in the network to service the subject site. The existing stormwater infrastructure will also require upgrade to manage overland flows currently entering the subject site from the south.

The water services will require a new tie and approximately three additional hydrants to satisfy the F5 fire risk rating spacing requirement of 60m.

A new sewer tie and main will be required to be constructed to the proposed development from the existing sewer infrastructure located in the south western corner of the Kathner Street and Darwinia Terrace Intersection.

Telstra is supportive of the development and will require a minor network upgrade to accommodate the proposed development. The existing 20mm diameter Telstra service will require an upgrade to 100mm diameter.

Advice from ActewAGL is that the existing substation south west of the site will be suitable for use by the development. This is on the condition that the point of entry to the site is relatively close to the south west corner of the subject site.

iinet did not raise any concerns for the development and NBN is not currently available within the area.

A tree assessment undertaken by Redbox Design Group (2016) indicates that 20 trees have been identified within or adjacent the sites, of which 2 are regulated. Several of the trees identified are of excellent quality and will require close consultation with the Conservator/TCCS to ensure DA consent is granted swiftly.

The traffic parking and access studies undertaken by Cardno within this report indicates the following:

- Vehicle access can be achieved from Darwinia Terrace with minimal affect expected to the surrounding roads network.
- Vehicle access from Darwinia Terrace will be required as a minimum for emergency vehicles (unlocked gate) to allow adequate access/egress routes from the proposed development during bushfire management / evacuation.
- Existing bus stops are in close proximity to the site, however, pedestrian access to local bus stops and pedestrian infrastructure would be via existing grassed verges. Any path network upgrade would need to be undertaken in close consultation with TCCS and EPSDD.

A Phase 1 Environmental Site Assessment has been undertaken by Coffey Environmental in 2012 and a Preliminary Environmental/Ecological Assessment was prepared by Robert Jessop in 2012. Neither report has identified any environmental or ecological issues with the site beyond the presence of existing registered trees.

This site investigation report is for information only. Buyers are required to undertake their own assessments of the site prior to forwarding a Development Application with EPSDD.

Recommendations

Based on the findings of this investigation the following recommendations are made and should be undertaken:

1. Establish a final layout based on the findings of this report and the recommendations provided within the Bushfire Risk and Compliance Assessment; Bushfire Protection Planning & Assessment Services (April 2017). An updated bushfire risk assessment may be required by EPSDD during the final design of the internal proposed development to ensure compliance with ACT Fire and Rescue requirements.
2. Commence consultation with EPSDD in relation to subdivision of the subject block.
3. Undertake detailed geotechnical analyses of the subject site to ascertain detailed subsurface strata information and development constraints.
4. Construct an extension to the existing sewer network within the eastern verge of Darwinia Terrace and a tie to the proposed new block boundary.
5. Construct an extension to the existing stormwater network within the eastern verge of Darwinia Terrace, tie to the proposed new block boundary and associated block/verge earthworks (as indicated on **Drawing 50517005 – SK02)**. This is to be undertaken in close consultation with TCCS/EPSDD to maintain developable area of block by removing overland flows from subject site boundaries.
6. Confirm final fire rating of F5 with ACT Fire Rescue once the final development layout, materials etc. are established.
7. Construct required upgrades to existing water network in accordance with requirements established by the abovementioned fire rating to be confirmed with ACT Fire Rescue.
8. Construct a new water service tie to the subject site and install additional hydrants internally and externally as indicated on **Drawing 50517005 – SK02**. This to be undertaken in consultation with EPSDD, ACT Fire Risk and ICON Water.
9. Prior to DA, liaise with ActewAGL during detailed design and submit a Request for Preliminary Network Advice (PNA) to determine the specific requirements for connection to the site by underground supply.
10. The developer will be responsible to provide 1XP100 to the property boundary to facilitate connection to the Telstra network. These conduits must have access to MDF(s) in each building in each area and be reserved for Telstra's exclusive use. All existing Telstra network infrastructure will need to be protected / recovered prior to commencement of hazardous activity. Liaison with Telstra Network Integrity will be required through the re-development of the block and the developer will be required to register the development on the Telstra Smart Community website, for connection purposes.
11. Determine the extent of affected trees on site and liaise with the TCCS Tree Protection Unit and the Conservator regarding the removal of all trees affected by the development. Removal of regulated trees if proposed will require significant justification.
12. Investigate and confirm the suitability of the proposed site access points proposed prior to undertaking detailed design, especially for the southern driveway in close proximity to the existing power pole.
13. Establish key preferred WSUD measures early in the design process to ensure ease of design and subsequent approvals with TCCS/EPSDD.
14. Establish connectivity to existing pedestrian network through construction of footpaths and associated infrastructure to the extent determined in consultation with TCCS/EPSDD.
15. The proposed development shall incorporate external materials and design in accordance with Sections 3 & 5 of AS3959 Construction of buildings in bushfire-prone areas (BAL-12.5 requirements).

    AS3959 Table 3.1 (Bushfire Attack Levels & Corresponding Sections for Specific Construction Requirements) describes the predicted bushfire attack and levels of exposure as 'Ember Attack' only for a building within 100m of classified vegetation and heat flux exposure thresholds ≤12.5 kW/m .

Ember attack is described as attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.

AS3959 BAL-12.5 is primarily concerned with protection from ember attack and radiant heat up to and including 12.5 kW/m2 where the site is less than 100 m from the source of bushfire attack.

Effectively, a building constructed to AS3959 Sections 3 & 5 (BAL-12.5) is designed and maintained to ensure airborne and/or wind driven burning embers or debris (>2mm in size / width) emanating from a bushfire or grassfire event cannot enter the structure when reasonably secured.

16. The entire area of the proposed development site shall be identified and maintained as an APZ in accordance with the ACT Bushfire Management Standards – ACT Strategic Bushfire Management Plan Version 3 (2014). This also includes the proposed northern portion of the subdivided subject site until such time it is formally developed.

    Vegetation and landscape management for APZ compliance should consider the principals of the document Landscape and Building Design for Bushfire Areas, by Caird Ramsay and Lisle Rudolph published November 2003.

17. Any vegetation landscaping to be retained or re-introduced as part of the proposed development shall ensure any readily combustible dry garden mulching and/or plantings are minimised within the proposed development site, or else should be entirely excluded.

18. Any internal landscaping shall ensure any readily combustible dry garden mulching and/or plantings are separated away from the proposed building lines by at least 2m.

19. Any internal landscaping shall ensure trees planted directly adjacent to the internal roadway area does not significantly overhang or obstruct the access of larger vehicle's entering the proposed development site. Any overhanging vegetation shall be maintained to ensure a minimum height of 4.2m above the road at all times.

20. Any internal landscaping shall ensure only fire retardant trees are reintroduced as part of the proposed development. Fire retardant plants for the ACT are listed by the Yarralumla nursery-Garden Advice series 2.

21. All internal vehicle access roadway sections shall have a minimum carriageway width of 6m or else the proposed internal roadway and verge area shall facilitate an unobstructed and trafficable width of at least 6m at all times. The minimum inner radius of any roadway bend shall be ≥6m and any identified parking spaces.

22. Any gating or obstacles for traffic or pedestrian management or calming shall be designed to ensure firefighting and emergency services vehicles can safely pass through, over or remove / open the traffic management obstacle at all times. Emergency access gating used to control traffic flow during non-emergency periods shall not be locked

23. The proposed internal vehicle access roadway shall have a carrying capacity of at least 30 tonnes in anticipation of a standard ACTFR aerial appliance seeking to access and operate within the proposed development site.

24. The proposed development and associated internal roadway access section shall be clearly signposted at the entry point from Darwinia Terrace to identify the proposed development site and that access to Percy Drive is not provided through the site.

25. All new electrical/communication lines to service the proposed development shall be located underground.

26. All external / exposed water and gas supply pipes supplying the subject development shall be metal.

27. At least one additional hydrant connection point should be located centrally within the subject development site and not within a road carriageway or designated parking space / area. The recommended location would be preferably between proposed unit dwelling groups 4 & 5, and accessible for unit dwelling groups 1 & 2.

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Appendices

Figures

1 Introduction

Cardno has been engaged by the Land Development Agency (LDA) to undertake a Stage 2 Site Investigation for a subdivided portion of Block 1, Section 45, Chapman. Refer to **Figure 1-1** below for a locality plan with the subject site highlighted in yellow.

The purpose of the site investigation is to assess the condition of the site for information to the LDA and potential buyers. It is understood that the site is intended to be developed to provide the area with an additional 29, two bedroom residential housing dwellings of medium density.

The report identifies opportunities, constraints and required works, on and off site, and includes recommendations of works to be undertaken post sale.

A detailed scope of works is listed in **Section 3**, which is generally in accordance with the LDA Standard Stage 2 Site Investigation Report Template as well as project specific LDA directions.

Figure 1-1 Aerial View of the Site (2016 photography)

2 Land Use and Planning Framework

2.1 Overview

The existing Block 1 Section 45 Chapman occupies an area of 14,096m^2 as listed on ACTmapi, the area of the block to be utilised for the proposed development site is approximately 11,399m^2. The site is surrounded from the north by Kathner Street, the east by Darwinia Terrace, Percy Crescent to the West and Block 2 Section 46 to the south.

The surrounding infrastructure and lands within the area consist of low density residential developments to the west and east of the subject site (RZ1: Urban).

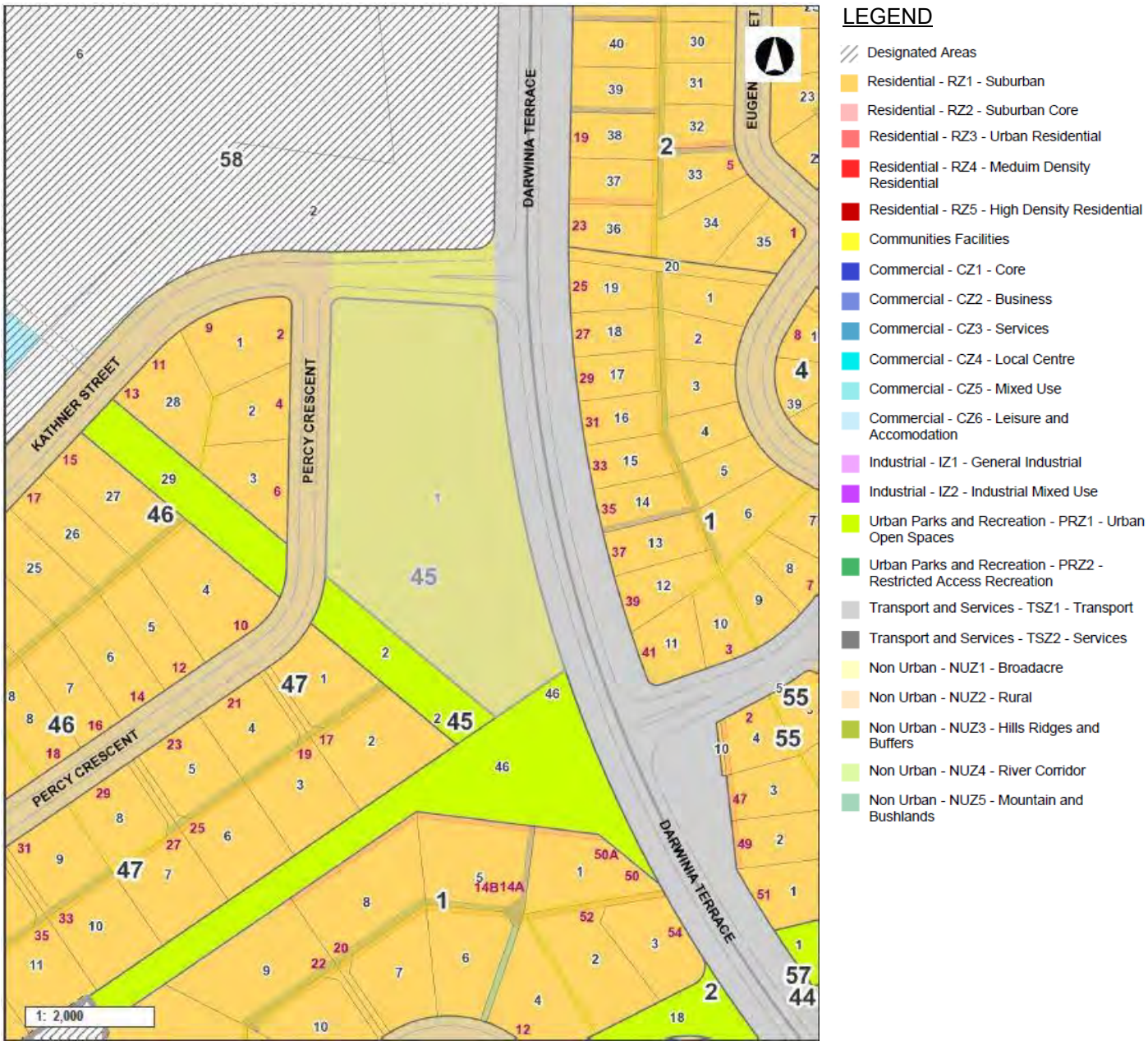
To the north of the site beyond Kathner Street lies managed rural grassland lands zoned as DES: Designated. The future development of these lands are not currently nominated by EPSDD.

The existing Block 2 Section 45 and Block 1 Section 46 to the south of the subject site are zoned as PRZ1: Urban Open Space. Due to the presence of twin 900mm reservoir distribution/transport water mains and overland flows occurring during major rainfall events within these blocks, they are expected to remain as PRZ1: Urban Open Space for the foreseeable future.

The subject site is currently zoned as CF: Community Facilities.

For reference, the land use zoning prior to any variation of zoning is presented in **Figure 2-1** below.

Figure 2-1 Territory Plan Land Use Zoning



2.2 Proposed Development

As understood from the LDA, there are two developments proposed on Block 1 Section 45; a 29 unit, 2 bedroom development and a separate community facility site to the north. This report will focus on the 29 unit 2 bedroom proposed development and the associated proposed services calculations assumed, herein. The works required to develop the community facility site to the north of the subject site is excluded from this report.

A draft layout has been provided for the proposed development. Refer to **Figure 2-2** for the proposed development's draft layout.

Figure 2-2 Section 45 Block 1 Draft Layout

3 Investigation Scope

This report provides a preliminary investigation of the following existing conditions:

- Investigation of the following existing services:
  - Sewerage
  - Water
  - Stormwater Drainage
  - Overland Flows
  - Telecommunications
  - Gas Supply
  - Electrical and Street lighting
  - Easement and Setbacks
  - Verge works
  - Traffic, Parking and Access
  - Vegetation
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- Literature review of the following specialist investigations:
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4 Site Description

The subject site of Block 1 Section 45 is located on Percy Crescent within the Suburb of Chapman approximately 3km north west of the local Chapman Shopping Centre and Primary School.

The subject site is currently undeveloped and occupies an approximate area of 11,400sqm of Block 1 Section 45 Chapman. The surface of the site is covered by dryland grass with few trees clustered generally towards the centre of the site. A registered tree of the species Eucalyptus Polyanthemos (#PTR104) is located in the centre of the site with smaller unregistered tree clusters extending along the north to south axis of the site with some outliers.

The current site is located in an area generally surrounded by low density residential development (RZ1) with managed rural grasslands to the north and PRZ1: Urban Open Space to the south consisting of important stormwater and bulk water easements that are unlikely to be rezoned/developed further in future.

Interpretation of the 2004 aerial survey contours available from ACTmapi indicates that consistent falls across the site are towards the north east corner of the block and suggest areas to the south of the block may need to be protected from overland flows. Grades of the subject site range between 3 and 5%. These grades and general contours were reflected on site during our investigations.

Current aerial photography and photos of the site show the site's current layout and features (refer to **Figure 4-1** and **Appendix B**).

Figure 4-1 Current Condition of the Site (ACTMAPI April 2016 photography)

5 Existing Site Servicing

5.1 General

A detailed summary of the existing services information has been completed for the proposed development. The detailed analysis includes Dial Before You Dig (DBYD) enquiries, WAE records, correspondence with service authorities and visual site inspections.

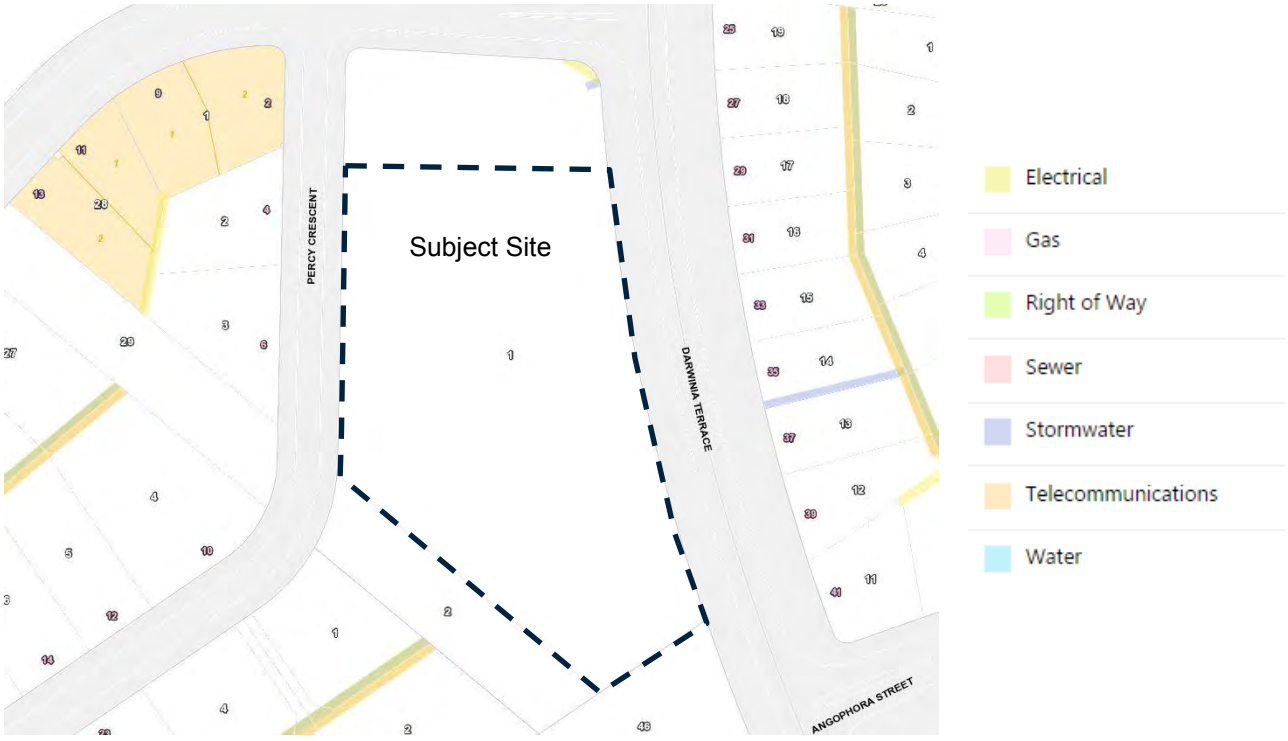
The existing service information has been compiled from available documentation obtained from site inspections, information from service providers and the prescribed literature outlined in **Section 3**. The details, dimensions and alignments of existing services included in this report should be treated as indicative only and the accuracy of the information cannot be warranted. All services must be accurately located on site prior to any development proceeding.

All existing services described under this section are depicted on the drawings within **Appendix A** and all relevant correspondence with service authorities including DBYD is included within **Appendix C**.

5.2 Easements

Review of the ACTmapi database indicates there are no easements within the proposed development areas (refer to **Figure 5-1**).

Figure 5-1 Easements for the Development Site



5.3 Sewer

The existing sewer service information compiled from DBYD information and consultation with ICON Water indicates the following:

- A DN100 sewer tie currently services Block 1 Section 45 from the north eastern corner of the block. The sewer tie is connected to a DN150 sewer main within the southern verge of Kathner Street. This tie is outside of the proposed subject site boundary and is therefore not suitable for use by the proposed development.
- The DN150 sewer main in the southern verge of Kathner Street to the north of the subject site. The sewer main deflects through a manhole northward along the eastern verge of Darwinia Terrace.

- A DN150 sewer main is located along the western verge of Percy Crescent. This connects to the DN150 sewer main in the southern verge of Kathner Street.
- A DN150 sewer main runs along the southern boundary of the subject site within Block 2, Section 45. This connects to the DN150 sewer main in the western verge of Percy Crescent.

Refer to drawing **50517005-SK01** within **Appendix A**, which details the existing sewer services.

5.4 Potable Water

The existing water supply service information compiled from DBYD information and consultation with ICON Water indicates the following:

- There is currently a DN20 tie servicing Block 1 Section 45 in the north western corner of the block. This tie is outside of the proposed subject site boundary and is therefore not suitable for use by the proposed development.
- The existing tie connects to a DN100mm Cast Iron Concrete Lined (CICL) water main, which runs along the eastern verge of Percy Crescent. Hydrant spacing along this main is approximately 80m.
- A DN150mm CICL watermain runs along the southern boundary of the subject site within Block 2 Section 45 and Block 1 Section 46. Hydrant spacing along this main is approximately 90m.
- A DN225mm CICL watermain traverses the northern verge of Kathner Street. Hydrant spacing along this main is approximately 90m.
- A DN300mm CICL watermain was identified to run along the eastern verge of Darwinia Terrace. Hydrant spacing along this main is approximately 105m.
- Two large diameter DN900 transfer water mains providing water supply from Stromlo to Rivett exist within Block 2 Section 45.

Refer to drawing **50517005-SK01** within **Appendix A**, which details the existing potable water services.

5.5 Stormwater Drainage

Review of the ACT Stormwater database provided by Roads ACT regarding the existing stormwater infrastructure indicates the following:

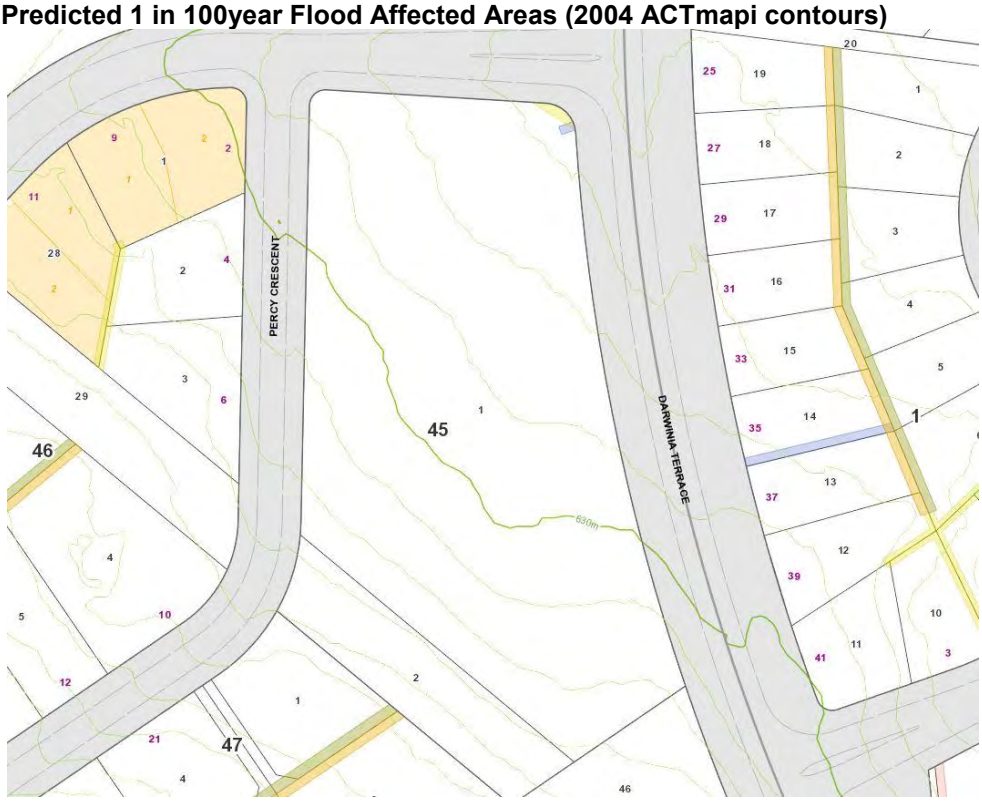
- The existing stormwater tie servicing Block 1 Section 45 is of 375mm diameter reinforced concrete pipe constructed at a grade of 6.4% and is located in the north eastern corner of the block. This tie is outside of the proposed subject site boundary and is therefore not suitable for use by the proposed development.
- Presently, overland flows from Block 1 and 2, Section 45, are directed by grassed swales towards and through the subject site northbound for capture by the existing stormwater tie to Block 1 Section 45.
- An R type sump is located in the western verge of Darwinia Terrace just south of Kathner Street intersection, which diverts stormwater north via a 450mm diameter RCP stormwater main graded at 1.5%.
- There is an existing 525 to 675mm diameter RCP stormwater main present in the southern verge of Kathner Street.
- A 300mm RCP is present in the western verge of Percy Crescent which drains northbound into the existing stormwater infrastructure in the southern verge of Kathner Street.

Refer to drawing **50517005-SK01** within **Appendix A**, which details the assumed existing stormwater services.

5.6 Flooding and Overland Flows Characteristics

Review of the ACTmapi 1 in 100 year flood map indicates that the proposed development area is not within a potential flood zone, refer to **Figure 5-2** below.

Figure 5-2 Predicted 1 in 100year Flood Affected Areas (2004 ACTmapi contours)



The site elevations in reference to the available contour information (ACTmapi 2004 contours), indicate the subject site generally falls away from the south west corner at an approximate grade of 4.5%. The overland flow paths associated with areas adjacent the subject site fall from south to north with Block 2 Section 45 and Block 1 Section 46 graded towards the subject Block. The relatively flat consistent grades demonstrated within the 2004 contours were reflected on site upon inspection.

Areas graded towards the site are presently captured by the following swales within and immediately adjacent the subject site.

- A swale is present within the northern boundary of the subject site capturing flows from the Block and directing them towards the existing stormwater tie in the north eastern corner of the Block.
- Currently a swale drain runs generally within the subject site along the western verge of Darwinia Terrace to the existing stormwater tie for the subject site. This swale captures overland flows from Block 1 Section 46 and Blocks 1 and 2 Section 45.
- An additional swale is present on the south western edge of Block 2 Section 45 which drains north west towards an existing plantation sump in the eastern verge of Percy Crescent.

Refer to drawing **50517005-SK01** within **Appendix A** detailing existing overland flow paths.

5.7 Telecommunications Services

Refer to drawing **50517005-SK01** within **Appendix A** detailing existing communication services.

Existing services information provided by the relevant telecommunications providers indicates the following:

5.7.1 Telstra

A Dial Before you Dig (DBYD) search has confirmed the following:

- A Dial Before you Dig (DBYD) search has confirmed there is an existing overhead Telstra service crossing Darwinia Terrace and entering the site via a DN20 underground conduit.
- A DN50 to DN100 Telstra conduit is present with Block 2 Section 45 along south western corner of the subject site.

5.7.2 iinet

A Dial Before you Dig (DBYD) search has confirmed the following:

- iinet infrastructure is not present in the area although a DBYD response was generated.

5.7.3 NBN

A Dial Before you Dig (DBYD) search and subsequent availability check has confirmed that NBN infrastructure is not currently available to the subject site.

5.8 Gas

The existing gas supply service information compiled from the DBYD information provided by ActewAGL/Jemena indicates the following:

- Presently a DN40, 210 kPa gas main exists in the southern verge of Kathner Street.
- A DN40 210kPa gas main is offset 0.5m from the kerb in the eastern verge of Percy Crescent. As the main heads south along Percy Crescent, it crosses the roadway and continues south along the western verge of Percy Crescent.
- A DN40 210kPa gas main is present to the south of the subject site within Block 2 Section 45 (1.5m offset from the south eastern boundary of Block 2) and within Block 1 Section 46 offset 6.5m from the southern boundary of the subject site.
- A DN63 210kPa gas main exists in the eastern verge of Darwinia Terrace.

Refer to drawing **50517005-SK05** within **Appendix A**, which details the existing gas services.

5.9 Electrical

The existing electrical supply service information compiled from the DBYD information provided by ActewAGL indicates the following:

- There is an existing overhead high voltage electrical infrastructure in the western verge of Darwinia Terrace. Low voltage street lighting overhead supply cables and outreach arms are also present on this infrastructure.
- From pole 81918 the abovementioned overhead electrical infrastructure extends north along Darwinia Terrace and east along Kathner Street.
- On pole 56648, substation A6728 is present, which being immediately adjacent the subject site may serve as the electrical connection point for the proposed development.
- The existing overhead high voltage electrical infrastructure extends along the southern boundary of the subject site through Block 1 Section 46 on a south western alignment.
- Streetlighting infrastructure exists in the northern verge of Kathner Street with underground cabling and separate/combined columns to the adjacent overhead HV poles.
- Streetlighting infrastructure is present in the eastern verge of Percy Crescent. This consists of approximately 3m high concrete pole top style street lighting columns and associated underground electrical cables approximately 2.4m offset from the subject block boundary.

Refer to drawing **50517005-SK05** within **Appendix A**, which details the existing electrical services.

5.10 Verges

The nature of the adjacent road reserves and associated verges are outlined below:

Darwinia Terrace

- The road reserve width is approximately 35m wide and is comprised of the following:

  - 10.2m wide road carriageway single lane.
  - 10.5m wide western grassed verge with kerb and gutter, no footpath is present, however a desire line exists.
  - 14m wide eastern grassed verge with kerb and gutter and a 1.2m wide footpath offset 12m from the roadway.
- The road verge is grassed with and graded towards the road on the western side.
- The eastern verge is generally poorly grassed from residential parking and grades towards the roadway.

Kathner Street

- The road reserve width is approximately 23m wide and is comprised of the following:
  - 12m wide road carriageway single lane widening towards the intersection of Darwinia Terrace.
  - 6m wide northern grassed verge with kerb and gutter, no footpath is present.
  - 5m wide southern grassed verge with kerb and gutter, no footpath is present.
- The road verge is sparsely grassed and graded towards the road on the northern and southern sides.

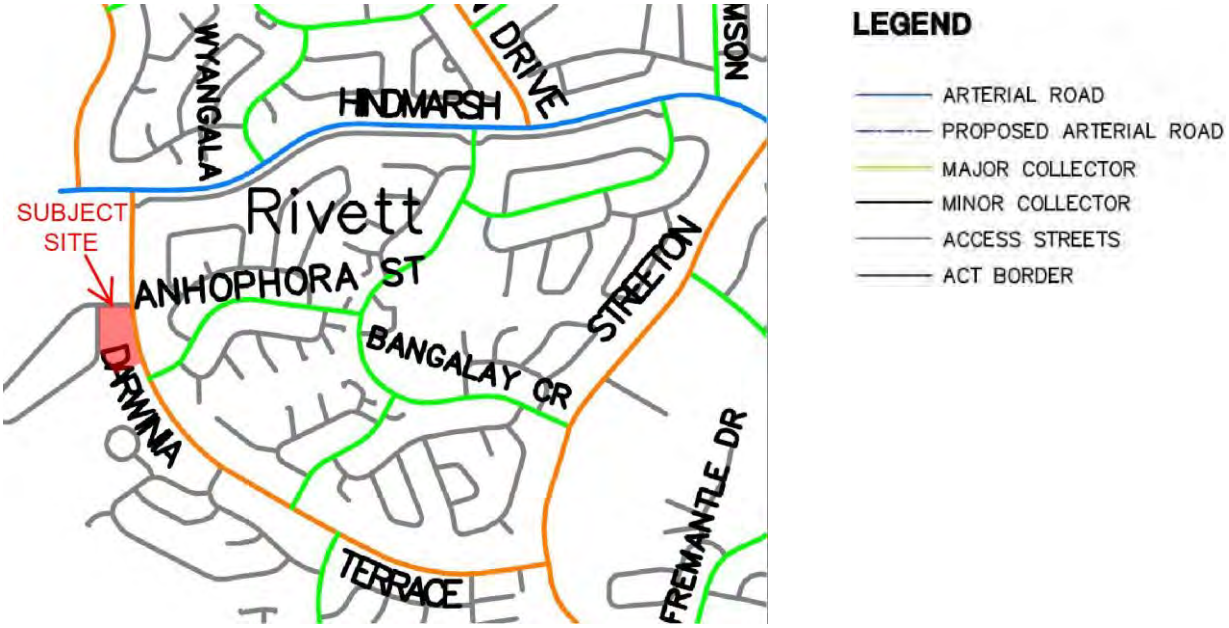
Percy Crescent

- The road reserve width is approximately 18m wide and is comprised of the following:
  - 7m wide road carriageway single lane.
  - 5.7m wide eastern grassed verge with modified layback kerb and gutter, no footpath is present.
  - 5.7m wide western verge developed individually by residents with modified layback kerb and gutter, no footpath is present.
- The road verge is graded towards the road on the western and eastern sides.

5.11 Traffic, Parking and Access

The proposed development area is located in a residential zone within 3km of the Chapman local shopping facilities / primary school and has excellent access to the arterial road network via Hindmarsh Drive. In accordance with the ACT Road Hierarchy Maps (2011) (refer to **Figure 5-3**) Darwinia Terrace is the nearest major collector road and is connected to the arterial road, Hindmarsh Drive. In addition, Kathner Street and Percy Crescent (minor collector roads) are the main roadways servicing travel to and from the site.

Figure 5-3 ACT Road Hierarchy Maps (2011)



A review of the surrounding road network infrastructure indicates there is no existing on street parking available in the immediate vicinity of the subject site.

An assessment of current midblock traffic volumes produced from EMME modelling supplied by RoadsACT indicates that during the 2031 AM peak hour, Darwinia Terrace is subject to approximately 202 vehicles headed northbound and 97 vehicles southbound. Based on our assessment of the traffic generation catchment for Percy Crescent and Kathner Street, there is not expected to be significant traffic volumes on either of these roads. Refer to Figure 5-3 below for the 2031 AM Peak Hour Strategic Model

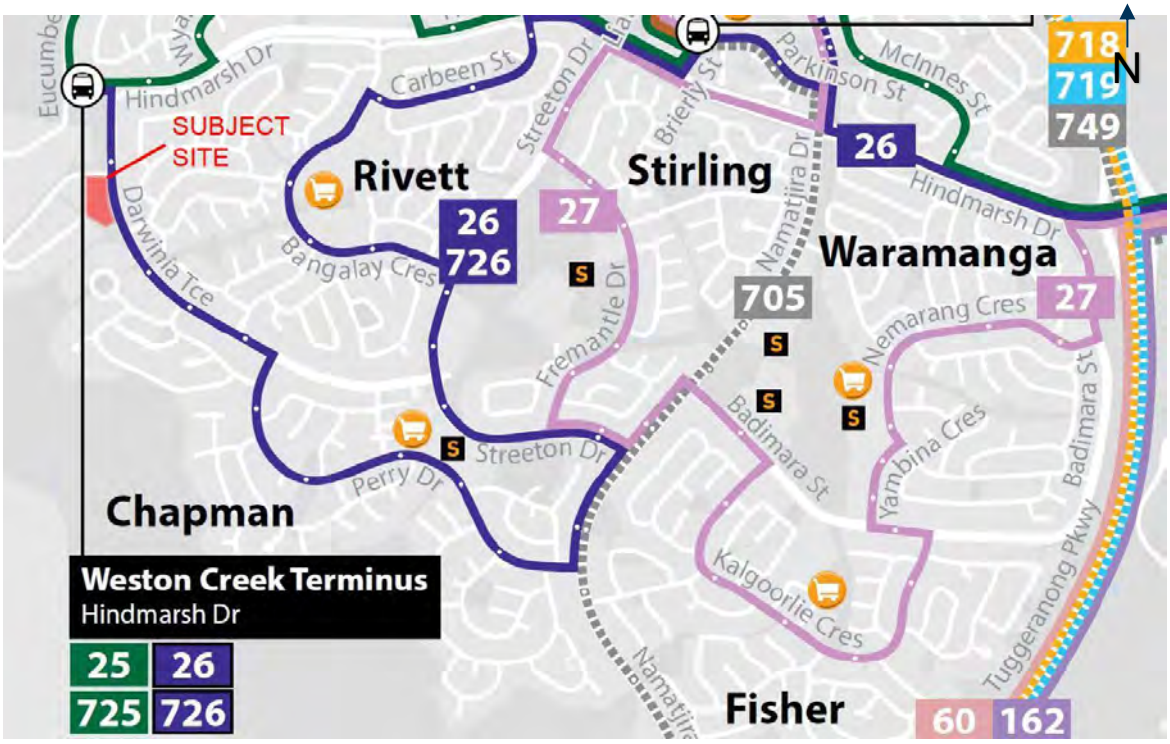
Figure 5-4 RoadsACT Strategic Model EMME 2031 AM Peak

Currently pedestrian accessibility to the subject site is limited with no footpaths or pedestrian crossings from Darwinia Terrace connecting the proposed development to nearby pedestrian infrastructure. Based on existing infrastructure, the nearest connection points to the Chapman pedestrian network would involve informal crossing of Darwinia Terrace (Major Collector) or walking 80m south along the western verge of Darwinia Terrace to the existing 1.2m wide footpath.

5.12 ACTION Bus Service

The nearest ACTION bus stop is located within the western verge of Darwinia Terrace approximately 80m north of the subject site following the existing grassed verge desire lines. Refer **Figure 5-4** below for proximity to the ACTION bus routes from the subject site.

Figure 5-5 ACTION Bus routes in close proximity to the development



5.13 Geotechnical

The following relevant geotechnical aspects are based on the Geotechnical Desktop Study dated 13th July 2012 undertaken by Coffey Geotechnics. For further geotechnical detail/analysis of the site please refer to the Coffey Geotechnics Report, Reference number – GEOFYSH09557AA.01.

The scope of the report was to establish an understanding of the following conditions:

- Likely subsurface strata.
- Likely excavation conditions
- Geotechnical constraints relevant to the potential land use
- Geotechnical factors relevant to construction

The geotechnical aspects identified from the above mentioned investigations are listed as follows:

- Review of the 1:100,000 Geology map of New South Wales and Australian Capital Territory indicated that the site would consist of a thin topsoil layer above natural clayey soils. The site is expected to be underlain by weathered volcanic rocks (Rhyodacite) of high to extremely high strength to depths unknown without further detailed geotechnical investigation.
- If Rhyodacite is encountered, an excavator size greater than 30T with a rock hammer will be required in order to excavate further. Construction of bored piers if nominated for foundation or excavation support will likely require large track mounted drilling rigs capable of significant down force and lateral restraint. Excavations with similar geology have experienced significant delays in bulk excavations due to the occurrence of high strength rock such as Rhyodacite. It is recommended that further geotechnical investigation via detailed drilling of concept layouts is undertaken if basements are proposed for the subject site.
- Coffey Geotechnics assumes that it is unlikely significant groundwater will be encountered during bulk excavations to a depth of one or even two basements although some seepage may occur. However, locally significant inflows could occur during periods of rain, particularly adjacent low points or open swales within the site.

- A complete listing of expected preliminary bearing capacities for Rhyodacite materials are listed within the below.

Footing type	Bearing Pressure (kPa)
Strip and pad footings founded within very stiff to hard extremely weathered material.	300
Strip and pad footings founded within highly weathered rock of at least very low strength.	500
Strip and pad footings founded within moderately weathered rock of at least medium strength.	1,000
Bored piles founded at least two pile diameters into extremely weathered material of hard consistency.	400 (end bearing) 20 (side adhesion[1]) 40 (side adhesion[2])
Bored piles founded at least two pile diameters into highly weathered rock of at least very low strength.	1,000 (end bearing) 100 (side adhesion)
Bored piles founded at least two pile diameters into moderately weathered rock of at least medium strength.	2,000 (end bearing) 200 (side adhesion)

[1] In natural soils, [2] in extremely weathered material.

The suitability of the above bearing pressures would need to be assessed prior to construction, following further geotechnical investigations.

Further details of requirements for construction of foundations and excavation conditions are provided within the Coffey Geotechnics Report, Reference number – GEOFYSH09557AA.01 included within **Appendix D**.

5.14 Heritage

Review of the ACTmapi Heritage Map indicates that there are no heritage listed sites within the proposed development area.

5.15 Environmental

The proposed development area is generally well grassed in the verge areas and is complimented by clusters of existing trees generally along the north to south central axis of the site with a few outliers.

Review of the ACTmapi Significant Species, Vegetation Communities and Registered Tree Map (Refer to figure 5-5 below) indicates that there are two registered trees of significance to the site, namely:

- Registered Tree PTR104: Eucalyptus Polyanthemos located in the centre of the site.
- Registered Tree PTR179: Eucalyptus Polyanthemos (Low colonisation potential and canopy connection) located on the southern boundary of the site.

Further to the above, there are no environmental offset zones, significant plants or animals or threatened plants within or immediately adjacent to the subject site.

Refer to Tree Assessment drawing **1292 Sheet 101** within **Appendix A**, which fully details the locations and quality of existing vegetation in the area.

The complete Tree Assessment report and plan showing regulated tree locations and expanding on tree quality/health was undertaken by Redbox Design Group and is attached within **Appendix D**.

Figure 5-6 Environmental Listings in the Area

5.16 Soil Condition

The following relevant soil condition aspects are based on the Phase 1 Contamination Assessment dated 11th July 2012 undertaken by Coffey Environments For further environment/contamination detail/analysis of the site please refer to the Coffey Phase 1 Contamination Assessment Report, Reference number – ENAUBRAD01190AA within the previous site investigation report undertaken by Mott MacDonald within **Appendix D**.

- Based on the review of the Dangerous goods database and dangerous substances register, there are no records of dangerous substances being stored on site.
- The Environment Protection Agency is not aware of or in possession of any contamination records for the site.
- A review of The Office of Regulatory Services Land Titles and Historical Documents database indicates the site was not historically used with potential for soil contamination.

6 Specialist Investigations

Several specialist investigations pertaining to the subject site have been undertaken prior to this site investigation. These reports have been reviewed and summarised to inform the LDA and prospective buyers. Full copies of the reports can be found in **Appendix D**.

6.1 Tree Assessment Report; Redbox Design Group (July 2016)

Redbox Design Group were engaged by Cardno to undertake tree assessment and survey of the subject site which identified and classified the trees within the proposed development areas. The report found that at the time of inspection 2 of the 20 trees present at the site were classified as being regulated under the Tree Protection Act (2005). The existing tree stock on site displayed a wide variance in quality of poor to excellent health.

Regulated trees are those that meet any of the following criteria:

- Located within leased land;
- 12m or more in height;
- Trunk circumference of 1.5m or more at 1.0m above ground level;
- Crown width of 12.0m or more; or
- Has two or more trunks and the total circumference of all the trunks is 1.5m or more at 1.0m above ground level.

As regulated trees are protected under the Act, they will require review and approval from TCCS prior to being removed from the site. While most of these trees will require removal based on the provided development footprint, it is noted that some of these trees will fall within the designated landscape areas not affecting the proposed buildings and should be incorporated into the design.

A copy of the report and plan showing regulated tree locations is attached within **Appendix D**.

6.2 Preliminary Environmental/Ecological Assessment; Robert Jessop (April 2013)

A preliminary environmental/ecological assessment report was prepared by Robert Jessop Pty Ltd for the LDA to describe the general ecological characteristics of, and identify potential ecological constraints associated with, the proposed release of Block 1 Section 45 Chapman for development.

Some information provided within this Preliminary Environmental Assessment is now superseded by the Tree Assessment Report and this Site Investigation Report. As such, only information relevant to the currently proposed development is expanded upon below.

There are no issues associated with the development that would warrant a referral under the Commonwealth EPBC Act or that would trigger the requirement for an EIS under the ACT P&D Act.

The subject site is modified by past land uses but contains mature trees likely to provide habitat for common fauna species that use tree hollows as nesting sites.

The site contains registered tree(s). The tree(s) are protected under the ACT Tree Protection Act and any proposed development would be required, subject to advice from the Conservator/TCCS who may approve tree removal, to ensure the tree was not damaged or that no prohibited activities were undertaken within the tree protection zone.

From an environmental perspective, it is recommended that development planning considers the retention of the mature hollow bearing trees and as much of the areas immediately surrounding the trees as is practicable. The trees contain important habitat for common native fauna and the areas surrounding the trees are most likely to support native grasses and forbs, and regenerating trees.

A copy of the Preliminary Environmental Assessment report is attached within **Appendix D**.

6.3 Bushfire Risk and Compliance Assessment; Bushfire Protection Planning & Assessment Services (April 2017)

Bushfire Protection Planning & Assessment Services were engaged by Cardno to undertake a bushfire risk and compliance assessment for the subject site based on the development proposed by the LDA. This report was undertaken based on the current draft layout and may require review once the final arrangement, materials, tree species, etc. are confirmed.

The report identified the subject site is within the Bushfire Prone Area (BPA) as provided by the Strategic Bushfire Management Plan shown on ACTmapi. This risk is justified by the currently densely grassed areas of land to the north of the subject site (Blocks 2 and 6 Section 58 Chapman), which are identified as DES: DESIGNATED on the territory plan. Block 2 Section 58 Chapman is currently actively managed by slashing of grasslands.

It was acknowledged that a potential and contiguous area of grassland may persist further to the north through to west of the proposed development site (i.e. rural paddocks). The extent of the potential grassland vegetation would provide a fire run in excess of 350mm, and hence would be considered a 'Primary' Asset Interface in accordance with BMS requirements.

The Primary Asset Interface to the proposed development site will be separated away (~70m or greater) from the nearest building structure within the subject site by the existing sections of Kathner Street and managed / slashed land (Blocks 2 Section 58 Chapman).

Based on the above information, the existing services identified on site (Refer Section 5 of this report) and the complete bushfire assessment, the Bushfire Risk and Compliance Assessment has nominated the following recommendations.

1. The proposed development shall incorporate external materials and design in accordance with Sections 3 & 5 of AS3959 Construction of buildings in bushfire-prone areas (BAL-12.5 requirements).

   AS3959 Table 3.1 (Bushfire Attack Levels & Corresponding Sections for Specific Construction Requirements) describes the predicted bushfire attack and levels of exposure as 'Ember Attack' only for a building within 100m of classified vegetation and heat flux exposure thresholds ≤12.5 kW/m .

   Ember attack is described as attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.

   AS3959 BAL-12.5 is primarily concerned with protection from ember attack and radiant heat up to and including 12.5 kW/m2 where the site is less than 100 m from the source of bushfire attack.

   Effectively, a building constructed to AS3959 Sections 3 & 5 (BAL-12.5) is designed and maintained to ensure airborne and/or wind driven burning embers or debris (>2mm in size / width) emanating from a bushfire or grassfire event cannot enter the structure when reasonably secured.

2. The entire area of the proposed development site shall be identified and maintained as an APZ in accordance with the ACT Bushfire Management Standards – ACT Strategic Bushfire Management Plan Version 3 (2014). This also includes the proposed northern portion of the subdivided subject site until such time it is formally developed.

   Vegetation and landscape management for APZ compliance should consider the principals of the document Landscape and Building Design for Bushfire Areas, by Caird Ramsay and Lisle Rudolph published November 2003.

3. Any vegetation landscaping to be retained or re-introduced as part of the proposed development shall ensure any readily combustible dry garden mulching and/or plantings are minimised within the proposed development site, or else should be entirely excluded.

4. Any internal landscaping shall ensure any readily combustible dry garden mulching and/or plantings are separated away from the proposed building lines by at least 2m.

5. Any internal landscaping shall ensure trees planted directly adjacent to the internal roadway area does not significantly overhang or obstruct the access of larger vehicle's entering the proposed development

site. Any overhanging vegetation shall be maintained to ensure a minimum height of 4.2m above the road at all times.

6. Any internal landscaping shall ensure only fire retardant trees are reintroduced as part of the proposed development. Fire retardant plants for the ACT are listed by the Yarralumla nursery-Garden Advice series 2.
7. All internal vehicle access roadway sections shall have a minimum carriageway width of 6m or else the proposed internal roadway and verge area shall facilitate an unobstructed and trafficable width of at least 6m at all times. The minimum inner radius of any roadway bend shall be ≥6m and any identified parking spaces.
8. Any gating or obstacles for traffic or pedestrian management or calming shall be designed to ensure firefighting and emergency services vehicles can safely pass through, over or remove / open the traffic management obstacle at all times. Emergency access gating used to control traffic flow during non-emergency periods shall not be locked
9. The proposed internal vehicle access roadway shall have a carrying capacity of at least 30 tonnes in anticipation of a standard ACTFR aerial appliance seeking to access and operate within the proposed development site.
10. The proposed development and associated internal roadway access section shall be clearly signposted at the entry point from Darwinia Terrace to identify the proposed development site and that access to Percy Drive is not provided through the site.
11. All new electrical/communication lines to service the proposed development shall be located underground.
12. All external / exposed water and gas supply pipes supplying the subject development shall be metal.
13. At least one additional hydrant connection point should be located centrally within the subject development site and not within a road carriageway or designated parking space / area. The recommended location would be preferably between proposed unit dwelling groups 4 & 5, and accessible for unit dwelling groups 1 & 2.

A copy of the bushfire risk and compliance assessment is attached within **Appendix D**.

6.4 Site Investigation Report, Block 1, Section 45, Chapman; Mott MacDonald Hughes Trueman (July 2012)

Mott MacDonald Hughes Trueman were engaged by the LDA to prepare a site investigation report for the subject site in July 2012. At the time of the investigation it was unclear what the proposed development would be. The majority of information provided for in the previous site investigation report is therefore superseded by the information provided in this report prepared by Cardno.

A copy of the Site Investigation Report is attached within **Appendix D**.

6.5 Overland Flow Investigations and Options Studies; Mott MacDonald Hughes Trueman (December 2012 to March 2014)

During the previous site investigation undertaken by Mott MacDonald Hughes Trueman in July 2012, it was identified that Block 1 Section 45 Chapman would be subject to overland flows from the nearby Blocks 1 Section 46 and Block 2 Section 45. These areas were found to consist of significant pervious areas sloping towards the subject site with existing swales diverting flows to the existing storm water tie / headwall structure located in the north east corner of the subject site.

As a result of the identification of the abovementioned concentrated overland flow paths through the subject site, the LDA commissioned Mott MacDonald to undertake an options study of potential flow path risk mitigation/elimination measures.

In total, three options were offered to the LDA which are summarised as follows.

- **Option 1; Realign the existing route of overland flow path**. This option proposed to incorporate a short length of new swale within the south east corner of the subject site, reducing the block area by

approximately 900sqm, removal of the existing stormwater headwall located in north eastern corner of the subject site and installation of a new stormwater pipe from the existing stormwater tie within the verge of Darwinia Terrace approximately 150m to the newly proposed swale location in the south east corner of the subject site.

The cost of these works was estimated as the median of the three options as noted within the associated report in **Appendix D**.

Advantages of this option are listed as follows:

- Allows simpler construction of vehicle / pedestrian access to Darwinia Terrace as recommended by the bushfire risk and compliance assessment undertaken as part of this Site Investigation Report.
- Increased block area retained when compared to other options

The disadvantages of this option are:

- Increased construction costs when compared with other options
- Irregular shape of the southern area of the subject site, potentially affecting the development opportunities in this section of the block.

- **Option 2**; **Retain existing route of overland flow path**. This option proposed the increase of capacity of the existing swale drain along Darwinia Terrace within the current block boundary, retention of existing stormwater pipework and headwall in the north eastern corner of the block.

  The cost of these works was estimated as lowest of the three options as noted within the associated report in **Appendix D**.

  Advantages of this option are listed as follows:

  - Relatively cheaper immediate cost to construct stormwater drainage works

  The disadvantages of this option are:

  - Irregular shape of block at southern boundary
  - Increased loss of block area when compared to other options
  - Location of swale drain alone entire Darwinia Terrace block frontage of the subject site. Increasing costs of establishing pedestrian and vehicle connectivity with infrastructure on Darwinia Terrace. Potential hidden costs involved in this item that may not have been considered in the original options study undertaken by Mott MacDonald.

- **Option 3**; **Realign existing swale outside of subject site including fill within blocks and adjacent verge.** A third option was provided by Mott MacDonald within a later report dated March 2014. Option 3 proposed the filling of the south and east sections of the block to levels 200mm above the 1 in 100 year flood level, filling of all existing swales within the subject block bounds and installation of a new 375mm diameter stormwater pipe from the existing stormwater tie within the verge of Darwinia Terrace approximately 150m to the newly proposed swale location in the south east corner of the subject site.

  The cost of these works was estimated as the highest of the three options as noted within the associated report in **Appendix D**.

  Advantages of this option are listed as follows:

  - No adjustment of block boundaries, loss of block area or irregular block layout.
  - Full access to Darwinia Terrace for construction of vehicle and pedestrian access routes.

  The disadvantages of this option are:

  - Increased cost when compared to options 1 and 2

Of all the options, depending on the budget of the project and final proposed development, it appears that option 3 would be the best outcome of the three options from a general development standpoint. This option offers the following benefits:

- Maintained original block area.
- Increased access to Darwinia Terrace facilitating pedestrian and vehicle accessibility to the surrounding infrastructure.
- Retention of significant trees.
- Assurance that the block will be outside of 1 in 100 year flow paths.

A copy of the Options Study report for Options 1 & 2 (December 2012) and the report for option 3 (March 2014) are attached within **Appendix D**.

7 Proposed Site Servicing

This section evaluates the suitability of existing services discussed within Section 5 with the proposed development as described within Section 2 and will nominate the minimum upgrades to existing infrastructure to enable continuation of the development process.

7.1 Sewer

To provide prospective developers with an understanding of the sewage requirements Cardno is able to provide the following advice.

Using the ICON Water Sewerage Service Standards and Guidelines, calculations have been completed to determine the size required for the service tie for the development outlined in **Section 2**.

The following sewer loading in **Table 7-1** was calculated in accordance with *ICON Water Design Standards, Table 3-3*.

Table 7-1 ICON Water Sewer Calculations

Description	Value
Total Equivalent Population	73
Average Dry Weather Flow (L/s)	0.260
Peak Dry Weather Flow (L/s)	0.99
Peak Infiltration Intensity (L/s)	1.59
Peak Wet Weather Flow (L/s)	2.576
Required Pipe Size at 2% Grade	**DN100**

Calculation shows that the proposed development would be adequately serviced by a DN100 sewer tie.

An existing sewer tie is present to Block 1 Section 45, however, this sewer tie is outside the area of the proposed development. Hence a new DN150 main and DN100 sewer tie are required to be constructed from the existing sewer manhole in the south western corner of the Kathner Street and Darwinia Terrace intersection to the north eastern corner of the subject site.

Due to the relatively consistent existing grading across the block of approximately 4.5% towards the proposed sewer tie location. It is not expected that the site will have areas unserviceable by gravity unless block levels are significantly altered.

Refer to **Appendix C** for correspondence with ICON Water and DBYD information. Calculation tables for the sewer loadings in each area are attached in **Appendix E**.

7.2 Water Supply

7.2.1 Service Connection

The potable water demand for the proposed development was based on the requirements of ICON Water Design Standards and AS3500 Part 1. ICON Water was contacted for advice in relation to the proposed development and were able to provide information on the existing services and water main pressures (correspondence is included within **Appendix C)**.

The Probable Simultaneous Demand (PSD) for multiple dwellings (Peak Demand) is based on Table 3.2.3, Note 2 of AS3500.1. For the subject site, the proposed development index length exceeded the values

contained within Table 3.2.3. As such, the equation provided in Note 2 of the table was utilised to obtain the PSD for that area.

Index lengths were estimated from the proposed layouts and each area assessed using Table D1 of AS3500.1 to determine the required tie size. The results are presented in **Table 7-2**.

Table 7-2 ICON Water / AS3500.1 Water Supply Calculations

Description	Value
Available Minimum Pressure at Main @ Peak Demand (m)	50
RL of Highest Fixture (Existing surface contours) (AHD)	643
RL of Main (Survey elevations, 600mm deep) (AHD)	629
Head Loss (m)	15.1
Available Head (30m req. by Icon Water) (m)	**36 (<30m)**
No. Units	29
Probable Simultaneous Demand (L/s)	**3.390**
Index Length (m)	250
Required Potable Water Pipe Size	**DN65**

Currently Block 1 Section 45 has been provided with an individual DN20 tie and meter, however, this existing tie will be outside the area of the proposed subject site subdivision. Therefore, a new DN65 water tie is required for potable water supply to the subject site. This tie size may be increased in diameter to deliver fire service requirements, this is discussed further within Section 7.2.2 below. All connection and disconnection works are to be carried out by ICON Water at the expense of the developer.

In accordance with the ICON Water Design Standards, the minimum pressure during peak hour demands for a development exceeding two stories or commercial developments is 30 metres head over the highest fixture within the developed block. The existing pressure in the water network at the water tie for the proposed development area has been found to be adequate for the proposed development demand.

Refer to sketch **50517005-SK02** within **Appendix A** for a proposed services sketch.

7.2.2 Fire Service

ACT Emergency Services advised that the fire risk category for the proposed development is F5 as the buildings are in a bushfire risk zone. The fire risk category for the proposed development requires 45L/s fire demand with 60m hydrant spacing (ICON Water General Design Standards).

For F5 fire category, the required pressure attainable at the block boundary during firefighting is 10m head pressure including peak demand draw off and the 45L/s firefighting requirement. The pressures provided by ICON Water indicate that 10m head can be expected during peak demand and 45L/s firefighting draw off for the development, which is acceptable.

Refer to **Table 7-3** for available pressures and **Appendix C** for ICON Water correspondence in relation to pressures achievable at the Block boundary.

Table 7-3 ICON Water Provided Available Water Pressures

Description	Pressure Head (m)
Max Static Pressure (m)	55
Min Pressure @ Peak Demand	50
Min Pressure @ Peak Demand + 10 L/s (m)	49
Min Pressure @ Peak Demand + 20 L/s (m)	48
Min Pressure @ Peak Demand + 30 L/s (m)	46
Min Pressure @ Peak Demand + 40 L/s (m)	44
Min Pressure @ Peak Demand + 50 L/s (m)	42
Min Pressure @ Peak Demand + 60 L/s (m)	39

In accordance with the ICON Water Guidelines, the hydrant spacing for a development with an F5 fire risk category is 60m. Currently the spacing of the hydrants along Darwinia Terrace, Kathner Street and Percy Crescent are varied and typically in excess of 60m. To meet the 60m spacing requirement three additional hydrants will be required to be installed unless a suitable alternative firefighting solution is developed and approved by ACT Emergency Services.

The Bushfire Risk Assessment undertaken by ABPP in 2016 indicates that internal firefighting measures in the form of a hydrant may be required and therefore an increased diameter tie would be required. To supply one hydrant within the proposed development a DN100 DICL tie is recommended, though further investigation into the final layout of fire servicing internally may lead to increased demands beyond a DN100 DICL tie capacity.

Calculations related to fire services are presented in **Appendix E**.

Coordination with ACT Emergency Services and ICON Water will be required to determine the final fire risk type for the proposed development during internal design of the multi-unit site.

7.3 Stormwater

The proposed development scenario has been assessed in conjunction with relevant guidelines as endorsed by the ACT Government. The development site has been designated as an Urban Neighbourhood Development and assessed for the 5 year ARI in accordance with *Table 1.2-Minor System Design ARI* within the TCCS Standards. An impervious area of 60% for multi-unit developments is specified within the TCCS Standard and has been adopted to reflect the nature of the proposed development.

The expected runoff from the developed block area is detailed in **Table 7-4**. The table also provides the required tie size based on being laid at a 2.0% minimum grade.

Table 7-4 TCCS / AS3500.3 Stormwater Calculations

Description	Value
ARI	5
Rainfall Intensity (mm/hr)	98
Area (m^2)	11,399
Impervious Area Percentage	60%
Estimated Flow, Q (L/s)	248
Required Tie Size (mm)	**DN375**
Required Tie Minimum Grade (%)	**2%**

As the existing stormwater tie to Block 1 Section 45 is located outside of the proposed boundaries of the subject site, it is recommended that a new tie and stormwater main is provided to the north eastern corner of the proposed block from the existing stormwater infrastructure located in the south west corner of the Darwinia Terrace / Kathner Street intersection. The connection at this location, as opposed to connection to other existing stormwater sumps located on Darwinia Terrance is required to maintain the previous stormwater flow path and ensure that the capacity of existing stormwater infrastructure elsewhere is not exceeded.

It is noted that the *EPSDD WaterWays: Water Urban Sensitive Design General Code* requires that the stormwater quality and quantity for new developments must be managed and the proposed development would be required to adhere to those guidelines (refer to **Section 7.8** for more details). Part of those requirements include the reduction of post development flows to pre-development levels via retarding measures such as On Site Detention. Confirmation of this can only be achieved during the detailed design process of the internal development once the final development configuration is known.

Refer to sketch **50517005 – SK02** for details of proposed services and **Appendix E** for calculations.

7.4 Telecommunications

7.4.1 Telstra

The proposed development is acceptable to Telstra. However, the existing Telstra network will need to be upgraded to provide sufficient capacity as follows.

The existing conduit serving the site is only a P20, which is insufficient to service the proposed development. It will need to be replaced with a 1XP100 conduit. On site investigation of the supply to this site suggested that there is no existing overhead supply from Telstra's network to the site as is shown on the DBYD information.

Telstra will also require exclusive access to a lead-in conduit for all dwellings. A minimum 1XP100 conduit will be required. The developer is responsible for the provision of a lead-in conduit from each dwelling to a suitable network access point at Darwinia Terrace.

All existing Telstra network infrastructure will need to be protected / recovered prior to commencement of hazardous activity. Liaison with Telstra Network Integrity will be required through the re-development of the block and the developer will be required to register the development on the Telstra Smart Community website, for connection purposes.

Refer to **Appendix C** for correspondence and DBYD information.

Provision of the above services for the servicing of the proposed development are detailed on drawing **50517005 - SK02** within **Appendix A**.

7.4.2 iinet

iinet has confirmed that there is sufficient capacity to service the proposed residential development and that there are no objections for a new connection to the existing infrastructure. However, based on our assessment of the DBYD plans, iinet do not appear to have any network in the area.

Refer to **Appendix C** for correspondence and DBYD information.

7.5 Gas

Jemena has confirmed that the existing medium pressure network has sufficient capacity to service a development of the proposed type/size. There aren't any constraints that would prevent connection from the existing infrastructure. Jemena will however require the developer to supply trenching for any internal reticulation of the gas network.

Connections to the buildings could be located anywhere along the existing gas mains.

Refer to **Appendix C** for correspondence and DBYD information.

7.6 Electrical

ActewAGL have confirmed their support of the development and they have not raised any significant constraints with the construction thereof.

It was noted that there is an existing pole mounted substation 2609 located in the laneway adjacent Block 6 Section 46 approximately 120m from the subject site. This substation can be utilised for power supply of the proposed development if the point of entry is located as near as possible to the block boundary in the south west corner of the subject site.

The developer will be required to fund any new connection and removal or relocation of any ActewAGL assets, as per 'ActewAGL connection policy'.

Refer to **Appendix C** for correspondence and DBYD information and to sketch **50517005 – SK02** for details of proposed services.

7.7 Flooding and Overland Flows

Initial assessment of the existing flow characteristics of the site within **Section 5-5** indicates that the proposed development is not within the affected area for a 1 in 100 year flood as shown on ACTmapi.

The overland flows associated with the site flow towards the north east corner of the site. There is an existing swale located within the eastern edge of the subject site which captures flows from upstream catchments within Blocks 1 Section 46 and Block 2 Section 45 and diverts them through the subject site to the existing stormwater tie/headwall located in the north east corner of Block 1 Section 45.

Based on our investigations of the site and review of initial options studies prepared by Mott MacDonald from 2012 to 2013, we recommend the diversion / backfilling of the abovementioned swale to allow full development of the site. Of the previous options established by Mott MacDonald and the LDA, option 3 appears to offer the best outcome from a development and engineering perspective.

The benefits of constructing piped stormwater infrastructure (similar to Option 3 of the Mott Macdonald Stormwater Options Report) are listed as follows:

- Maximised access to Darwinia Terrace for vehicles and pedestrians alike. This will assist in creating a development that is well connected to existing infrastructure and enable ease of compliance with potential future accessibility requirements.
- No reduction of the existing block boundaries will be required, maximising development opportunities for the site and potential yield.
- Less irregular block layout in the South of the subject site by comparison to other options ensuring that the developable area is not constrained by acute angles of block boundaries.
- A slightly higher initial expense, approximately $50,000 higher than utilisation of overland flow options. However, this initial cost may be offset by the increased developable area.

- Assurance that nuisance flows from up to 1 in 100 year ARI rainfall events are captured and diverted

Further breakdown of the available options to the development investigated thus far are provided for within **Section 6.5** of this report and within the original Options Study Reports conducted by Mott MacDonald refer **Appendix D**.

7.8 Water Sensitive Urban Design

The redevelopment will drain via TCCS' stormwater infrastructure into the existing stormwater network. It is important the developer is aware of and complies with all legislative requirements with regards to stormwater runoff quality and quantity.

Internal stormwater designs shall comply with the Environment, Planning and Sustainable Development Directorate (EPSDD) Waterways Water Sensitive Urban Design General Code for which the requirements are summarised within the Water Sensitive Urban Design Development Checklists including but not limited to the following requirements:

- The developer must not increase the stormwater run-off from the previous retention levels on site.
- A summary of the required WSUD targets and achievements are listed below
    - Mains water use reduction = 40%
    - Reduction in suspended solids = 60%
    - Reduction in total phosphorous = 45%
    - Reduction in total nitrogen = 40%
    - Effluent Reuse = Optional

These objectives and targets can be achieved through design and construction of Water Sensitive Urban Design measures such as:

Mains water use reduction;

- Water efficient irrigation systems
- Use of stormwater to replace mains water for irrigation
- Water efficient landscaping
- Rainwater tanks for garden watering and internal uses, such as toilet flushing
- Use of greywater for irrigation and toilet flushing on individual dwellings
- Wastewater treatment and reticulation to commercial or industrial users who do not require water of a potable water mains standard

Stormwater management;

- Wetlands and Ponds,
- Retarding basins,
- Filter strips,
- Swales and Bio-Retention Swales in lieu of piped drainage systems,
- Downpipes and impervious surface areas not directly connected to the stormwater system; direct run-off across lawns and gardens
- Minimising impervious surfaces,
- Installing on-site detention storage, particularly in multi-dwelling sites (which may be increased in size to allow for water harvesting)
- Creating extended detention volume in ornamental ponds or landscaped depressions

- Direct connection of downpipes to a separate collection system to discharge to ornamental ponds to maintain water quality

Wastewater reuse;

- Use of domestic greywater, treated or untreated

Construction of the proposed development will be required to comply with the Environment Protection Authority, Environment Protection Guidelines for Construction and Land Development in the ACT.

8 Opportunities and Constraints

8.1 Planning and Layout

The development will be required to ensure existing easements/services displayed on the ACTmapi database and DBYD are clear of all proposed building works in accordance with each authority's requirements.

No environmental or heritage constraints that could prohibit development internally were found to be contained within the site or nearby areas.

8.2 Geotechnical

Based on the existing ground conditions identified within **Section 5.13** of this report. It is recommended to undertake a development specific detailed geotechnical investigation inclusive of detailed drilling to fully determine the underlying ground conditions and engineering attributes of the site to determine the suitability of the site for the final proposed development. If this is not undertaken the developer may face significant delays with excavation of high to very high strength rhyodacite rock to foundation levels.

8.3 Hazardous Material and Environmental

The soil condition aspects discussed within **Section 5.16** of this report outline that soil contamination is not expected to be a constraint to development of the subject site.

If fill is encountered at the site during any future geotechnical investigations and/or earthworks associated with future development of the site, then the potential for contamination and/or hazardous materials within associated fill should be assessed by a suitably experienced consultant.

It is a mandatory requirement that the future developer prepare an unexpected finds management plan and have it endorsed by the ACE Environment Protection Unit prior to excavation of the site. Further specific requirements for the unexpected finds management plan and associated protocols are detailed within Coffey Environments Phase 1 Environmental Assessment included within **Appendix D**.

8.4 Vegetation

The Redbox Design Group tree assessment identified that there are 20 trees found within or adjacent to the development area, of which 2 are deemed to be regulated. Any works proposing to remove or significantly affect existing trees and associate root protection zone would either require approval from the Conservator of Flora and Fauna, or be required to be adapted into the development layout.

These works will require detailed and ongoing liaison with the TCCS Tree Protection Unit during design in order to avoid setbacks during the development application process.

8.5 Servicing

The existing site is currently serviced with water, sewer, stormwater, communications and electrical mains, most of which are readily available to service the site with capacity in the network. The existing stormwater infrastructure, although readily available to the site, will require upgrade to manage overland flows currently entering the subject site from the south.

The water services will require upgrades to the ties and surrounding infrastructure to adequately service and facilitate the proposed development, but should not form a major constraint to the proposed development. Three additional hydrants will be required to satisfy the F5 fire risk rating spacing requirement of 60m.

Telstra is supportive of the development and will require minor network upgrade to accommodate the proposed development. The existing 20mm diameter Telstra service will require an upgrade to 100mm diameter, however this is not expected to be a major cost to the development.

Advice from ActewAGL is that the existing substation south west of the site will be suitable for use by the development provided the point of entry to the site relatively close to the south west corner of the subject site.

iinet did not raise any concerns for the development. NBN is not currently available within the area.

8.6 Traffic and Access

A review of the existing site layout and surrounding road network has verified that the existing road network is generally in accordance with Table 2A: Street Network requirements – All estates except in industrial zones of the Estate Development Code (2013).

Traffic generation calculations were based on 6 vehicle movements per day per dwelling for multi-unit developments and 29 dwellings, totalling 174 vehicle movements per day for the proposed development.

In order to assess the provided AM peak values in terms of vpd, TCCS Design Standard 6 – Pavement Design, Section 6.4.3 specifies that peak hour volumes may be adapted to Annual Average Daily Traffic (AADT) by assuming that the peak hour volume is representative of approximately 10-12% of the AADT. For this study a value of 10% will be adopted for each leg of the intersection.

Addition of the proposed development traffic to the existing 2031 AM Peak Traffic Scenario from the RoadsACT Strategic Model (Refer Figure yields a total average vehicles per day of 3,214 on Darwinia Crescent. This is well within the requirements of a major collector road with the maximum of 6000 vehicles per day (Estate Development Code Table 1.1A). Review of the surrounding road network revealed Darwinia Terrace to be operating at the low level of congestion and therefore the additional 174 vehicles per day from the proposed development is not expected to have a significant effect on the existing road network level of service.

The driveways for the subject site are required to be constructed in accordance with the TCCS Design Standards for Urban Infrastructure Type HD2 geometry. It is recommended that early consideration of the splays required for each driveway based on the proposed design vehicle is made to ensure that clearance to services is achieved in accordance with TCCS Design Standard DS05 Driveways. This is especially relevant to achieving clearance of the southern driveway to ActewAGL power pole 80221.

It is evident the levels in the verge at proposed driveways to the subject site will be sufficient to allow compliance with TCCS and AS2890.1 requirements related to maximum grade changes with minimal earthworks required.

8.7 Parking Facilities

The proposed development is zoned on the Territory Plan as Community Facilities (CF) although is earmarked for rezoning to allow medium density residential development, and is therefore subject to the requirements of the EPSDD Parking and Vehicular Access General Code - Clauses 3.1; Residential Zones.

Vehicular access to on-site parking for residents is expected to operate via the proposed driveways shown on Darwinia Terrace. Close consultation with EPSDD and TCCS will be required to ensure the recommended access locations are approved in principal prior to proceeding with detail design works.

The development will be required to comply with ACT emergency vehicle access requirements.

If the proposed development is to facilitate waste disposal via communal waste enclosures, extra provision for a recycling truck will be required in accordance with the Planning and Development Act 2007. ACT NoWaste / TCCS will need to be consulted for the location and design of facilities for waste receptacles if the site is proposed to be publicly serviced.

Provision of parking for people with disabilities shall be allowed for in accordance with Clause 2.2.4, EPSDD Parking and vehicular Access General Code 2014, which states that for residential developments no disabled parking is required, however, visitor parking is required to have provision for 3% disabled parking.

In accordance with the EPSDD Parking and Vehicular Access General Code 2014, Clause 2.4, parking for motorcycles and scooters should allow provision for 3 motorcycle parking spaces per 100 parking bays with a minimum provision of 1 motorcycle parking space for carparks with provision for a minimum of 30 parking spaces. Motorcycle parking spaces should comply with AS2890, Parts 1 and 5.

Tandem Parking for multi-unit residential apartment developments for dwellings of 2 or more bedrooms is permitted when 2 parking spaces have been allocated per two or more bedroom apartments or the proportion of tandem parking spaces does not exceed 50% of the number of dwellings with two or more bedrooms. It is anticipated that tandem parking may be incorporated into the parking design and therefore has been included in the proposed development parking requirements calculations shown in **Table 8-2**.

To maximise community safety in the proposed development, it is highly recommended that parking facilities are designed with provision for lighting, sightlines, informal surveillance, signage, carpark sizes, landscaping, access, safe pedestrian routes, and facilities in accordance with the requirements of Clause 2.5 of the Parking and Vehicular Access General Code 2014 and all relevant standards.

Based on the table provided within Clause 3.1.4 of EPSDD Parking and Vehicular Access General Code, it is required that all long stay parking remains 'on site', whereas short stay / visitor parking is 'on site' or within 100 metres. The parking provision rates are listed in **Table 8-1** over leaf.

Table 8-1 Parking Provision Rates for Residential Zones

Development	Parking Provision Rates for residential zones
Apartments	One (1) parking space per single bedroom dwelling. and A minimum average provision of 1.5 spaces per two bedroom dwelling, provided that each two bedroom dwelling is allocated a minimum of one parking space and each two bedroom dwelling is allocated no more than two parking spaces. or Two parking spaces per two bedroom dwelling; and Two parking spaces for each dwelling with three or more bedrooms; Plus One visitor parking space per four dwellings or part thereof where a complex comprises four or more dwellings
Attached housing	One (1) parking space per single bedroom dwelling. and A minimum average provision of 1.5 spaces per two bedroom dwelling, provided that each two bedroom dwelling is allocated a minimum of one parking space and each two bedroom dwelling is allocated no more than two parking spaces. or Two parking spaces per two bedroom dwelling; and Two parking spaces for each dwelling with three or more bedrooms; Plus One visitor parking space per four dwellings or part thereof where a complex comprises four or more dwellings
Detached housing	One (1) parking space per single bedroom dwelling, except that, for two bedroom dwellings only, a minimum average provision of 1.5 spaces per dwelling, provided that each two bedroom dwelling is to be allocated a minimum of one parking space and no two bedroom dwelling is to be allocated more than two parking spaces Plus One visitor space per four dwellings or part thereof where a complex comprises four or more dwellings *Note: if there is only one detached two bedroomed dwelling in a development, then two parking spaces are required.*

Source: EPSDD Parking and Vehicular Access General Code (2014)

8.7.1 Proposed Development Parking Requirements

Based on the parking requirements set out in **Table 8-1** above, **Table 8-2** below has been prepared to detail the requirements of Apartments/Attached Housing with two to three bedrooms for the developer to consider as part of the conceptual design phase. The calculations have assumed a development consisting of 29 dwellings in accordance with the client brief.

Abbreviations: TB: Total Bedrooms, SP: Standard Parking, VP: Visitor Parking, DP: Disabled Parking, MP: Motorcycle Parking, BP: Bicycle Parking

Table 8-2 Minimum development parking requirements

Development Type	Dwellings	Bedrooms	TB	SP	VP	DP	MP	BP
Apartments / Attached Housing	29	2	58	44(58) *	7	1	2	

* Values in parenthesis apply only if the proportion of tandem parking spaces exceeds 50% of the number of dwellings with two or more bedrooms

If required, 'off site' parking is approved at the discretion of the ACT Planning and Land Authority having regard to the potential demand that may be generated by the particular proposal as well as the potential for nearby lessees to seek to expand their activities and lay claim to potential public parking areas.

9 Reserved

10 Recommendations

Based on the findings of this investigation the following recommendations are made and should be undertaken:

1. Establish a final layout based on the findings of this report and the recommendations provided within the Bushfire Risk and Compliance Assessment; Bushfire Protection Planning & Assessment Services (April 2017). An updated bushfire risk assessment may be required by EPSDD during the design of the internal proposed development to ensure compliance with ACT Fire and Rescue requirements.
2. Commence consultation with EPSDD in relation to subdivision of the subject block.
3. Undertake detailed geotechnical analyses of the subject site to ascertain detailed subsurface strata information and development constraints.
4. Construct an extension to the existing sewer network within the eastern verge of Darwinia Terrace and a tie to the proposed new block boundary.
5. Construct an extension to the existing stormwater network within the eastern verge of Darwinia Terrace, tie to the proposed new block boundary and associated block/verge earthworks (as indicated on **Drawing 50517005 – SK02)**. This is to be undertaken in close consultation with TCCS/EPSDD to maintain developable area of block by removing overland flows from subject site boundaries.
6. Confirm final fire rating of F5 with ACT Fire Rescue once the final development layout, materials etc. are established.
7. Construct required upgrades to existing water network in accordance with requirements established by the abovementioned fire rating to be confirmed with ACT Fire Rescue.
8. Construct a new water service tie to the subject site and install additional hydrants internally and externally as indicated on **Drawing 50517005 – SK02**. This to be undertaken in consultation with EPSDD, ACT Fire Risk and ICON Water.
9. Prior to DA, liaise with ActewAGL during detailed design and submit a Request for Preliminary Network Advice (PNA) to determine the specific requirements for connection to the site by underground supply.
10. The developer will be responsible to provide 1XP100 to the property boundary to facilitate connection to the Telstra network. These conduits must have access to MDF(s) in each building in each area and be reserved for Telstra's exclusive use. All existing Telstra network infrastructure will need to be protected / recovered prior to commencement of hazardous activity. Liaison with Telstra Network Integrity will be required through the re-development of the block and the developer will be required to register the development on the Telstra Smart Community website, for connection purposes.
11. Determine the extent of affected trees on site and liaise with the TCCS Tree Protection Unit and the Conservator regarding the removal of all trees affected by the development. Removal of regulated trees if proposed will require significant justification.
12. Investigate and confirm the suitability of the proposed site access points proposed prior to undertaking detailed design, especially for the southern driveway in close proximity to the existing power pole.
13. Establish key preferred WSUD measures early in the design process to ensure ease of design and subsequent approvals with TCCS/EPSDD.
14. Establish connectivity to existing pedestrian network through construction of footpaths and associated infrastructure to the extent determined in consultation with TCCS/EPSDD.
15. The proposed development shall incorporate external materials and design in accordance with Sections 3 & 5 of AS3959 Construction of buildings in bushfire-prone areas (BAL-12.5 requirements).

AS3959 Table 3.1 (Bushfire Attack Levels & Corresponding Sections for Specific Construction Requirements) describes the predicted bushfire attack and levels of exposure as 'Ember Attack' only for a building within 100m of classified vegetation and heat flux exposure thresholds ≤12.5 kW/m .

Ember attack is described as attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.

AS3959 BAL-12.5 is primarily concerned with protection from ember attack and radiant heat up to and including 12.5 kW/m2 where the site is less than 100 m from the source of bushfire attack.

Effectively, a building constructed to AS3959 Sections 3 & 5 (BAL-12.5) is designed and maintained to ensure airborne and/or wind driven burning embers or debris (>2mm in size / width) emanating from a bushfire or grassfire event cannot enter the structure when reasonably secured.

16. The entire area of the proposed development site shall be identified and maintained as an APZ in accordance with the ACT Bushfire Management Standards – ACT Strategic Bushfire Management Plan Version 3 (2014). This also includes the proposed northern portion of the subdivided subject site until such time it is formally developed.

    Vegetation and landscape management for APZ compliance should consider the principals of the document Landscape and Building Design for Bushfire Areas, by Caird Ramsay and Lisle Rudolph published November 2003.

17. Any vegetation landscaping to be retained or re-introduced as part of the proposed development shall ensure any readily combustible dry garden mulching and/or plantings are minimised within the proposed development site, or else should be entirely excluded.

18. Any internal landscaping shall ensure any readily combustible dry garden mulching and/or plantings are separated away from the proposed building lines by at least 2m.

19. Any internal landscaping shall ensure trees planted directly adjacent to the internal roadway area does not significantly overhang or obstruct the access of larger vehicle's entering the proposed development site. Any overhanging vegetation shall be maintained to ensure a minimum height of 4.2m above the road at all times.

20. Any internal landscaping shall ensure only fire retardant trees are reintroduced as part of the proposed development. Fire retardant plants for the ACT are listed by the Yarralumla nursery-Garden Advice series 2.

21. All internal vehicle access roadway sections shall have a minimum carriageway width of 6m or else the proposed internal roadway and verge area shall facilitate an unobstructed and trafficable width of at least 6m at all times. The minimum inner radius of any roadway bend shall be ≥6m and any identified parking spaces.

22. Any gating or obstacles for traffic or pedestrian management or calming shall be designed to ensure firefighting and emergency services vehicles can safely pass through, over or remove / open the traffic management obstacle at all times. Emergency access gating used to control traffic flow during non-emergency periods shall not be locked

23. The proposed internal vehicle access roadway shall have a carrying capacity of at least 30 tonnes in anticipation of a standard ACTFR aerial appliance seeking to access and operate within the proposed development site.

24. The proposed development and associated internal roadway access section shall be clearly signposted at the entry point from Darwinia Terrace to identify the proposed development site and that access to Percy Drive is not provided through the site.

25. All new electrical/communication lines to service the proposed development shall be located underground.

26. All external / exposed water and gas supply pipes supplying the subject development shall be metal.

27. At least one additional hydrant connection point should be located centrally within the subject development site and not within a road carriageway or designated parking space / area. The recommended location would be preferably between proposed unit dwelling groups 4 & 5, and accessible for unit dwelling groups 1 & 2.

11 Drawings

11.1 Drawings

As part of the site investigation report the following drawings have been prepared and are provided within **Appendix A**.

Drawing No.	Description	Revision
50517005 – SK01	Existing Services	B
50517005 – SK02	Proposed Services	C
1292-101	Tree Assessment	A

These drawings are to be read in conjunction with this report. The plans are based upon information and consultation provided by service providers and authorities. All services details are to be confirmed on site. The existing services in the vicinity of the site are represented in an indicative format. The plans were prepared solely for the purposes of this report and for the use of the client.

Chapman, Section 45,
Block 1 MU - Stage 2
SIR

APPENDIX A

DRAWINGS

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Shaping the Future

DATE PLOTTED: 16 March 2017 5:19 PM BY : CRAIG ALLEN

KATHNER STREET

PERCY CRESCENT

DARWINIA TERRACE

ANGOPHORA STREET

REMAINING COMMUNITY FACILITY BLOCK

SECT 45
BLK 1
(SUBJECT SITE)

EXISTING Ø20mm WATER SERVICE

EXISTING GAS PIT

EXISTING Ø100 SEWER TIE

EXISTING Ø375 HEADWALL STRUCTURE

OVERHEAD CABLE NOT VISIBLE ON SITE

EXISTING SUBSTATION 2609

EXISTING GAS PIT

EXISTING TELSTRA PIT

EXISTING TELSTRA PIT

EXISTING GATE

EXISTING BOLLARD

GARDEN

STEPS

NORTH

LEGEND

EXISTING

- SEWER / SEWER MANHOLE
- STORMWATER PIPE / SW MANHOLE STORMWATER SUMP
- EXISTING SWALE / OVERLAND FLOW PATH
- WATER / METER PIT / GATE VALVE DOUBLE AIR VALVE / FIRE HYDRANT
- ELECTRICAL U/G (SERVICE LINE)
- ELECTRICAL U/G (LOW VOLTAGE)
- ELECTRICAL U/G (HIGH VOLTAGE)
- ELECTRICAL U/G (STREET LIGHT)
- ELECTRICAL POLE/STREETLIGHT
- OVERHEAD LINK/ DROPOUT FUSE
- GAS / GAS VALVE
- TELSTRA / COMMUNICATION PIT
- OVERHEAD (STREET LIGHT)
- OVERHEAD (HIGH VOLTAGE)
- OVERHEAD (LOW VOLTAGE)
- TREE
- GATE
- BOLLARD

0 10 20 30 40 50m

SCALE 1:500 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
B	16/03/2017	DRAFT REPORT	C.A.	G.Z.	J.P.S.
A	08/082016	DRAFT REPORT	J.W.	G.Z.	J.P.S.

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Web: www.cardno.com.au

Drawn	M.P.Q.	Date 08/08/2016
Checked	C.A.	Date 08/08/2016
Designed	J.W.	Date 08/08/2016
Verified	C.A.	Date 08/08/2016
Approved	J.P.S.	Date 08/08/2016

Client: LAND DEVELOPMENT AGENCY

Project: SITE INVESTIGATION
SECTION 45, BLOCK 1, CHAPMAN, ACT

Title: EXISTING SERVICES

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

AHD		Scale 1:500	Size A1

Drawing Number: 50517005-SK01

Revision: B

XREFs: X-CVT-15052_001_2D_Rev A; X-CVT-URB_CURT; URB_HOLT; ALL_ACT_SW_04042016; URB_CHAP; URB_RIVE; X-Ex-Tree Assessment
CAD File: N:\Projects\50\51\71\7005_STG 2 SIR CHAPMAN SECTION 45 BLOCK 1\Drawings\Build\50517005-SK01-Ex-Services.dwg

KATHNER STREET

REMAINING COMMUNITY FACILITY BLOCK

PERCY CRESCENT

BLOCK BOUNDARY

SECT 45
BLK 1
(SUBJECT SITE)

DARWINIA TERRACE

ANGOPHORA STREET

GARDEN

EXISTING GAS PIT

EXISTING SUBSTATION

EXISTING TELSTRA PIT

EXISTING GATE

EXISTING BOLLARD

STEPS

EXISTING SEWER TIE

PROPOSED DN150 SEWER TIE

PROPOSED DNS375 STORMWATER TIE

PROPOSED DN100 DICL WATER TIE, CONNECTION BY ICON WATER AT THE CONTRACTORS EXPENSE.

REPLACE EXISTING TELSTRA CONDUIT (Φ20) WITH Φ100 COMMUNICATION CONDUIT

CONSTRUCT STANDARD Φ1050 STORMWATER MANHOLE OVER EXISTING Φ 375 REINFORCED CONCRETE PIPE

PROPOSED DN150 SEWER MAIN

PROPOSED DN1050 STANDARD SEWER MANHOLE

PROPOSED DN1050 STANDARD STORMWATER MANHOLE

OVERLAND FLOW PATH IN EXCESS OF Φ375 STORMWATER PIPE CAPACITY

INDICATIVE VEHICLE ACCESS DRIVEWAY, DEVELOPER TO CONFIRM 1.5m CLEARANCE TO STREETLIGHT ACHIEVED.

Φ1050 STANDARD STORMWATER MANHOLE

PROPOSED INDICATIVE OF EXISTING FOOTPATH ALONG DARWINIA TERRACE

INDICATIVE VEHICLE ACCESS DRIVEWAY, DEVELOPER TO CONFIRM 1.5m CLEARANCE TO STREETLIGHT ACHIEVED.

Φ1050 STANDARD STORM WATER MANHOLE

Φ375 RCP

CONSTRUCT STANDARD HEADWALL

FILL TO MAXIMUM DEPTH OF 0.6m

EXTENSION OF FOOTPATH ON DARWINIA TERRACE

NORTH

LEGEND

PROPOSED

- PROPOSED EXTENT OF EARTHWORKS
- AREA OF FILL EXCEEDING 400mm
- STORMWATER PIPE / SW MANHOLE / SW HEADWALL / STORMWATER SUMP
- SEWER PIPE / SEWER MANHOLE
- STORMWATER OVERLAND FLOW
- STORMWATER TIE / END CAP
- SEWER TIE / END CAP
- WATER TIE / WATER END CAP

EXISTING

- SEWER
- STORMWATER
- WATER / METER PIT / GATE VALVE DOUBLE AIR VALVE / FIRE HYDRANT
- STORMWATER SWALE
- WATER / WATER METER PIT
- ELECTRICAL U/G (SERVICE LINE)
- ELECTRICAL U/G (LOW VOLTAGE)
- ELECTRICAL U/G (HIGH VOLTAGE)
- ELECTRICAL U/G (STREET LIGHT)
- ELECTRICAL POLE/STREETLIGHT
- OVERHEAD LINK/ DROPOUT FUSE
- GAS
- TELSTRA
- OVERHEAD (HIGH VOLTAGE)
- OVERHEAD (STREET LIGHT)
- OVERHEAD (LOW VOLTAGE)
- TREE
- GATE
- BOLLARD

0 10 20 30 40 50m

SCALE 1:500 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
C	16/03/2017	DRAFT REPORT	C.A.	G.Z.	J.P.S.
B	08/09/2016	DRAFT REPORT	J.W.	G.Z.	J.P.S.
A	08/08/2016	DRAFT REPORT	J.W.	G.Z.	J.P.S.

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Drawn M.P.Q.	Date August 2016
Checked C.A.	Date 08/08/2016
Designed J.W.	Date 08/08/2016
Verified C.A.	Date 08/08/2016
Approved J.P.S.	Date 08/08/2016

Client: LAND DEVELOPMENT AGENCY

Project: SITE INVESTIGATION
SECTION 45, BLOCK 1, CHAPMAN, ACT

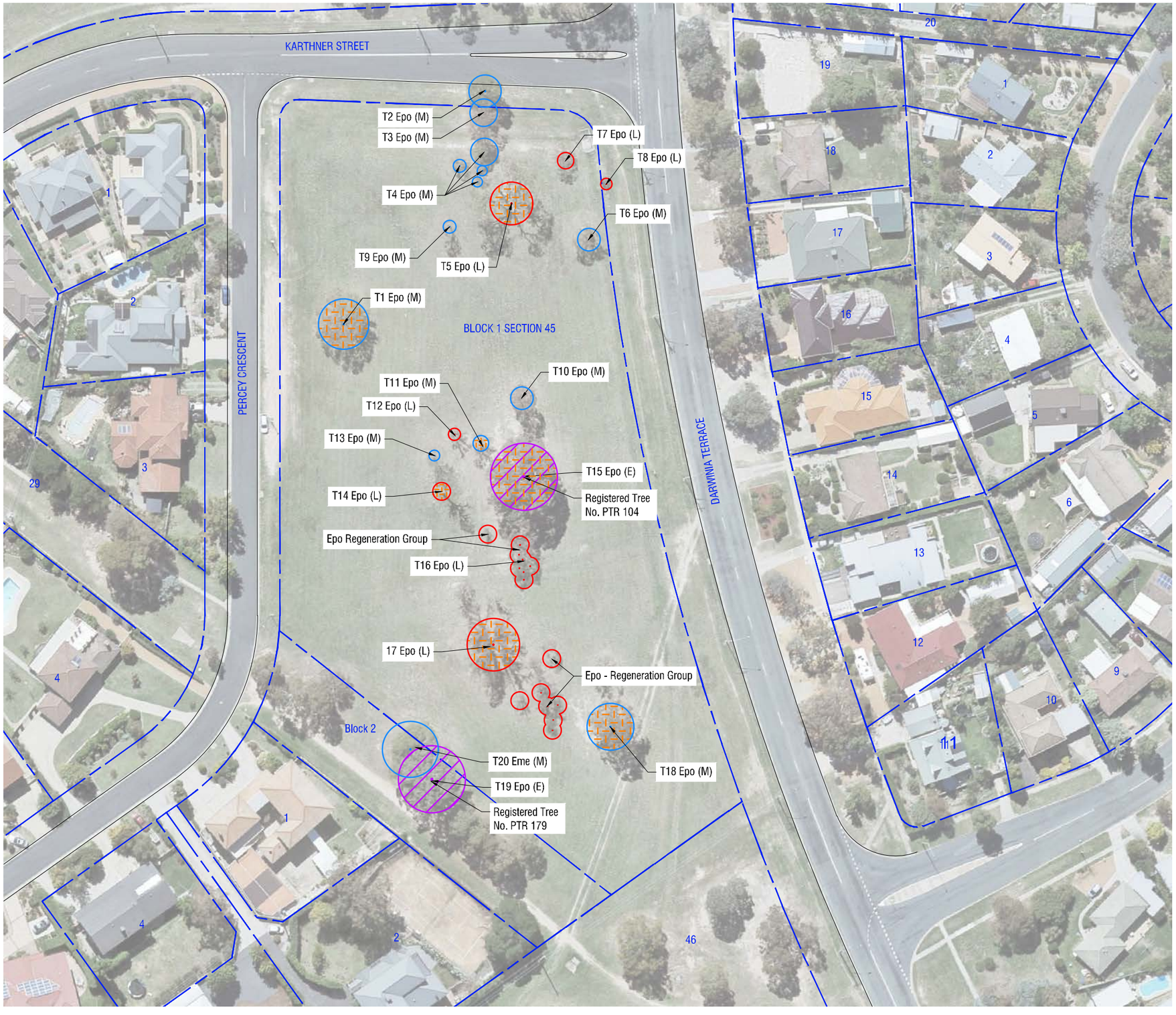
Title: PROPOSED SERVICES

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

AHD		Scale 1:500	Size A1

Drawing Number: 50517005-SK02

Revision: C



LEGEND

LEASE BOUNDARY

EXISTING TREE (E)
(Exceptional Quality)

EXISTING TREE (H)
(High Quality)

EXISTING TREE (M)
(Medium quality)

EXISTING TREE (L)
(Low quality)

T10 Eme (M) TREE NO., TREE SPECIES CODE, TREE QUALITY CODE

TREE SPECIES

Code	Botanical Name
Eme	*Eucalyptus melliodora*
Epo	*Eucalyptus polyanthemos*

TREE ASSESSMENT CODES

Tree Quality Code	Tree Quality (see below for definition)
E	Exceptional
H	High
M	Medium
L	Low

TREE QUALITY:
An overall assessment of the quality of the tree and its relative importance for retention within an urban context

Exceptional (E) A tree of group of trees that:
Has natural or cultural heritage importance; or
Has high aesthetic value and will have a major contribution to the surrounding landscape; or
Is of outstanding form and condition and is excellent example of the species; or
Has significant scientific value, including ecological importance.

High (H) A tree that:
Is of good form, structure and health;
Is without significant defect; and which has the potential to make a significant contribution to the landscape

Medium (M) A tree that:
Is of reasonable form, structure and health; and whose presence contributes to the landscape but not as significantly as high / exceptional quality.

Poor (P) A tree that:
Is of poor, structure or health, is in decline; and which has limited potential to contribute to the landscape.

PROTECTED TREES - (under the Tree Protection Act 2005)

Registered Tree (Tree No. PTR 104 and PTR 179) - Refer Report

Regulated Tree - Refer Report

NOTE: Location of trees annotated from ACTMAPI imagery as no survey information was provided.

FOR FURTHER INFORMATION REFER TO THE TREE ASSESSMENT REPORT

ALL DIMENSIONS AND EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR BEFORE PROCEEDING WITH THE WORK

ORIGINAL SHEET SIZE A1 0 5 10 15 20 25m

ISSUE	DATE	AMENDMENT DESCRIPTION	BY
A	20.07.18	CLIENT ISSUE	LD/GB

CLIENT

ARCHITECT

CONSULTING ENGINEER
Cardno

LANDSCAPE ARCHITECT
redboxdesigngroup

PROJECT
BLOCK 1 SECTION 45 CHAPMAN

TITLE
TREE ASSESSMENT

CAD FILE G:\Proj nds - Current\1292 - Block - Section 45 Chapman CURRENT DRAWINGS
SCALE 1:500@A1 • 1:1000@A3
DRAWN LD/GB
CHECKED GB
APPROVED KK
PROJECT CODE 1292
SHEET No. 101
ISSUE A

Chapman, Section 45, Block 1 MU - Stage 2 SIR

APPENDIX B

SITE PHOTOS

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Photo 1: 1 View east along Kathner Street southern verge from mid-block of subject site

Photo 2: Existing SW tie and headwall inlet structure to subject site

Photo 3: View north from southern point of swale along Darwinia Terrace

Photo 4: View north on Darwinia Terrace west verge from mid-block of subject site

Photo 5: View north on Darwinia Terrace western verge from mid-block of subject site

Photo 6: View north on Darwinia Terrace western verge from southern point of block

Photo 7: View north on Percy Crescent east verge from southern point of site

Photo 8: View north west of subject site from eastern boundary

Photo 9: View north west of subject site from south east boundary

Photo 10: View of swale along Darwinia Terrace (north)

Photo 11: View south along Percy Crescent eastern verge from Kathner Street

Photo 12: View south from Block 1 Section 45 to Block2 Section 45

Photo 13: View south from northern point of swale along Darwinia Terrace

Photo 14: View south on Darwinia Terrace western Verge from north east point of subject site

Photo 15: View south on Darwinia Terrace western verge

Photo 16: View south west of subject site from eastern boundary

Photo 17: View west along Kathner Street southern verge from Darwinia Terrace

Photo 18: View west along Kathner Street southern verge from mid-block of subject site

Photo 19: View west from Darwinia Terrace verge at southern point of subject site

Photo 20: View west of subject site from south east boundary

Photo 21: Air-valve structure located on twin 900 bulk water main in Block 1 Section 46

Photo 22: Hydrant in Eastern verge of Percy Crescent

Photo 23: Older standard pram crossing on south corner Kathner Street & Darwinia Terrace Intersection

Photo 24: Plantation sump mid-block of Block 2 Section 45 facing west

Photo 25: Plantation sump in south west corner of Block 2 Section 45

Photo 26: R-sump on Percy Crescent eastern verge near Kathner Street intersection

Photo 27: R-sump on southern verge of Kathner Street mid-block of subject site

Photo 28: R-sump on Kathner Street southern verge near Percy Crescent

Photo 29: SV in Eastern verge Percey Crescent

Photo 30: View north on western verge of Darwinia Terrace north east of subject site

Chapman, Section 45, Block 1 MU - Stage 2 SIR

APPENDIX C

CORRESPONDENCE

Cardno
Shaping the Future

Craig Allen

From:	Wayne Read <w.read@staff.iinet.net.au>
Sent:	Thursday, 14 July 2016 9:56 AM
To:	Lama Qasem
Cc:	Christiaan Theron
Subject:	RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Lama,
iiNet have reviewed the documents for SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2 and provide the following comment.

- The proposed development is acceptable to iiNet
- Currently iiNet does has capacity to service this development
- iiNet will require a footprint to install an electronic cabinet
- The developer is to contact iiNet at the detail design stage to confirm iiNet requirements

Please don't hesitate to contact us at iiNet for further information.

Regards

Wayne Read
Design Manager

iinet
connect better
www.iinet.net.au

470 Northbourne Avenue Dickson ACT 2602
Phone: 02 62298072
email: w.read@staff.iinet.net.au

Follow us on

From: Lama Qasem [mailto:Lama.Qasem@cardno.com.au]
Sent: Wednesday, 13 July 2016 5:24 PM
To: Wayne Read
Subject: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Wayne,

Cardno has been engaged for a Site Investigation for the LDA, for Section 45 Block 1 Chapman.

The block is intended to rezoned from their current use under the Territory Plan to RZ5: High Residential in order to facilitate the proposed development of 28 dwellings. Although we have not yet been provided further details on what configuration or layout the site will take, a mixture of 1, 2 and 3 bedroom (single and double storey) dwellings are anticipated within a the single development.

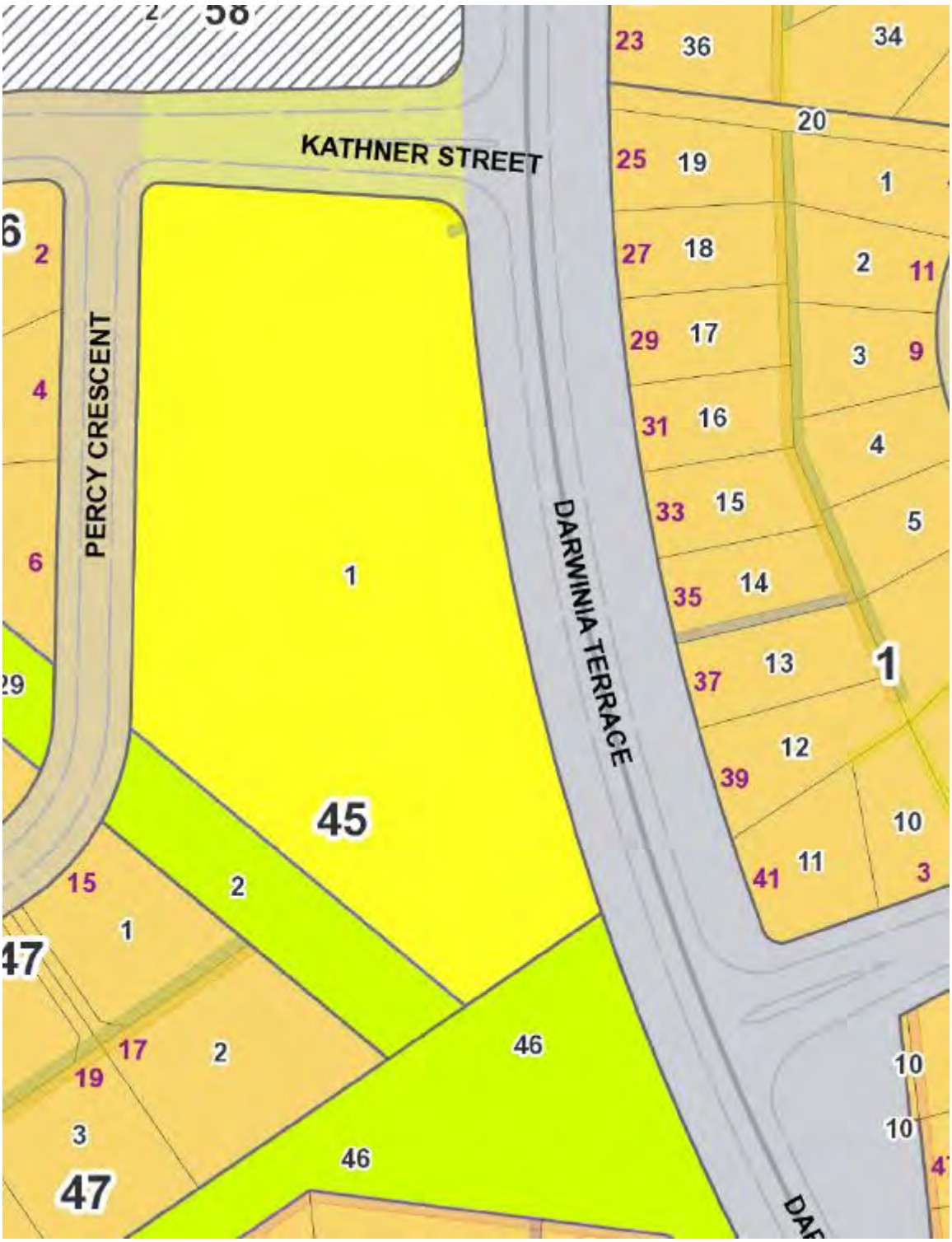
I have attached a locality plan showing the site and DBYD information received as well as the current and proposed Territory Plan zoning.

Could you please confirm the following in regards to the above:
- Is the proposed development of this for residential use acceptable to iinet (is there capacity in the network?)
- Are there any iinet infrastructure requirements/constraints for the site for connection of or reticulation within the site? and
- Are there any significant constraints preventing use of the existing service connections?

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further (02 6112 4512)

Aerial View of the site

Territory Plan Zone



Regards,

Lama Qasem
CIVIL ENGINEER/PROJECT MANAGER
CARDNO

Cardno
Shaping the Future

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4512

Address Level 2, 14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
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Email lama.qasem@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

Cardno's management systems are certified to ISO9001 (quality) and AS4801/OHSAS18001 (occupational health and safety)

Craig Allen

From: Lai, Jacob Y <Jacob.Y.Lai@team.telstra.com>
Sent: Thursday, 14 July 2016 3:46 PM
To: Lama Qasem
Subject: [Pending]RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Lama,

Please see Telstra reply (in red) below.

Regards,

Jacob Y Lai Principal Planner - NSW Country South & ACT
Forecasting & Area Planning NSW and Wideband | Networks & Access Technologies | Telstra Operations
P 02 8576 9799 | M 0419 442551
| E Jacob.y.lai@team.telstra.com| W http://www.in.telstra.com.au/ism/nswareaplanning/

From: Lama Qasem [mailto:Lama.Qasem@cardno.com.au]
Sent: Thursday, 14 July 2016 8:21 AM
To: Lai, Jacob Y <Jacob.Y.Lai@team.telstra.com>
Subject: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Jacob

Cardno has been engaged for a Site Investigation for the LDA, for Section 45 Block 1 Chapman.

The block is intended to rezoned from their current use under the Territory Plan to RZ5: High Residential in order to facilitate the proposed development of 28 dwellings. Although we have not yet been provided further details on what configuration or layout the site will take, a mixture of 1, 2 and 3 bedroom (single and double storey) dwellings are anticipated within a the single development.

I have attached a locality plan showing the site received as well as the current and proposed Territory Plan zoning.

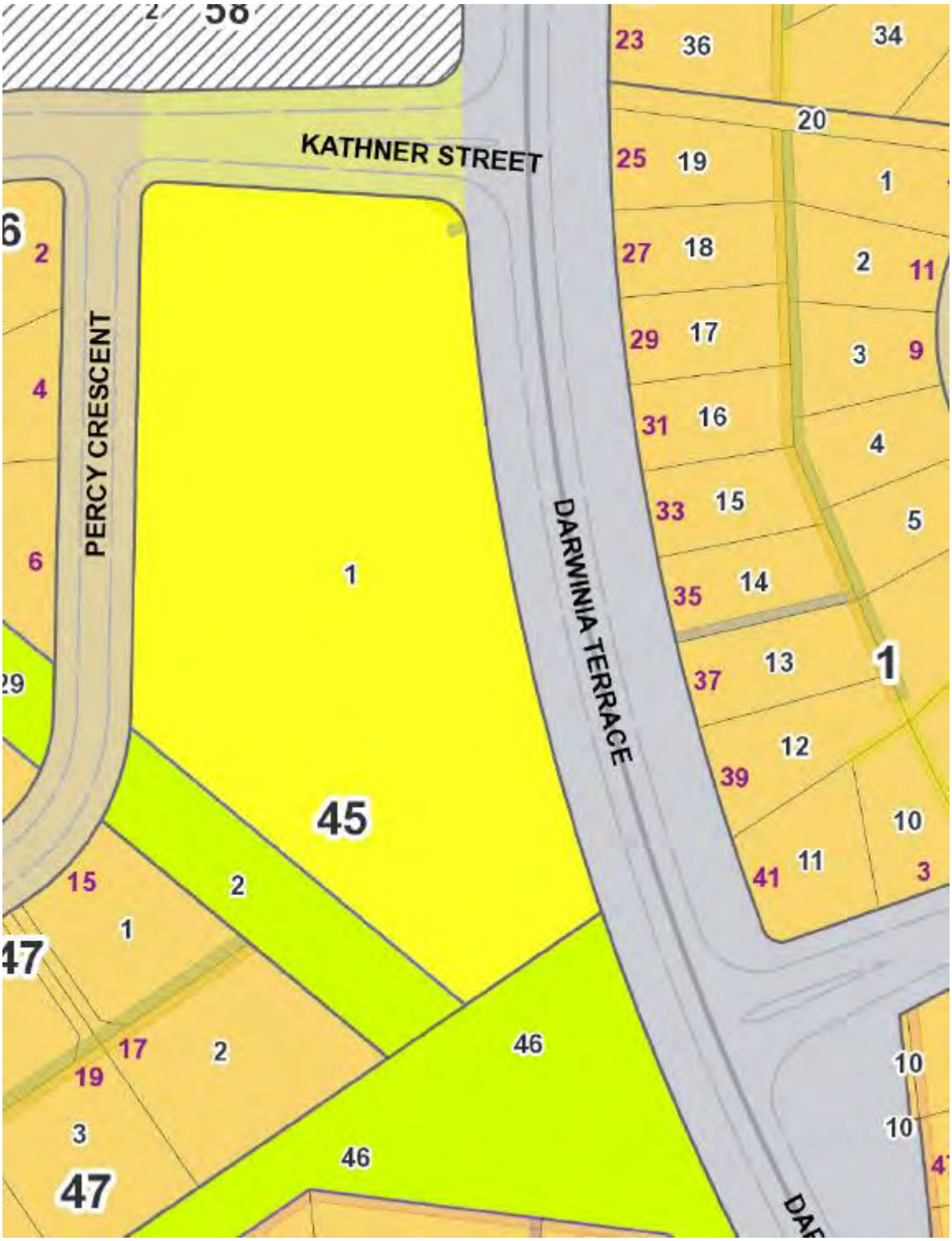
Could you please confirm the following in regards to the above:

- Is the proposed development of these sites for residential use acceptable to Telstra (is there capacity in the network?)
Proposal is acceptable to Telstra.
- Are there any Telstra infrastructure requirements/constraints for the site for connection of or reticulation within the site?; and
Telstra will require exclusive access to leadin conduit for all dwellings. Minimum of 1XP100 will be required. Developer is responsible for provision of leadin conduit from each dwelling to a suitable network access point at Darwina Terrace.
- Are there any significant constraints preventing use of the existing service connections?
There is no significant constraint preventing use of existing service connection. However, existing conduit serving site is only a P20 which is insufficient to service proposed development. It will need to be replaced by 1XP100 conduit.

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further. I'm reachable at (6112 4512)

Aerial View of the site

Territory Plan Zone



Regards,

Lama Qasem
CIVIL ENGINEER/PROJECT MANAGER
CARDNO

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Shaping the Future

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Address Level 2, 14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email lama.qasem@cardno.com.au Web www.cardno.com

Craig Allen

From: Steve Donnelly <Steve.Donnelly@jemena.com.au>
Sent: Thursday, 14 July 2016 8:47 AM
To: Lama Qasem
Subject: RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Follow Up Flag: Follow up
Flag Status: Flagged

HI Lama

The existing medium pressure network (210kPa) has sufficient capacity to service a development of the proposed type/size. There aren't any constraints that would prevent connection from the existing infrastructure. Jemena require the developer to supply trenching for any internal reticulation of the gas network.

Regards

Steve Donnelly
Network Development Manager
Jemena
Unit 1, 5-7 Johns Place, Hume, ACT 2620
(02) 6203 0640 | 0427 401 803
steve.donnelly@jemena.com.au | www.jemena.com.au

From: Lama Qasem [mailto:Lama.Qasem@cardno.com.au]
Sent: Wednesday, 13 July 2016 10:01 PM
To: Steve Donnelly
Subject: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2
Importance: High

Hi Steve,

Cardno has been engaged to complete another Site Investigation for the LDA - the development of Section 45 Block 1 Chapman.

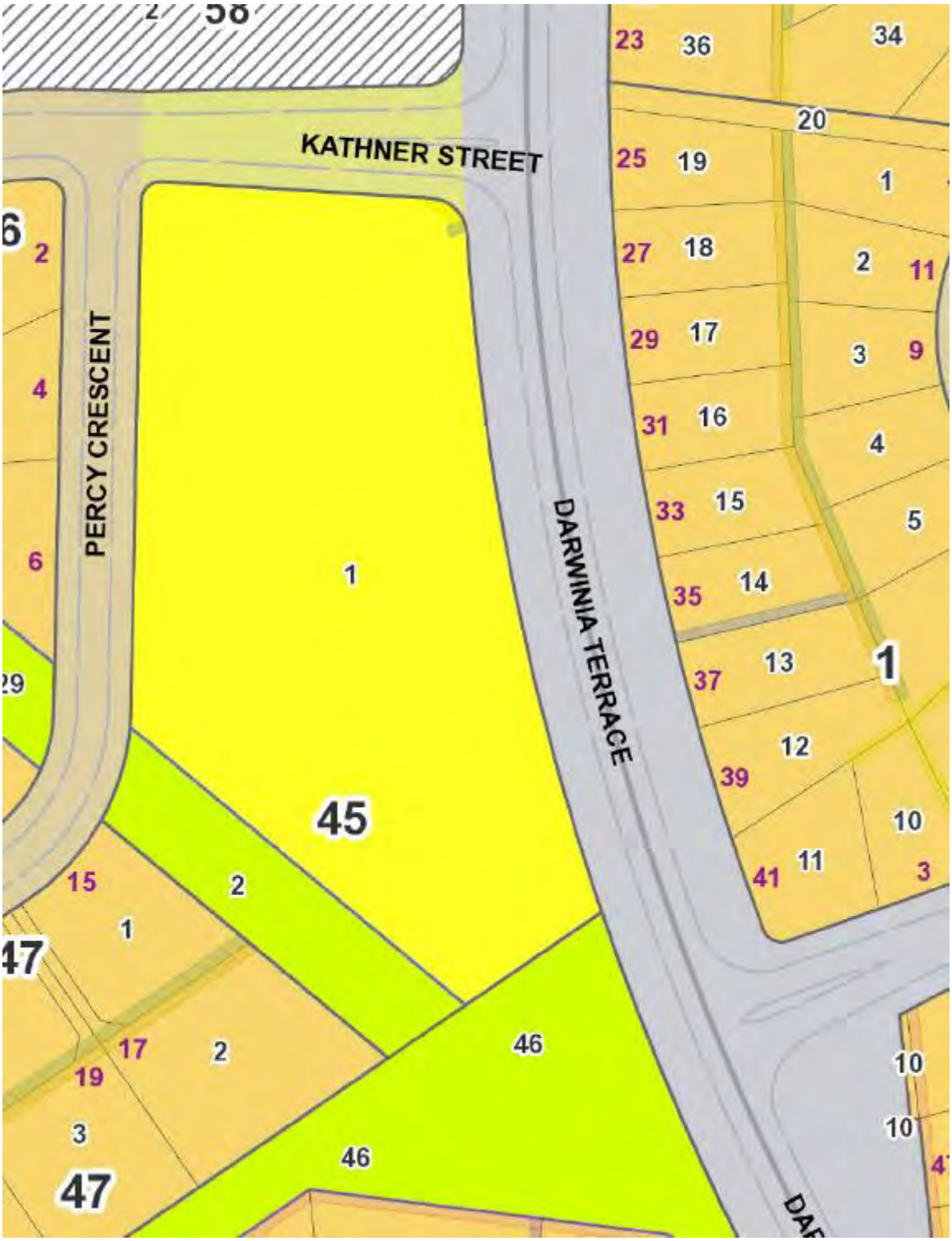
The block is intended to rezoned from their current use under the Territory Plan to RZ5: High Residential in order to facilitate the proposed development of 28 dwelling. Although we have not yet been provided further details on what configuration or layout the site will take, a mixture of 1, 2 and 3 bedroom dwellings are anticipated in one/two storey town houses development.

I have attached a locality plan showing the site and DBYD information received as well as the current and proposed Territory Plan zoning.

Could you please confirm the following in regards to the above:

- Is the proposed development of these sites for residential use acceptable to Jemena (is there capacity in the network?)
- Are there any Jemena infrastructure requirements/constraints for the site for connection of or reticulation within the site?; and
- Are there any significant constraints preventing use of the existing service connections?

Thanks for your continued help with these investigations, feel free to give me a call if you need anything further. I'm reachable at (6112 4512).



Kind regards,

Lama Qasem
CIVIL ENGINEER/PROJECT MANAGER
CARDNO

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Craig Allen

From: Dahal, Nabin <Nabin.Dahal@iconwater.com.au>
Sent: Monday, 25 July 2016 3:40 PM
To: Craig Allen
Cc: Havelka, Peter
Subject: RE: RE: RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Good Afternoon Craig,

The pressure with different flow condition for **Chapman Section 45 Block 1** is tabulated below with assumptions used. This is measured in-front of the block on DN100 main along COBBY STREET.

The following assumptions are used for the analysis:

- *The pressure is calculated with service reservoirs at half capacity and an allowance for reservoir outlet losses of 1.5 m.*
- *AWSSS design peak flow is considered in this analysis.*
- *The model contains identified unlined mains.*

	Chapman Section 45 Block 1 (Elevation = 630m)
Max Static Pressure (m)	55
Min Pr @ Peak Demand	50
Min Pr @ Peak Demand + 10 L/s (m)	49
Min Pr @ Peak Demand + 20 L/s (m)	48
Min Pr @ Peak Demand + 30 L/s (m)	46
Min Pr @ Peak Demand + 40 L/s (m)	44
Min Pr @ Peak Demand + 50 L/s (m)	42
Min Pr @ Peak Demand + 60 L/s (m)	39

Please give me a call if you want to discuss.

Regards,

Nabin Dahal
Team Leader, Hydraulic Asset Acceptance
Asset Insurance and Information

Icon Water
GPO Box 366 Canberra ACT 2601
T 02 6180 6011
iconwater.com.au | Twitter | YouTube | LinkedIn

From: Havelka, Peter
Sent: Monday, 25 July 2016 2:09 PM
To: 'Craig Allen'
Cc: Dahal, Nabin
Subject: RE: RE: RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Craig,

I was out of the office last week and back today sorting through my emails.

There is capacity in the system to accept the proposed 3.5L/s flow

Please liaise with the fire department regarding requirements

I spoke to Nabin and he will provide you the water pressure enquiry today

Regards
Peter

Peter Havelka
Technical Officer, Hydraulic Asset Acceptance

Icon Water
GPO Box 366 Canberra ACT 2601
T 02 6180 6015
iconwater.com.au | Twitter | YouTube | LinkedIn

From: Craig Allen [mailto:Craig.Allen@cardno.com.au]
Sent: Monday, 25 July 2016 9:03 AM
To: Dahal, Nabin
Cc: Havelka, Peter
Subject: FW: RE: RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Nabin,

I'm having a little trouble getting a hold of Peter Havelka, I wonder can you help me out with this one today if he is unavailable.

Kind Regards,

Craig Allen
PROJECT OFFICER
CARDNO

Cardno
Shaping the Future

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4562
Address Level 2, 14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia

Postal PO Box 40 Fyshwick ACT 2609
Email craig.allen@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

From: Craig Allen
Sent: Friday, 22 July 2016 1:01 PM
To: 'Havelka, Peter' <Peter.Havelka@iconwater.com.au>
Cc: Lama Qasem <Lama.Qasem@cardno.com.au>
Subject: [Pending]RE: RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Peter,

We've undertaken calculations for the proposed development on Chapman Section 45 Block 1 and can provide the following loadings.
Sewer:

- Sewer loading from block = 3.5L/s.

Water:

- Probable simultaneous demand for potable water = 3.75L/s.
- We'll have to upgrade the tie, however the final layout is not locked in at the moment so it may be best to allow for connection to the Percy Crescent water main (worst case).
- Fire flows required are F5, 45L/s. Although because located in a bushfire risk zone could you advise if a higher fire risk category is applicable?

Please provide available pressures and further advice as soon as possible.

Kind Regards,

Craig Allen
PROJECT OFFICER
CARDNO

Cardno
Shaping the Future

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Postal PO Box 40 Fyshwick ACT 2609
Email craig.allen@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

From: Havelka, Peter [mailto:Peter.Havelka@iconwater.com.au]
Sent: Tuesday, 19 July 2016 9:47 AM
To: Lama Qasem <Lama.Qasem@cardno.com.au>
Subject: [Pending]RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Lama,

Please see some detail below:

Sewer:
- Currently the block is serviced via DN100 tie located in the north eastern corner and may require upgrading to a DN150 depending upon the proposed development
- Please provide the loading so that the system can be checked for capacity

Water:
- Currently the site is serviced via a 20mm water tie located in the north western corner of the block
- Depending on the development layout there is a 150 CICL main on Percy Street; a 225CICL main on Kathner Street and a 300CICL main on Darwinia Terrace as per your attached drawing

Please also be advised there are 2 x 900mm bulk main supplies near the southern end of the block; early consultation with Icon Water will be required in order to protect the assets while construction of the development occurs

Regards
Peter

Peter Havelka
Technical Officer, Hydraulic Asset Acceptance

Icon Water
GPO Box 366 Canberra ACT 2601
T 02 6180 6015
iconwater.com.au | Twitter | YouTube | LinkedIn

From: Lama Qasem [mailto:Lama.Qasem@cardno.com.au]
Sent: Wednesday, 13 July 2016 9:52 PM
To: Havelka, Peter; O'Shannassy, Kieran; Dahal, Nabin
Subject: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2
Importance: High

Hi Peter/Kieran/Nabin,

Cardno has been engaged to complete another Site Investigation for the LDA - the development of Section 45 Block 1 Chapman.

The block is intended to rezoned from their current use under the Territory Plan to RZ5: High Residential in order to facilitate the proposed development of 28 dwelling. Although we have not yet been provided further details on what configuration or layout the site will take, a mixture of 1, 2 and 3 bedroom dwellings are anticipated in one/two storey town houses development.

I have attached a locality plan showing the site and DBYD information received as well as the current and proposed Territory Plan zoning.

Kieran,

Could I please receive any available WAE information for the area?

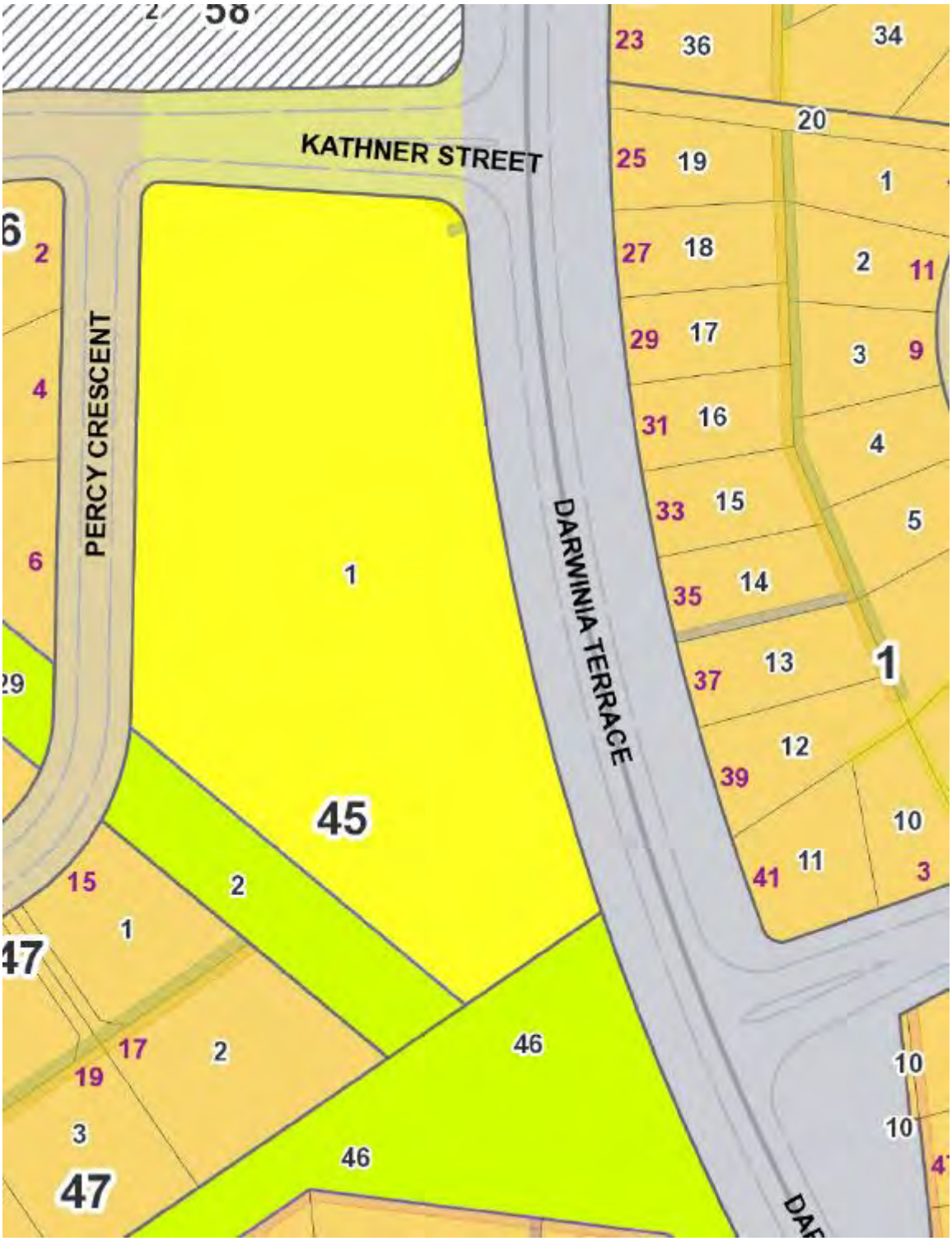
Peter,

Could you please confirm the following in regards to the above:
- Is the proposed development of these sites for residential use acceptable to Icon Water (is there capacity in the network?)
- Are there any Icon Water infrastructure requirements/constraints for the site for connection of or reticulation within the site?; and
- Are there any significant constraints preventing use of the existing service connections?

Nabin,

- Could I please receive information relating to the available pressures at the mains outside these blocks including pressures during firefighting drawoff? Values at 20,
30, 40, 50 and 60L/s drawoff would be most helpful.

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further. I'm reachable at (6112 4512)



Regards,

Lama Qasem
CIVIL ENGINEER/PROJECT MANAGER
CARDNO

Cardno
Shaping the Future

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Email lama.qasem@cardno.com.au Web www.cardno.com

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****

Craig Allen

From: O'Shannassy, Kieran <Kieran.O'Shannassy@iconwater.com.au>
Sent: Tuesday, 19 July 2016 9:17 AM
To: Lama Qasem
Subject: Chapman Section 45 block 1
Attachments: Chapman_S45blk1.pdf

Lama

Information as requested. Please note that for any development in this area significant consultation will need to be undertaken with Icon Water due to the proximity of the 900mm bulk supply mains. The alignment of these mains is only indicative and they will need to be located and their depth determined to ensure that the protection envelope and integrity of this infrastructure is maintained.

Regards

Kieran

Kieran O'Shannassy
GIS Scientist
Geospatial Asset Services

GPO Box 366 Canberra ACT 2601
T 02 6180 6056
iconwater.com.au

Craig Allen

From: ACTF&R Risk & Planning <ACTF-RRisk-Planning@act.gov.au>
Sent: Monday, 25 July 2016 2:46 PM
To: Craig Allen
Subject: RE: Block 1 Section 45 Chapman - ICON Water Fire Risk Level [SEC=UNCLASSIFIED]
Attachments: Unit Complex and Rear Lane Hydrant and Access Policy 2015.pdf

Hi Craig,
Are these to be 1 or 2 storey buildings, and are they more than one self contained unit high?

Fire risk classification is usually determined at development application where full nature and scope of the development is know.
Regardless, (depending on the fire risk classification) it may be beyond the scope of your development to alter the size of the mains to achieve the flow rate required in an existing situation such as this.
It may be more appropriate for you to consider the rear lane and unit complex hydrant and access provisions attached.

SFF Neil Willis Grad Dip. Bushfire Protection,
ACT Fire & Rescue - Risk and Planning Section
9 Amberley Ave, Majura ACT 2601
PH: 0262078472 E: neil.willis@act.gov.au

From: Craig Allen [mailto:Craig.Allen@cardno.com.au]
Sent: Monday, 25 July 2016 2:22 PM
To: ACTF&R Risk & Planning
Subject: RE: Block 1 Section 45 Chapman - ICON Water Fire Risk Level [SEC=UNCLASSIFIED]

Hi Neil,

Layout of site in attachment, unfortunately the previous attachment was still too large and has caused my original email to bounce.

Kind Regards

Craig Allen
PROJECT OFFICER
CARDNO

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Address Level 2, 14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email craig.allen@cardno.com.au Web www.cardno.com

From: ACTF&R Risk & Planning [mailto:ACTF-RRisk-Planning@act.gov.au]
Sent: Monday, 25 July 2016 2:05 PM
To: Craig Allen <Craig.Allen@cardno.com.au>
Cc: ACTF&R Risk & Planning <ACTF-RRisk-Planning@act.gov.au>
Subject: RE: Block 1 Section 45 Chapman - ICON Water Fire Risk Level [SEC=UNCLASSIFIED]

Hi Craig,
I am currently in the process of handing over this position. for future correspondence please email actf-rrisk-planning@act.gov.au

There are also no attachments to your email ?

SFF Neil Willis Grad Dip. Bushfire Protection,
ACT Fire & Rescue - Risk and Planning Section
9 Amberley Ave, Majura ACT 2601
PH: 0262078472 E: neil.willis@act.gov.au

From: Craig Allen [mailto:Craig.Allen@cardno.com.au]
Sent: Monday, 25 July 2016 1:04 PM
To: Willis, Neil
Subject: FW: Block 1 Section 45 Chapman - ICON Water Fire Risk Level

Hi Neil,

Resent without attachment due to size issues.

Cardno have been engaged by the LDA to undertake a stage 2 site investigation of Block 1 Section 45 Chapman.

The proposed development is a residential medium density residential zone with approximately 35 dwellings over the 1.4Ha site.

As part of the investigation we need to provide a fire risk level for the future design of ICON Water supply and surrounding hydrants.
A bushfire risk assessment has been undertaken by our sub consultant (refer attached), which has suggested either F4 or F5 level.

Could you please advise if the site should be F4 or F5? We are in a bit of a rush on this one and if you have time to respond today it would be greatly appreciated.

P.S. I've had to cut a few pages from the attached report to bring it under the max email file size, the only pages removed were related to locality plans and other image heavy pages not necessarily required.

Kind Regards,

Craig Allen
PROJECT OFFICER
CARDNO

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4562
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Craig Allen

From: Lama Qasem
Sent: Monday, 25 July 2016 4:00 PM
To: Craig Allen
Subject: FW: SIR Request - SECTION 53 BLOCK 5 HOLT [SEC=UNCLASSIFIED]

FYI

Lama Qasem
CIVIL ENGINEER/PROJECT MANAGER
CARDNO

Cardno
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Postal PO Box 40 Fyshwick ACT 2609
Email lama.qasem@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

From: ACTF&R Risk & Planning [mailto:ACTF-RRisk-Planning@act.gov.au]
Sent: Monday, 25 July 2016 3:48 PM
To: Lama Qasem <Lama.Qasem@cardno.com.au>
Cc: ACTF&R Risk & Planning <ACTF-RRisk-Planning@act.gov.au>
Subject: RE: SIR Request - SECTION 53 BLOCK 5 HOLT [SEC=UNCLASSIFIED]

Hi Lama,
As requested, in the last email, please send your requests to actf-rrisk-planning@act.gov.au

Residential areas are typically F6 or F5, depending on rise in storeys or exposure to bushfire hazard. In limited circumstances where the development is greater than 3 storeys, F4 classification may be used.

SFF Neil Willis Grad Dip. Bushfire Protection,
ACT Fire & Rescue - Risk and Planning Section
9 Amberley Ave, Majura ACT 2601
PH: 0262078472 E: neil.willis@act.gov.au

Craig Allen

From: enworks <enworks@actewagl.com.au>
Sent: Thursday, 14 July 2016 9:49 AM
To: Lama Qasem
Subject: RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Lama,

We do support the development and do not have any significant constraints about the proposed development of 28 units at B1 Section 45 Chapman.

It is noted that there is an existing pole sub 2609 is located at laneway adjacent to B4 S46 which is approx.110-120 m away from the B1 S45. This substation can be utilised to provide power supply to proposed development if the point of entry is located as near as possible to block boundary towards the direction of the source/sub 2609.

There may be a need of new substation/upgrade of existing if any commercial/retail load is proposed in addition to 28 units or in case of any significant load increase.

I hope above will help at this stage.

Regards
Kedar Vedanti
Industry Interface and Coordination Lead
Network Connection Services
Customer Connections Branch
Energy Networks - ActewAGL Distribution
t 02 6248 3582 | **f** 02 6293 5762

www.actewagl.com.au

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From: Lama Qasem [mailto:Lama.Qasem@cardno.com.au]
Sent: Wednesday, 13 July 2016 9:35 PM
To: enworks
Cc: Vedanti, Kedar
Subject: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Kedar,

Cardno has been engaged to complete another Site Investigation for the LDA - the development of Section 45 Block 1 Chapman.

The block is intended to rezoned from their current use under the Territory Plan to RZ5: High Residential in order to facilitate the proposed development of 28 dwelling. Although we have not yet been provided further details on what configuration or layout the site will take, a mixture of 1, 2 and 3 bedroom dwellings are anticipated in one/two storey town houses development.

I have attached a locality plan showing the site and DBYD information received as well as the current and proposed Territory Plan zoning.

Could you please confirm the following in regards to the above:
- Is the proposed development of these sites for residential use acceptable to ActewAGL (is there capacity in the network?)
- Any requirement for a new substation and where do you think it needs to be located?

- Are there any significant constraints preventing use of the existing service connections?

Thanks again for your continued help, feel free to give me a call if you need anything further.

Regards,

Lama Qasem
CIVIL ENGINEER/PROJECT MANAGER
CARDNO

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CONNECT WITH CARDNO

James Walton

From: Wayne Read <w.read@staff.iinet.net.au>
Sent: Thursday, 14 July 2016 9:56 AM
To: Lama Qasem
Cc: Christiaan Theron
Subject: RE: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Lama,
iiNet have reviewed the documents for SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2 and provide the following comment.

- The proposed development is acceptable to iiNet
- Currently iiNet does has capacity to service this development
- iiNet will require a footprint to install an electronic cabinet
- The developer is to contact iiNet at the detail design stage to confirm iiNet requirements

Please don't hesitate to contact us at iiNet for further information.

Regards

Wayne Read
Design Manager

iinet
connect better
www.iinet.net.au

470 Northbourne Avenue Dickson ACT 2602
Phone: 02 62298072
email: w.read@staff.iinet.net.au

Follow us on

From: Lama Qasem [mailto:Lama.Qasem@cardno.com.au]
Sent: Wednesday, 13 July 2016 5:24 PM
To: Wayne Read
Subject: SIR Request - CHAPMAN SECTION 45 BLOCK 1 - STAGE 2

Hi Wayne,

Cardno has been engaged for a Site Investigation for the LDA, for Section 45 Block 1 Chapman.

The block is intended to rezoned from their current use under the Territory Plan to RZ5: High Residential in order to facilitate the proposed development of 28 dwellings. Although we have not yet been provided further details on what configuration or layout the site will take, a mixture of 1, 2 and 3 bedroom (single and double storey) dwellings are anticipated within a the single development.

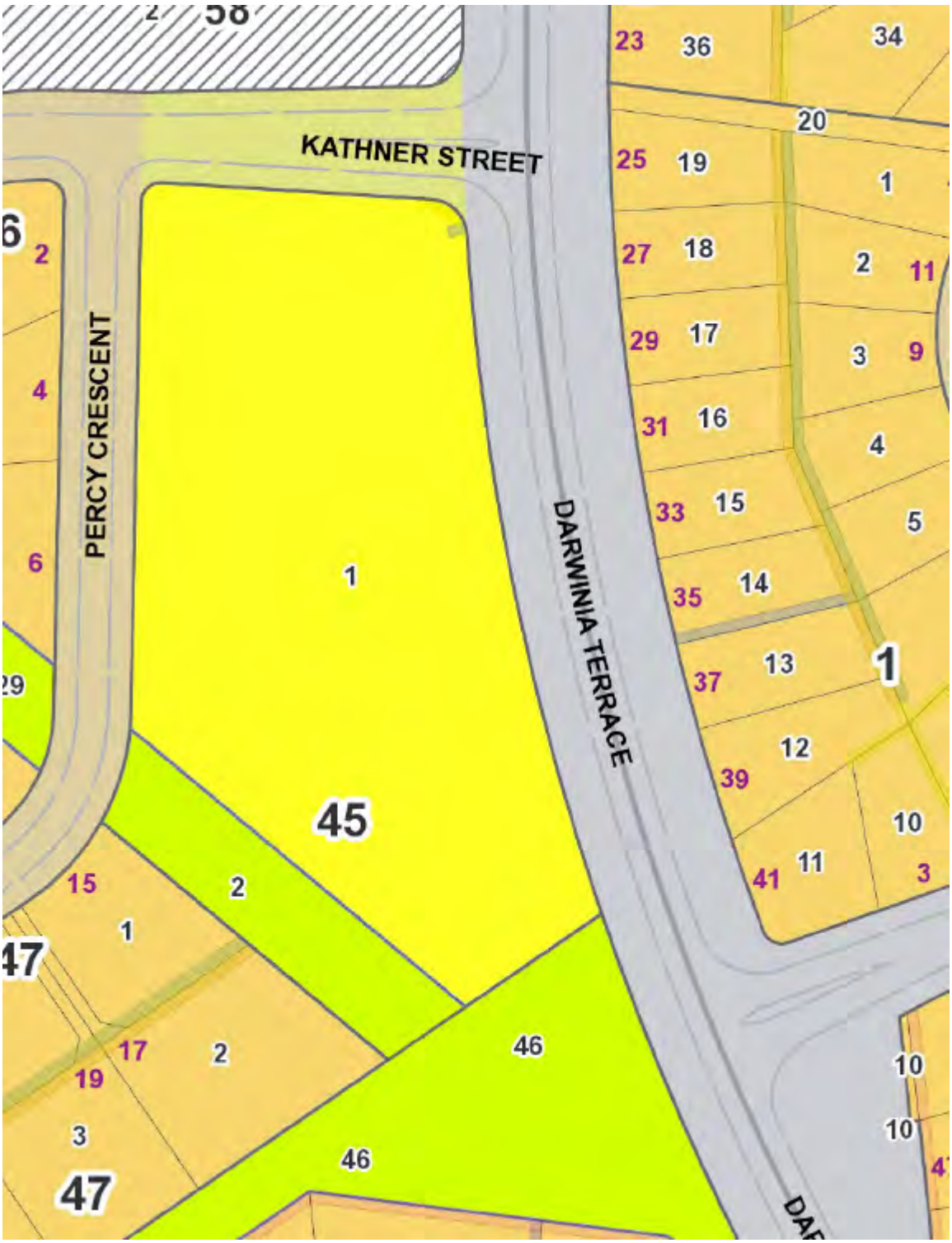
I have attached a locality plan showing the site and DBYD information received as well as the current and proposed Territory Plan zoning.

Could you please confirm the following in regards to the above:
- Is the proposed development of this for residential use acceptable to iinet (is there capacity in the network?)
- Are there any iinet infrastructure requirements/constraints for the site for connection of or reticulation within the site? and
- Are there any significant constraints preventing use of the existing service connections?

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further (02 6112 4512)

Aerial View of the site

Territory Plan Zone



Regards,

Lama Qasem
CIVIL ENGINEER/PROJECT MANAGER
CARDNO

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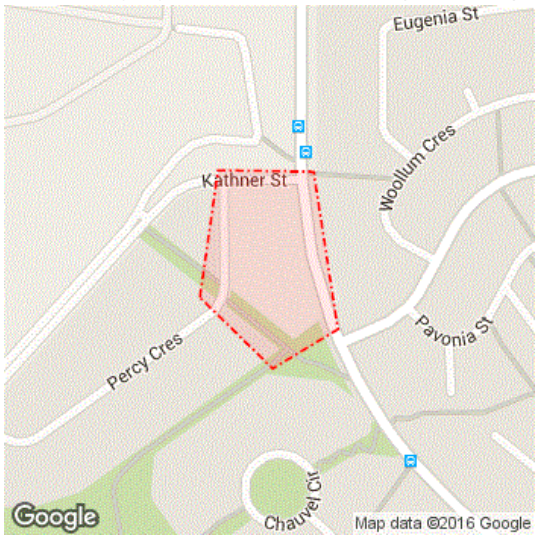
Caller Details

Contact: Mr Craig Allen
Company: Cardno (NSW/ACT) Pty Ltd
Address: Level 2 14 Wormald Street
Symonston ACT 2609

Caller Id: 1458270 **Phone:** 0261124500
Mobile: 0411476065 **Fax:** Not Supplied
Email: craig.allen@cardno.com.au

Dig Site and Enquiry Details

WARNING: The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables. The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.



User Reference: Chapman SIR B1 S45
Working on Behalf of:
ACT Government

Enquiry Date:	Start Date:	End Date:
21/07/2016	23/07/2016	24/08/2016

Address:
Percy Crescent
Chapman ACT 2611
Job Purpose: Design
Onsite Activity: Planning & Design
Location of Workplace: Both
Location in Road: CarriageWay,Footpath,Nature Strip

- Check that the location of the dig site is correct. If not you must submit a new enquiry.
- Should the scope of works change, or plan validity dates expire, you must submit a new enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

Notes/Description of Works:
Site Investigation for the construction of residential subdivision

Your Responsibilities and Duty of Care

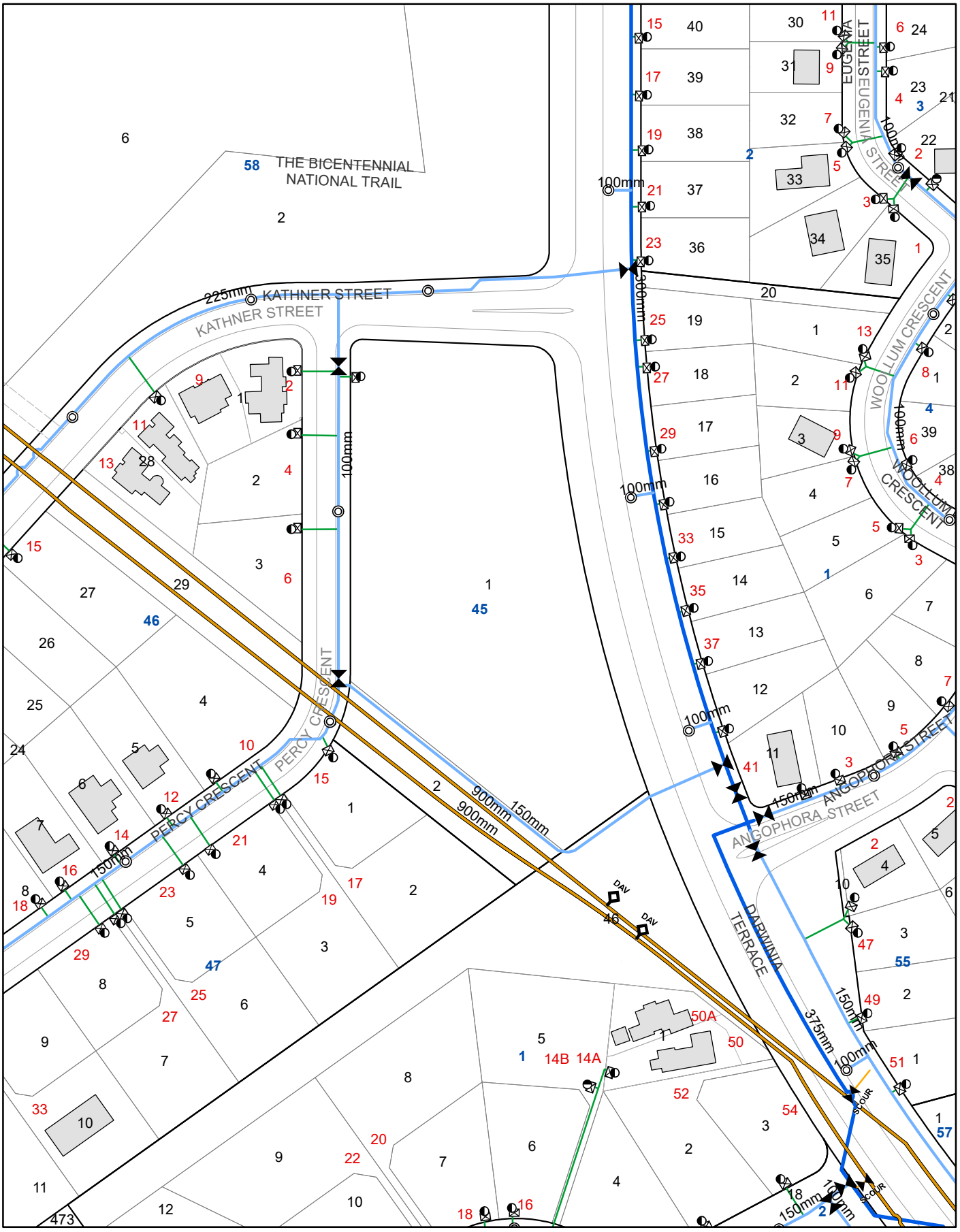
- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at **www.1100.com.au**
- **For more information on safe excavation practices, visit www.1100.com.au**

Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days. Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.
** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.
# Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

Seq. No.	Authority Name	Phone	Status
54398737	ActewAGL / Icon Water	0262935770	NOTIFIED
54398736	Telstra NSW, South	1800653935	NOTIFIED
54398735	Transact Communications	0262298009	NOTIFIED

END OF UTILITIES LIST



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Seq #: 54398737

Percy Crescent, Chapman

Water Network

icon WATER

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0 5 10 20 30 40 M

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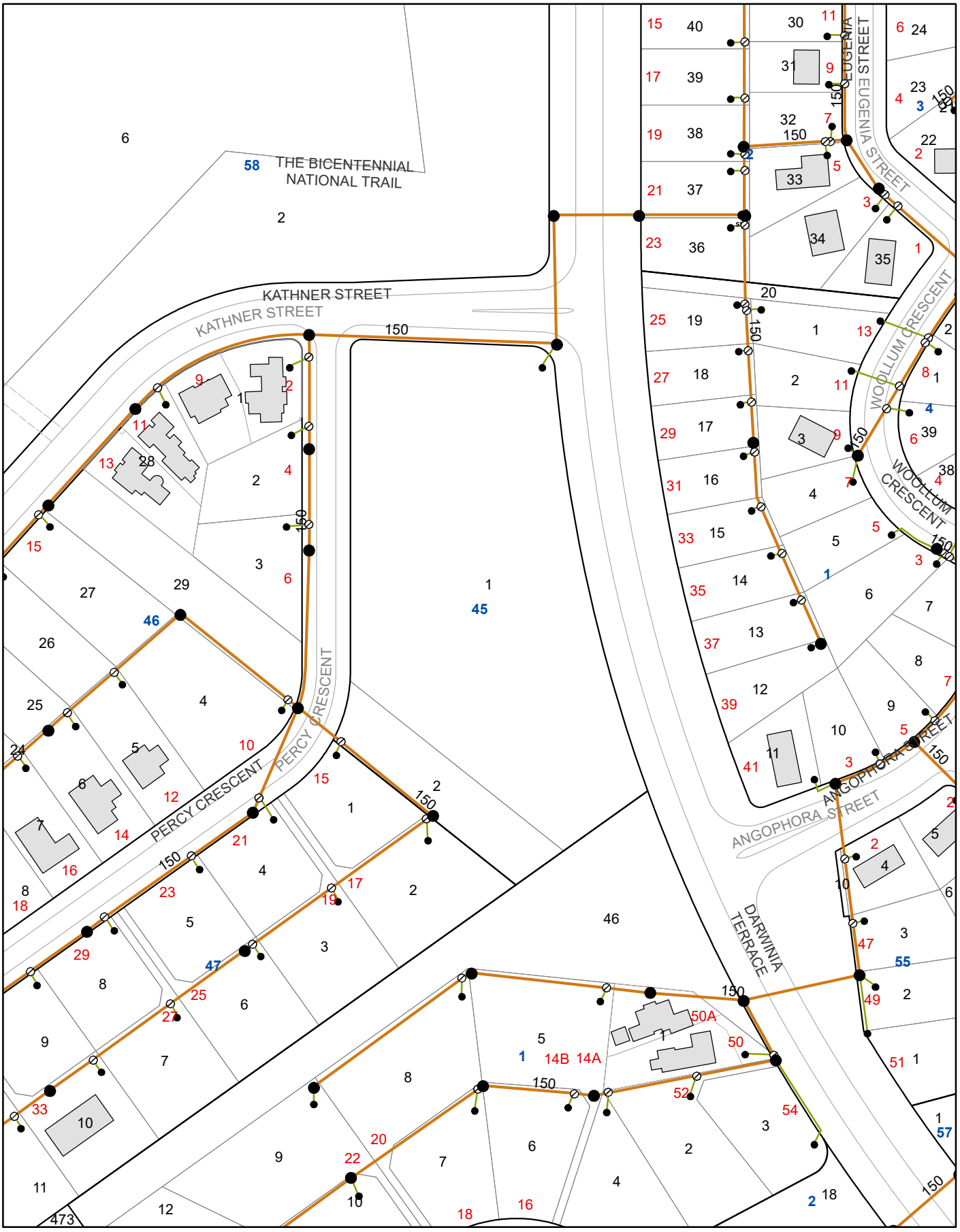
Template: WaterA4Portrait

Creation Date: 21-Jul-2016



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Seq #: 54398737

Percy Crescent, Chapman

Sewer Network

icon WATER

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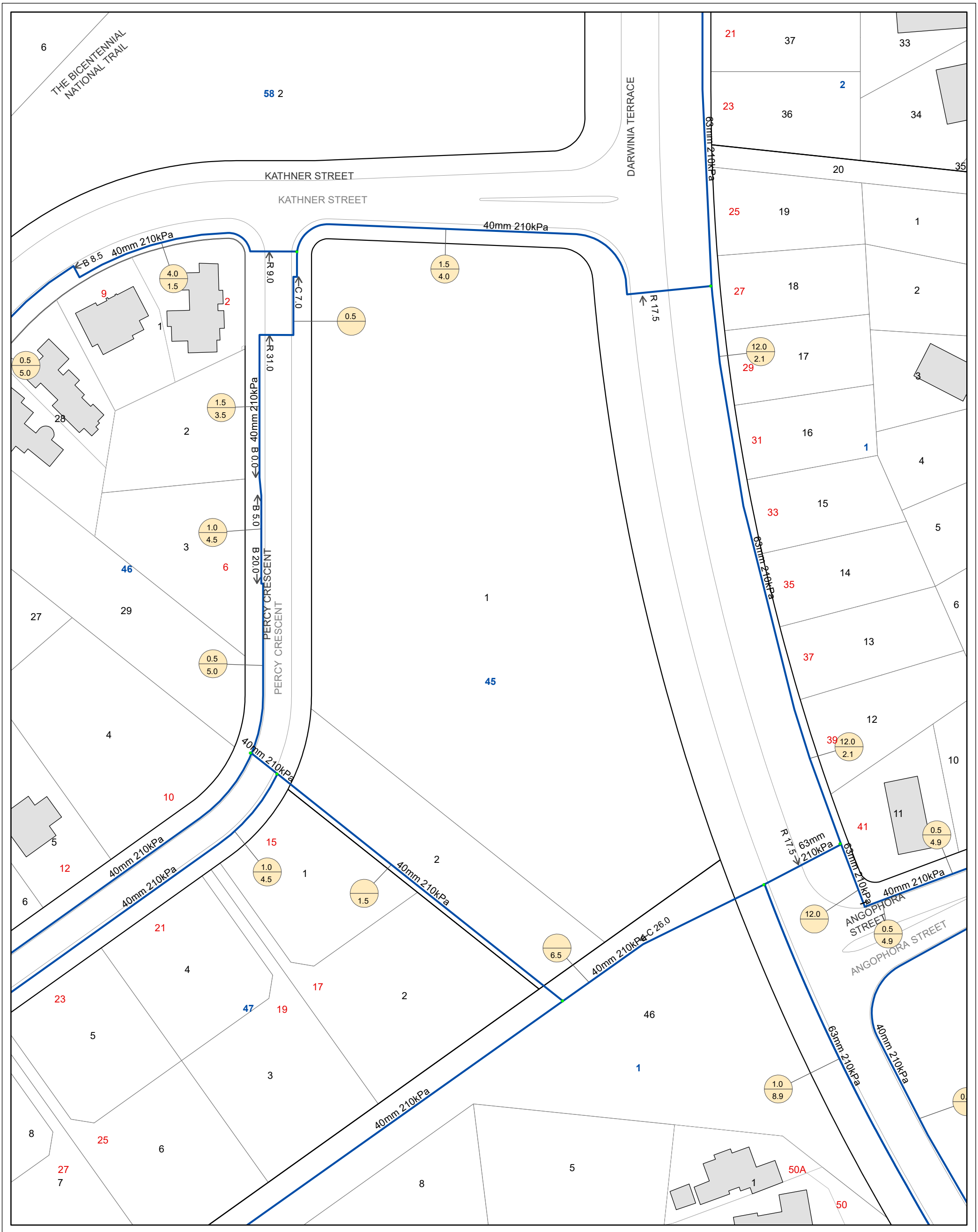
Creation Date: 21-Jul-2016



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Seq #: 54398737

Percy Crescent, Chapman

ActewAGL Gas Network

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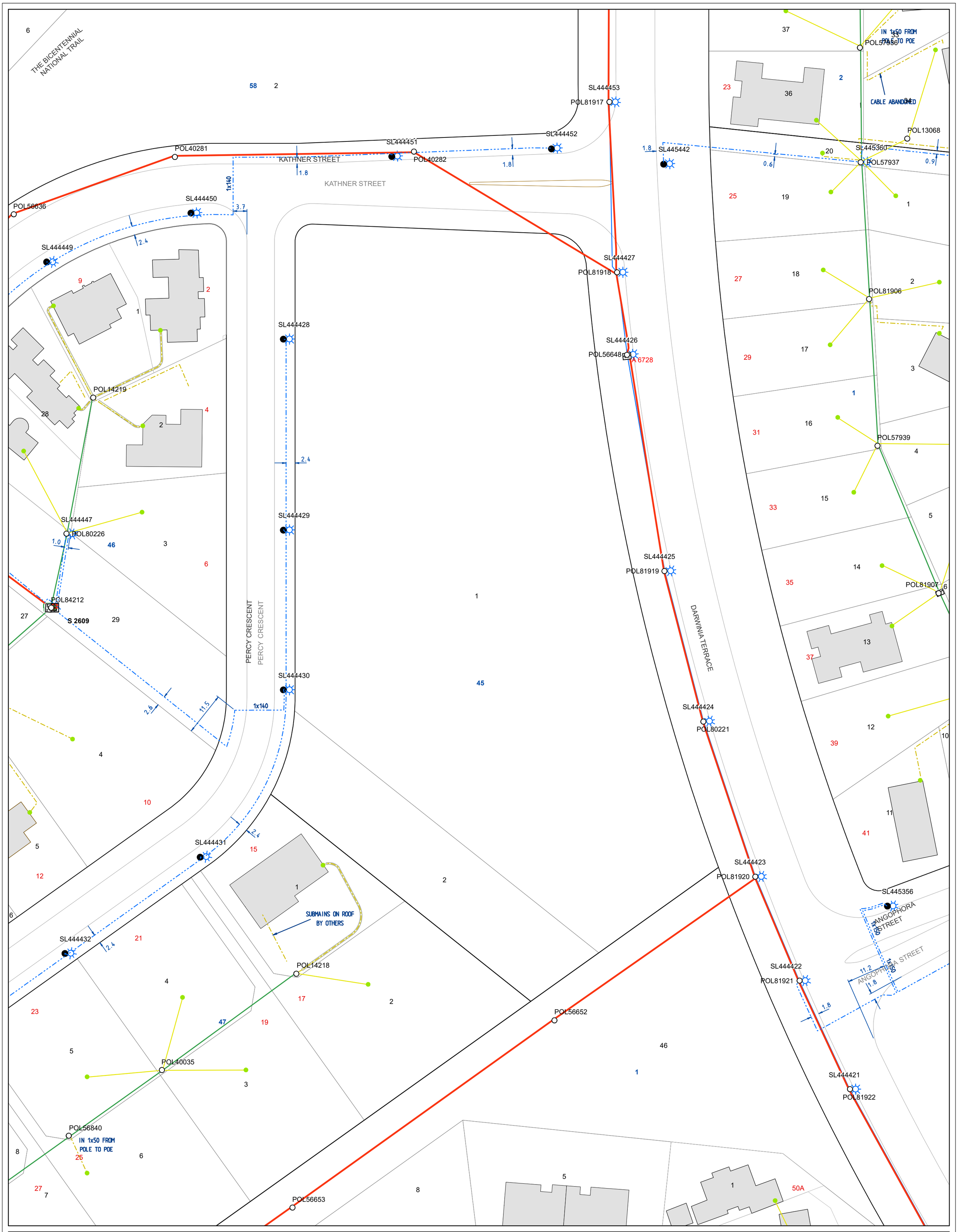
Template: GasA3Portrait

Creation Date: 21-Jul-2016



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Seq #: 54398737

Percy Crescent, Chapman

ActewAGL Electricity Network

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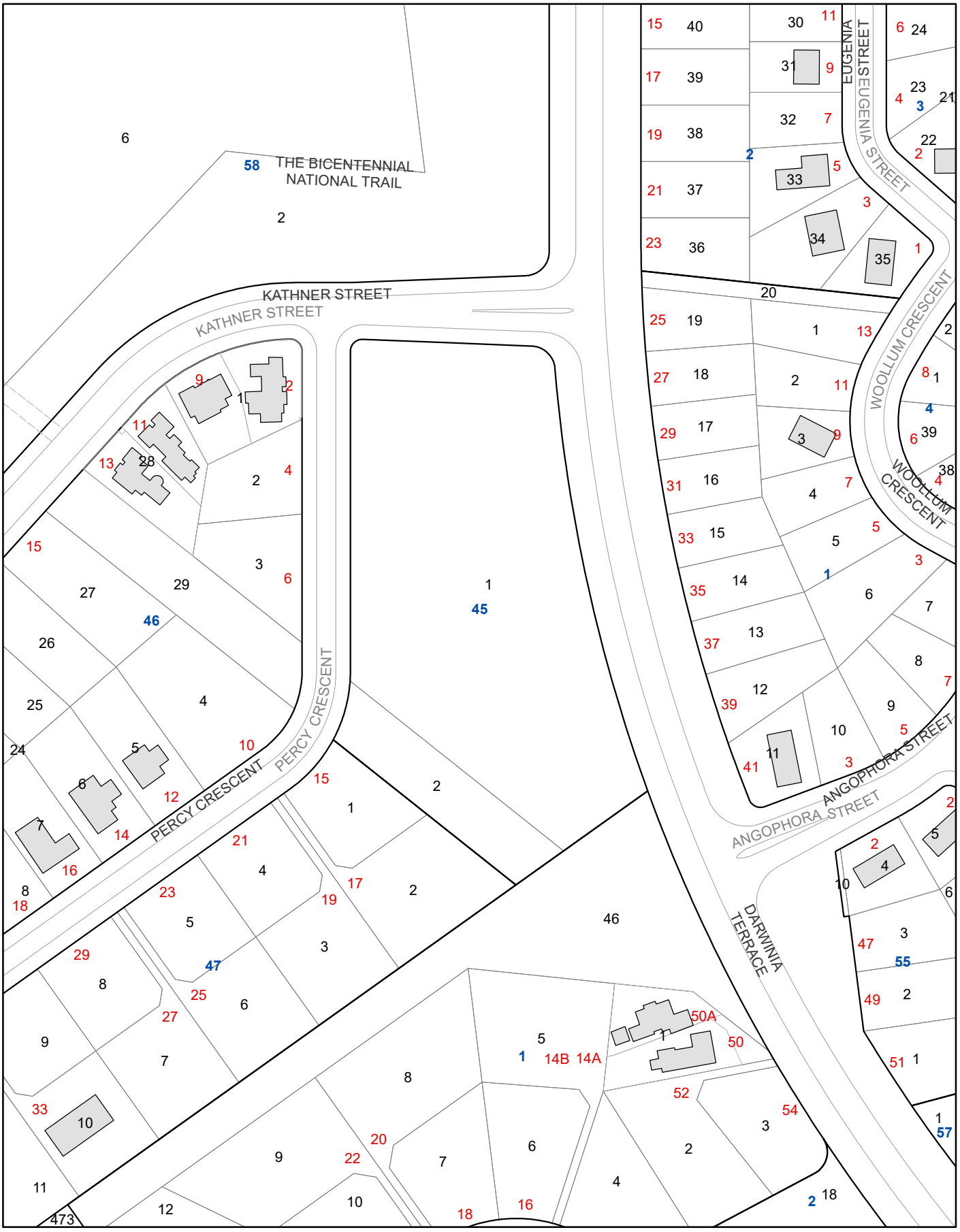
Template: ElectricityA2Portrait

Creation Date: 21-Jul-2016



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Seq #: 54398737

Percy Crescent, Chapman

Effluent Network

icon WATER

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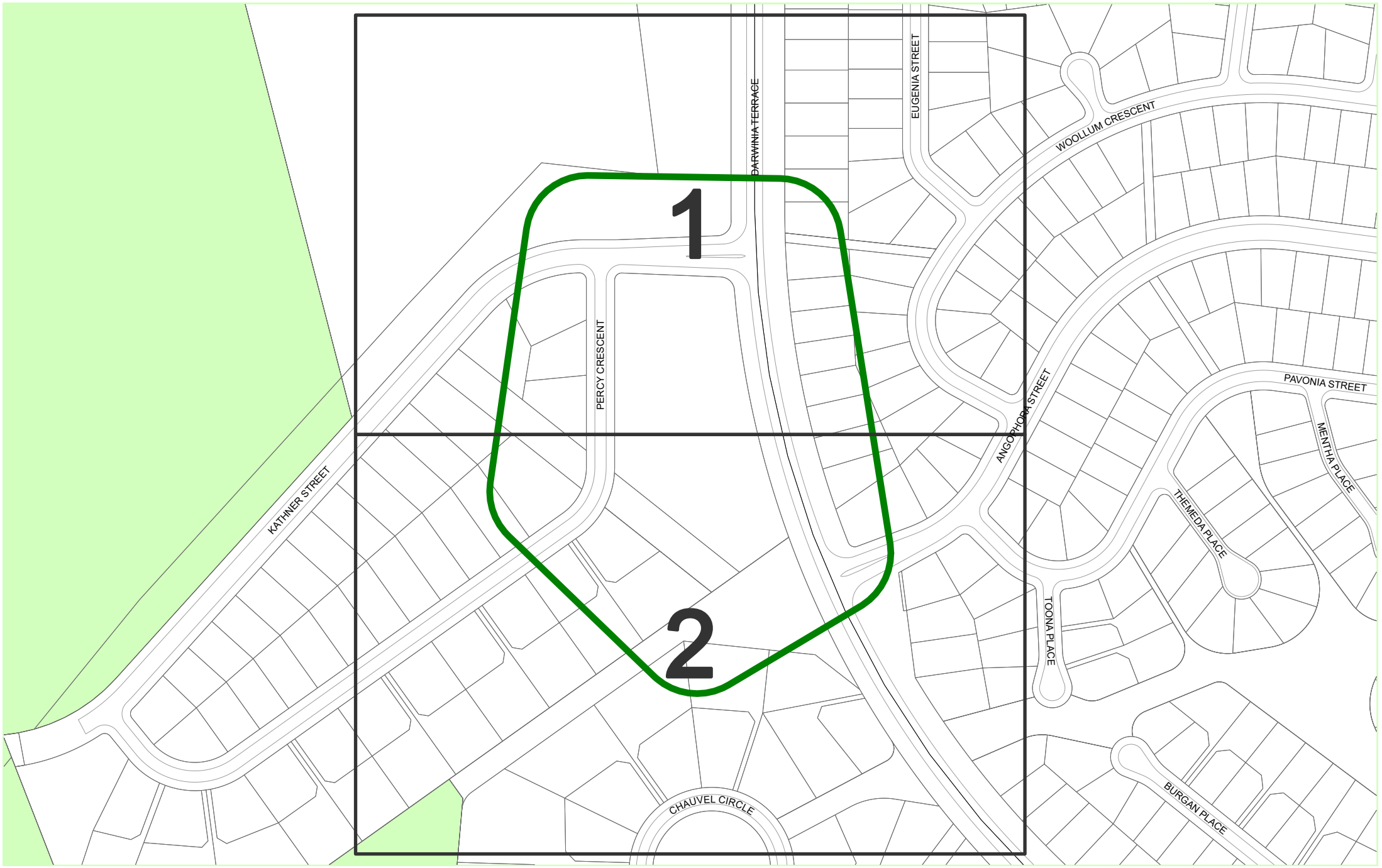
Creation Date: 21-Jul-2016



CONDUIT LEGEND

- Communications (100/110mm, 1 conduit)
- Communications (100/110mm, 2 conduits)
- Communications (100/110mm, 3 conduits)
- Communications (100/110mm, 4 conduits)
- Communications (20/32/50/63mm, 1 conduit)
- Communications (20/50/63mm, 2 conduits)
- Communications (20mm, 4 conduits)
- Communications (20mm, 6 conduits)
- Electrical (32/35/50/63100/110mm)

WARNING

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CONDUIT LEGEND

- Communications (100/110mm, 1 conduit)
- Communications (100/110mm, 2 conduits)
- Communications (100/110mm, 3 conduits)
- Communications (100/110mm, 4 conduits)
- Communications (20/32/50/63mm, 1 conduit)
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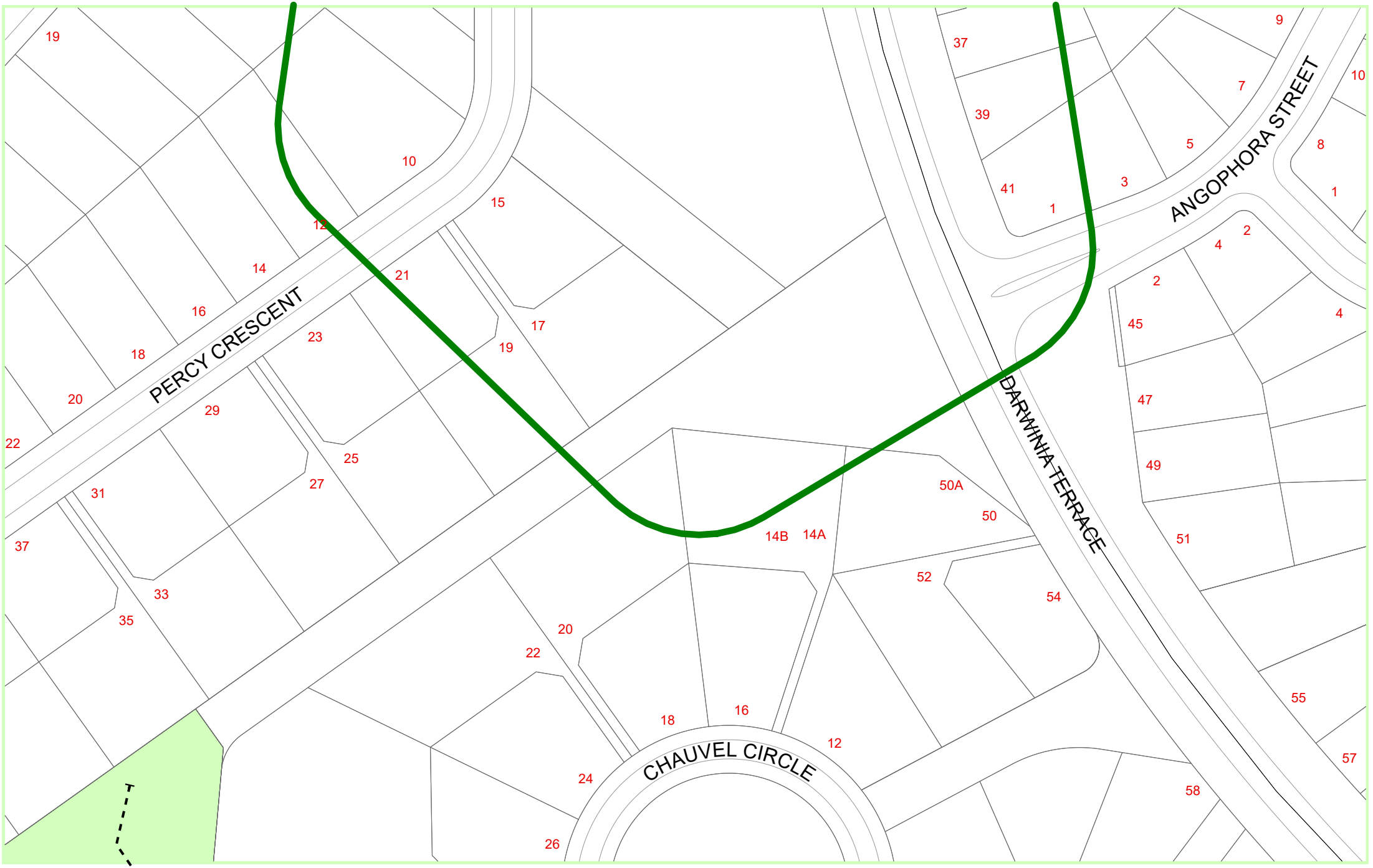

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Chapman, Section 45, Block 1 MU - Stage 2 SIR

APPENDIX D

SPECIALIST INVESTIGATION REPORTS

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BUSHFIRE PLANNING AND DESIGN CERTIFICATION

The following report titled and dated:

Bushfire Risk Assessment and Compliance Report for Proposed Block Subdivision & Residential Units / Complex, Block 1 Section 45 Chapman, 11th April 2017

has been prepared by:

Matthew E. Jones (Principal Consultant),

BPAD Accredited Practitioner 14598 L3-NSW

BUSHFIRE PLANNING AND DESIGN ACCREDIATION SCHEME: In accordance with the FPA Australia Bushfire Planning and Design Accreditation Scheme, the identified practitioner is accredited to assess potential bushfire risk and provide advice to manage the risk for existing buildings and for future developments using the follow methods:

1. *The determination of Bushfire Attack Levels using simplified methods and the applicable Deemed-to-Satisfy construction requirements.*
2. *The development of planning and building applications and reports by applying the prescribed design requirements in accordance with local regulatory requirements.*
3. *The development of planning and building applications and reports by developing alternative design solutions in accordance with local regulatory requirements.*

TERM OF VALIDITY: Opinions and statements made within the following report will expire 2 years from the date of the report. Should the following report require re-examination with a view to the possible extension of its term of validity, please apply to Bushfire Protection Planning & Assessment Services before the date of expiry. Bushfire Protection Planning & Assessment Services reserves the right at any time to withdraw any opinions or statements in the light of new knowledge, revised standards or Agency policies.

DISCLAIMER: Bushfire mitigation or protection measures as recommended or purported by the following report may not guarantee that the proposed building development will survive a bushfire event on every occasion. This is substantially due to the unpredictable nature and behaviour of fire and extreme weather conditions, and the behaviour of building occupants or fire fighters defending the building when exposed to severe or greater bushfire attack conditions.

TABLE OF CONTENTS

Mob. 0428 296 526 - Email: mattj@bushfireconsultants.com.au

BUSHFIRE RISK ASSESSMENT AND COMPLIANCE REPORT FOR PROPOSED BLOCK SUBDIVISION & RESIDENTIAL UNITS / COMPLEX, BLOCK 1 SECTION 45 CHAPMAN

11th April 2017

1.0 GENERAL

The following report outlines a Bushfire Risk and Compliance Assessment for proposed infill building development within Block 1 Section 45 Chapman (herein '***the subject property***'), which forms part of the Chapman urban residential precinct. The mapped location of the subject property is as shown Figures 1.0 - 4.0.

The proposed development is for a complex of single storey permanent residential building structures and associated infrastructure, services and landscaping (herein '***the proposed development***').

This report has been prepared on behalf of the ACT Government Land Development Agency, care of Cardno (NSW/ACT) Pty Ltd, (herein '***the proponent*** '). The report is provided for the information of ACT Planning and Land Authority (ACTPLA) and ACT Fire Rescue (ACTFR) in support of the proposed building and associated infrastructure development within the subject property.

Supporting publications and/or standards referred to for this assessment and stated compliance include;

- ACT Strategic Bushfire Management Plan 2014-2019 (herein '***SBMP***')
- ACT Bushfire Management Standards, Strategic Bushfire Management Plan 2014 (herein '***BMS***'),
- Australian Standard 2419 Fire hydrant installations 2005 (herein '***AS2419***')
- Australian Standard 3959 Construction of buildings in bushfire prone areas 2009 (herein '***AS3959***')
- NSW Planning for bushfire protection, A guide for Councils, Planners, Fire Authorities and Developers (herein '***PBP***')

Plans and development detail for the proposed development (as considered by this report) are as provided by the proponent. At the date of this report, this includes a site and subdivision plan (Block 1 Section 45 Chapman Development Options, Project No: 1706) as provided by the proponent on the 7/04/17.

Plans and mapped / site information relating to the subject property and proposed development are as follows throughout this report, Figures 1.0 – 8.0.

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2.0 SUBJECT PROPERTY – GENERAL DESCRIPTION

The address of the subject property is Block 1 Section 45, Cnr Darwinia Terrace, Kathner Street & Percy Crescent, Chapman ACT 2611.

The subject property is 14,937sqm (1.4ha) in total area, with direct public roadway access / frontage to Percy Crescent to the western boundary, Kathner Street to the northern boundary and Darwinia Terrace to the eastern boundary. All public roadway sections servicing the proposed development site provide two way / through access.

The subject property is generally bounded by existing residential building development to the west (opposite side if Percy Crescent), south-west and east (opposite side if Darwinia Crescent), and otherwise the last significant area of developable land within the Chapman urban precinct.

The subject property is zoned CF: COMMUNITY FACILITIES by the Territory and National Capitol Plan.

Apart from a few scattered woodland trees within and adjacent, the subject property is otherwise more or less maintained as cleared and managed landscape, i.e. a mown / slashed open area which appears to be regularly and historically maintained as such.

Existing power supply cabling (above ground lines / power poles) is located directly adjacent, and available, to the proposed development site.

Existing water supply services are also located directly adjacent, and available, to the proposed development site. At least five (5) existing hydrant outlets are located within vicinity (<90m) of the proposed development site.

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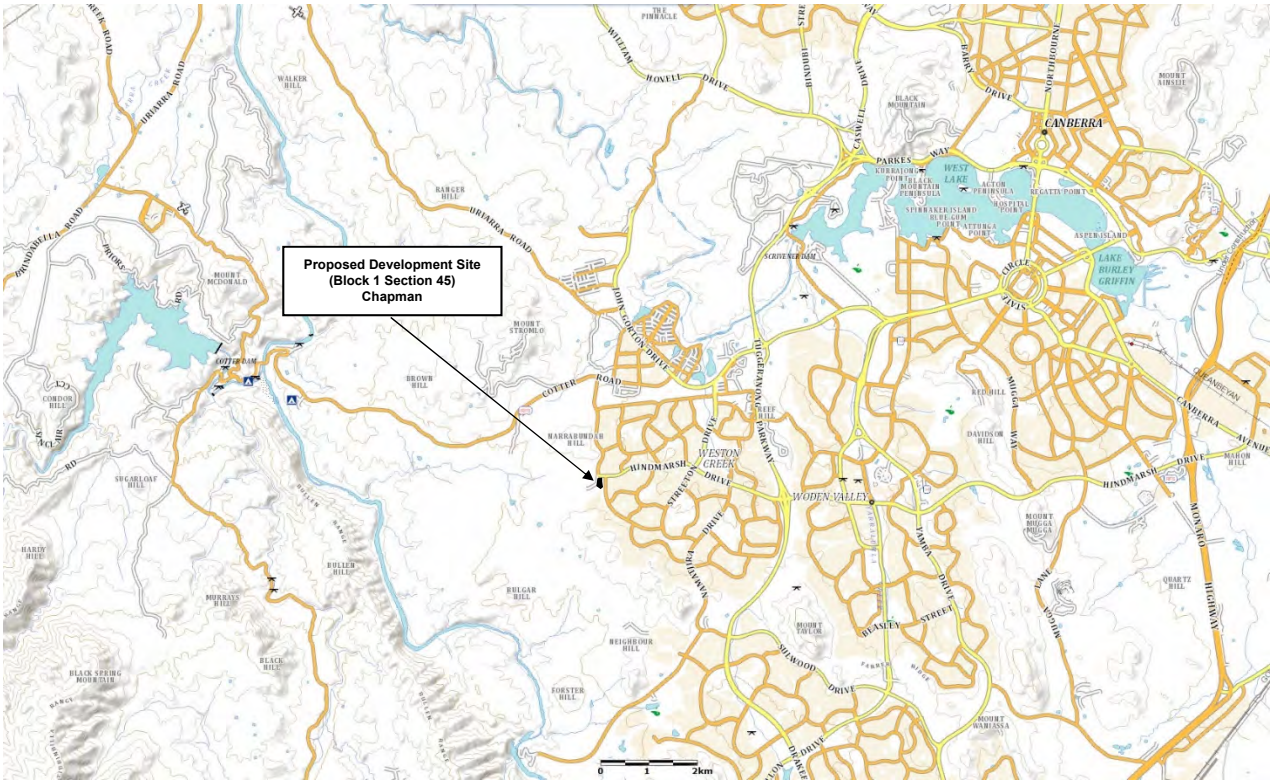
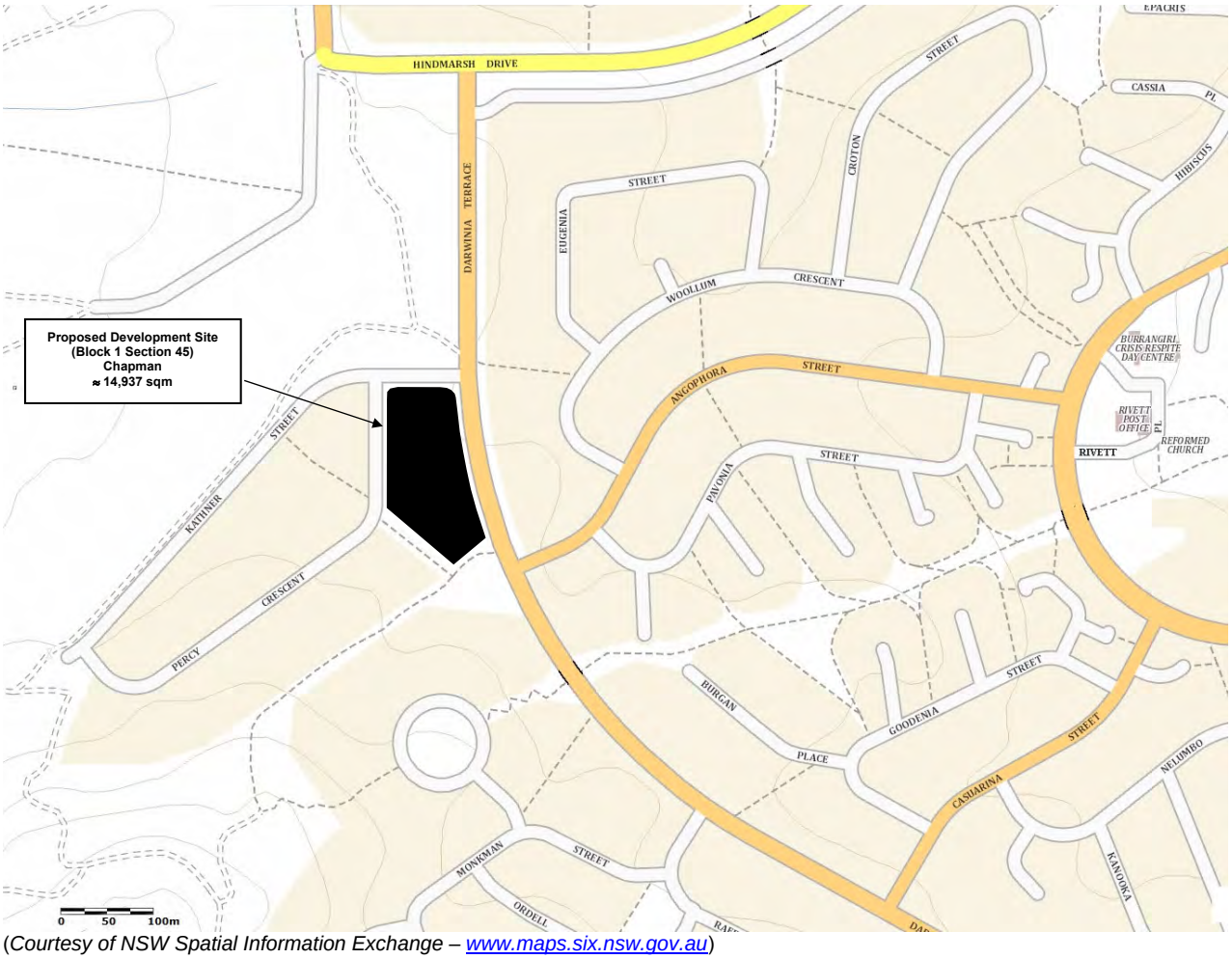
Figure 1.0 – Regional Location



(*Courtesy of NSW Spatial Information Exchange – www.maps.six.nsw.gov.au*)



(*Courtesy of NSW Spatial Information Exchange – www.maps.six.nsw.gov.au*)

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Figure 2.0 – Aerial Photo / Subject Property Overlay - Block 1 Section 45 Chapman

(*Courtesy of ACT Government Maps - www.actmapi.act.gov.au*)

(*Courtesy of ACT Government Maps - www.actmapi.act.gov.au*)

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3.0 PROPOSED DEVELOPMENT

3.1 Type and use

The proposed development (as currently considered at the time of this report) will be a complex of two bedroom single storey units for permanent residential occupation, with associated infrastructure, services and managed landscaping.

The subject property will also be subdivide into two new parcels of land, identified as;

- Block 1 – 3,538.8m^2, &
- Block 2 – 11,399m^2.

The complex will be comprised of 7 detached blocks, containing a total of 29 individual residential dwellings, all entirely located within proposed Block 2.

Proposed block 1 will remain as vacant land for 'community use' pending future development.

3.2 Building Classification

The proposed development will be of Class 2 building structures as classified by the Building Code of Australia (BCA), to be designed / constructed in accordance with standard BCA fire safety requirements. Each two bedroom residential unit being sole-occupancy and a separate dwelling.

3.3 Siting and building area / description

The proposed development is for 29 dwellings - 2 bed single storey structures arranged as attached/townhouse style complex.

For the purpose of this report, the residential unit sections are identified as Unit Blocks 1 – 7, including;

- Unit Block 1 – 3 x 2 bedroom residential units,
- Unit Block 2 – 6 x 2 bedroom residential units,
- Unit Block 3 – 3 x 2 bedroom residential units,
- Unit Block 4 – 4 x 2 bedroom residential unit,
- Unit Block 5 – 5 x 2 bedroom residential units,
- Unit Block 6 – 4 x 2 bedroom residential units, &
- Unit Block 7 – 4 x 2 bedroom residential units.

Each two bedroom residential unit is estimated to have a building foot print of approximately 90m^2, being an estimated total foot-print of ≈ 2,610m^2, positioned evenly across proposed block 2 and otherwise <70m from the existing public roadway system.

It is understood that vegetated landscaping to the proposed development will be at least comprised of at least 5-6 significant woodland trees pre-existing within the subject property. The location and arrangement of new building and vehicle access areas has been designed to facilitate the retention of the exist trees. A specific landscape plan for the proposed development has not been reviewed at the time of this report.

The location and extent of the proposed development is as denoted figures 3.0 & 4.0 as follows.

3.4 Vehicle access (Internal)

The proposed development site will be accessed via a total of ≈200m of internal roadway sections from Darwinia Terrace. The proposed access arrangement will effectively provide two separate internal roadway sections (≈100m long) from Darwinia Terrace, but will not provide through access onto Percy Crescent. As advised by the proponent, the proposed internal roadway system will be designed and constructed to normal civil standards for internal roadway access.

Apart from the above, vehicle or emergency access / egress for the proposed development site would be primarily via frontage to Darwinia Terrace and to a lesser extent from Percy Crescent.

The proposed width of the internal roadway section will be ≈6m wide, with 28 individual car parking space to be provided within the proposed development site.

For the purposes of bushfire safety and compliance, it is reasonable to suggest the proposed internal roadway section should facilitate access for a standard fire fighting vehicle (or fire fighters) seeking to access or egress the proposed development site for an emergency event.

3.5 Services / Utilities

As advised by the proponent, the proposed development will incorporate reticulated water and building service utilities (electricity and natural gas) as normally required for Class 2 building structures of the capacity and occupancy type.

Water supply to service the subject development will be provided by existing reticulated urban water lines servicing the Chapman residential precinct.

Any required fire hydrants, associated boosted installation and general building fire safety measures will be incorporated in accordance with Building Code of Australia, AS2419 requirements and as further required by ACT Fire Rescue.

For the purpose of this assessment, at least five existing hydrant connection points are located within close vicinity (<90m) of the proposed development site, located along Percy Crescent, Kathner Street and Darwinia Terrace. The nearest three hydrant points on Percy Crescent and Kathner Street are at intervals of approximately 80-90m in relation to the proposed development site. The fourth and fifth hydrant connection points located along Darwinia Terrace are at intervals of 100m (as denoted Figures 4.0 & 5.0 following).

In accordance with ACTEW and ACTFR Fire Risk Types and Hydrant Layouts (Tables 2.2 & 2.3 Deed of Agreement), the proposed development is considered to be a F5 Fire Risk (Small Institution / Medium Density Housing, Duplex, Flats and Dwelling Units more than one self-contained unit high unless individually classified F4) which otherwise require 2 standard hydrants together as close as possible at the end of a cul-de-sac and single standard hydrants at 60m intervals along mains.

The existing hydrant locations are reasonably identified by ‘cats eye’ blue reflectors and FH signage, or else were easily visible from the adjacent roadway area and not located within any designated parking spaces or the road carriageway area.

Assuming an open and accessible landscaping area, external firefighting hose line access from any of the identified hydrant locations should reasonably ensure the entire area of the proposed development site can be accessed by a charged firefighting hose line. This would include firefighting hose aid flat on ground for up to ≈90m from the identified hydrant locations.

The nearest overhead power lines to the subject property are located along the eastern boundary (Darwinia Terrace) and southern boundary, and also the opposite side of Kathner Street. Overhead powerlines from Kathner Street to Darwinia Terrace also partly cross over the northeast most corner of the subject property, but are otherwise well clear of any building structures within the proposed development site.

Recommendations for water supply and utilities protection for bushfire safety compliance are as further listed section 8.0 of this report.

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Figure 3.0 – Proposed Development / Subdivision

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Figure 4.0 – Aerial Photo / Proposed Development Overlay / Nearest Hydrant Locations

(*Courtesy of ACT Government Maps - www.actmapi.act.gov.au*)

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Figure 5.0 –Nearest Hydrant Intervals

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4.0 SURROUNDING AREAS

4.1 Bushfire Vegetation / Hazard Classification

The primary bushfire vegetation / hazard to the subject development site has been reasonably determined as GRASSLAND for the purposes of this assessment and associated Bushfire Attack Level (BAL) analysis in accordance with AS3959.

Remnant woodland vegetation is also acknowledged within, and within vicinity of, the proposed development site, but it otherwise reasonably excluded as a potential bushfire hazard in accordance with AS3959 Clause 2.2.3.2.

4.1.1 Canberra Equestrian Centre / Stromlo - Rural Paddocks

The primary grassland hazard within vicinity of the subject property lies to the north to northwest - opposite side of Kathner Street, within Block 6 Section 58 Chapman. The grassland vegetation is more or less associated with rural and grazed paddocks contiguous with the Canberra Equestrian Centre (Rural Block 433 Stromlo) and adjoining land (Block 1 Section 58 Chapman).

The primary grassland hazard is more or less contiguous with much larger areas of grassland vegetation and transitioning remnant woodland or plantation pine located further to the north to northwest (Rural Block 17 Stromlo and Block 2 Section 5 Duffy) within ACT Forestry / Narrabundah Hill area.

The location and extent of the primary grassland hazard is estimated to be separated away from the nearest section of the proposed development (Unit) by at least 70m.

4.1.2 Remnant Woodland / Isolated Trees (Proposed Development Site & Adjacent Public Land)

Potential dry woodland vegetation is also acknowledged within the proposed development site itself. The vegetation is isolated woodland species, approximately 5-6 significant trees and some smaller saplings, which appear to have been historically retained on the subject property.

Similarly, isolated woodland species are also acknowledged over adjoining public lands to the south (Block 46 Section 1 & Block 2 Section 45 Chapman) and adjacent public land to the north (Block 2 Section 58 Chapman – opposite side of Kathner Street)

These area of the isolated woodland vegetation within vicinity (i.e. estimated canopy cover) would not reasonably exceed 2,000sqm in area, and would otherwise reasonably be equivalent to a,

- *single areas of vegetation less than 1 ha in area and not within 100m of other areas of vegetation being classified, or*
- *strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation)*.

As such, in accordance with AS3959 Clause 2.2.3.2 (*Exclusions - Low threat vegetation and non-vegetated areas*), the areas of isolated woodland species within and adjacent to the proposed development site are considered excluded or low threat vegetation. Notwithstanding this assessment, this report still acknowledges the potential bushfire threat and makes recommendations for mitigation of the hazard.

Apart from the above grassland and remnant woodland identified above, all other land within vicinity (i.e. ≤ 100m) is generally non-vegetated, comprised of existing residential building development, public roadway, managed nature strips and maintained lawn or mown landscaped areas.

AS3959 Clause 2.2.3.2 (*Exclusions - Low threat vegetation and non-vegetated areas*) identifies;

- *Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops.*
- *Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.*

In this regard, all other surrounding land within prescribed vicinity (≤ 100m) is technically considered a *non-vegetated area* or *low threat (excluded) vegetation* in accordance with AS3959.

4.2 Effective Slope

The proposed development site is located on and adjacent to gently sloping land, falling southwest to northeast, which does not exceed 5° (9%). In this regard, the effective slope[1] within vicinity of the subject development site would be considered upslope to the west, with a maximum potential down slope not exceeding 5° (i.e. 0-5° downslope) in any other direction.

The gradient of the slope within the subject property will not affect the location of proposed vehicle access areas or designated / required Asset Protection Zone areas.

Mapped contours over the subject property and surrounds, showing 1m contour intervals, is shown Figure 6.0 as follows.

Site photo theodolite angles are as shown section 4.3.

[1] *the gradient within the hazard (vegetation) which will most significantly influence the fire behaviour of the site having regard to vegetation class found (PBP).*

Figure 6.0 –Contours of Subject Property and surrounds / Site Photo Reference Points

(*Courtesy of ACT Government Maps - www.actmapi.act.gov.au*)

Photo Reference Point - (#)

Mob. 0428 296 526 - Email: mattj@bushfireconsultants.com.au

4.3 Site Photos / Theodolite Estimates (12/07/16)

Photo 1 – Reference Point 1

Photo 2 – Reference Point 1

Photo 3 – Reference Point 1

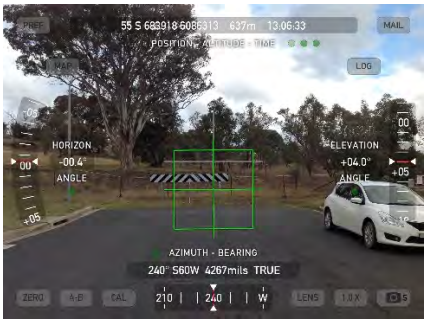

Photo 4 – Reference Point 1

Photo 5 – Reference Point 1

Photo 6 – Reference Point 1

Photo 7 – Reference Point 2

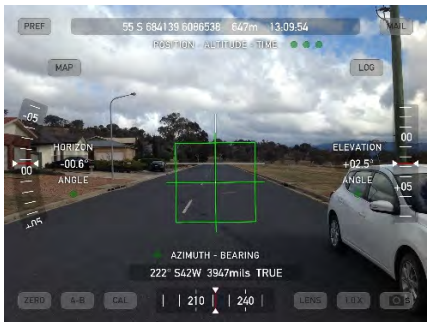

Photo 8 – Reference Point 2

Photo 9 – Reference Point 2

Photo 10 – Reference Point 2

Photo 11 – Reference Point 2

Photo 12 – Reference Point 2

Photo 13 – Reference Point 3

Photo 14 – Reference Point 3

Photo 15 – Reference Point 3

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Photo 16 – Reference Point 3

Photo 17 – Reference Point 3

Photo 18 – Reference Point 3

Photo 19 – Reference Point 4

Photo 20 – Reference Point 5

Photo 21 – Reference Point 5

Photo 22 – Reference Point 5

Photo 23 – Reference Point 5

Photo 24 – Reference Point 6

Photo 25 – Reference Point 6

Photo 26 – Reference Point 6

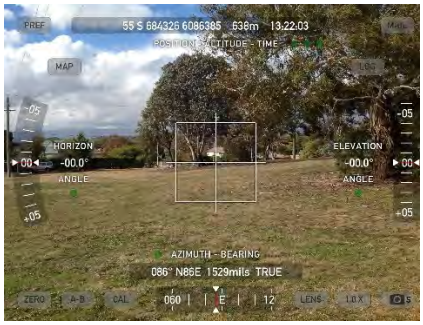

Photo 27 – Reference Point 6

Photo 28 – Reference Point 6

Photo 29 – Reference Point 6

Photo 30 – Reference Point 7

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Photo 31 – Reference Point 7

Photo 32 – Reference Point 7

Photo 33 – Reference Point 8

Photo 34 – Reference Point 7

Photo 35 – Reference Point 7

Photo 36 – Reference Point 7

Photo 37 – Reference Point 8

Photo 38 – Reference Point 8

Photo 39 – Reference Point 9

Photo 40 – Reference Point 9

Photo 41 – Reference Point 9

Photo 42 – Reference Point 9

Photo 43 – Reference Point 9

Photo 44 – Reference Point 9

Photo 45 – Reference Point 9

4.4 Asset Protection Zone (APZ) Areas

As shown figure 7.0, the zoning for the proposed development site is identified as CF: COMMUNITY FACILITIES.

The major zoning for land immediately to the west and further south and east (i.e. Chapman urban / built residential precinct) is identified as RZ1: SUBURBAN.

Public lands adjoining the southern boundary of the subject property are (Block 46 Section 1 & Block 2 Section 45 Chapman) are identified PRZ1: URBAN OPEN SPACE. This land is actively managed by slashing – as further identified and described.

Adjacent lands to the north (Blocks 2 & 6 Section 58 Chapman) are identified DES: DESIGNATED. Blocks 2 Section 58 Chapman (i.e. opposite side of Kathner Street) is actively managed by slashing – as further identified and described.

Considering the zoning and current use / management of the adjoining lands to the proposed development site and assumption of continuing vegetation and urban landscaping management (as identified or recommended by this report), the surrounding vegetation (within prescribed vicinity) should reasonably facilitate the fuel management standards required for an 'Inner' APZ area as defined within the BMS.

The adjoining and adjacent lands are more or less entirely developed for residential building and urban occupation, public roadway areas, pedestrian access or managed (slashed) open spaces. Any potential grassland or woodland vegetation associated with these areas should reasonably be *maintained at an overall fuel hazard ≤ low, 3-5 m canopy separation or fuel gap to crown >3m maintained,* or *grassland maintained at ≤200 mm height when grassland curing ≥70%.*

Further, all neighbouring lands within vicinity (i.e. ≤100m) would also be reasonably considered as *low threat or non-vegetated* as defined under AS3959 (see section 4.1 of this report).

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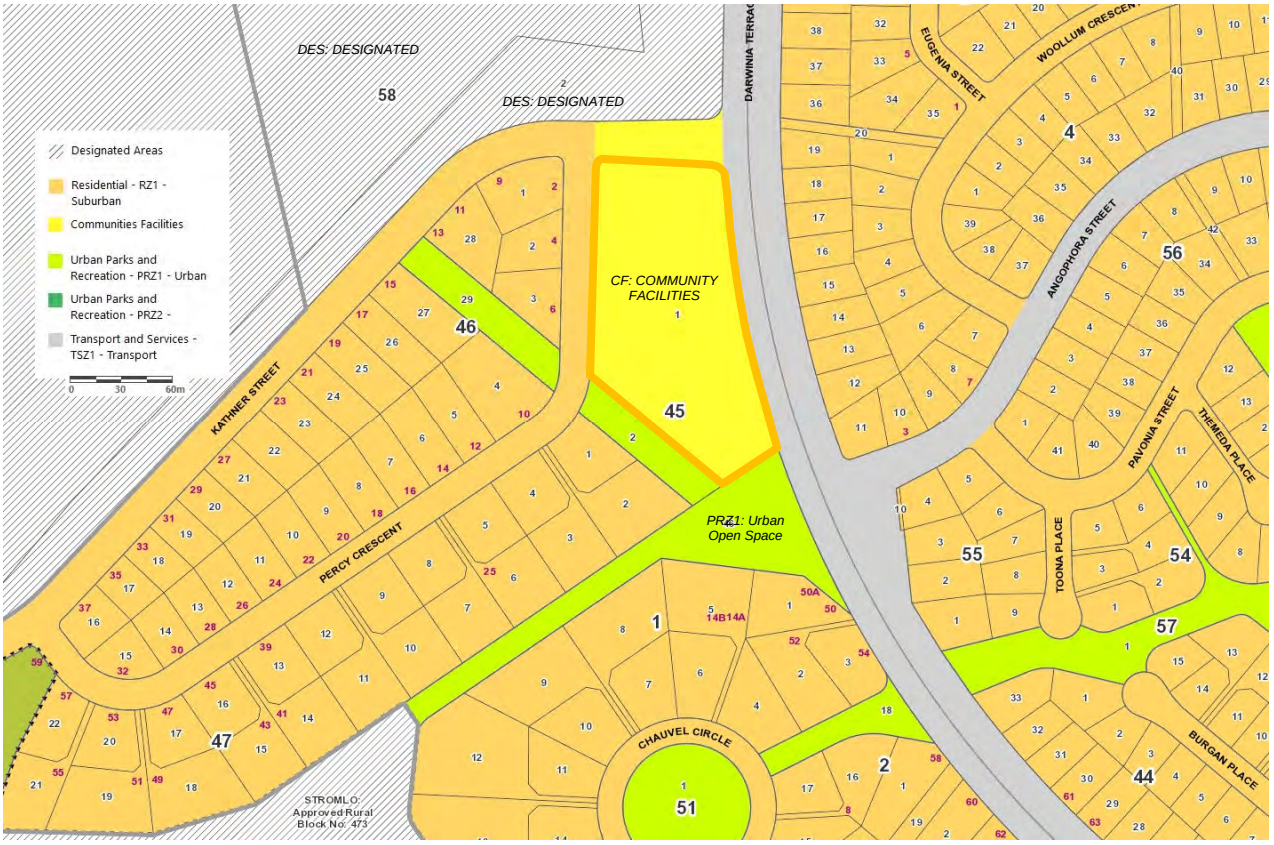
Figure 7.0 – Territory and National Capitol Plan



(*Courtesy of ACT Government Maps - www.actmapi.act.gov.au*)

It is acknowledged that a potential and contiguous area of grassland vegetation may persist further to the north through to west of the proposed development site (i.e. rural paddocks). The extent of the potential grassland vegetation would provide a fire run in excess of 350m, and hence would be considered a 'Primary' Asset Interface in accordance with BMS requirements.

The primary asset interface to the proposed development site will be separated away (≈70m or greater) from the nearest building structure (Unit Block 1) by the existing section of Kathner Street and managed / slashed land (Blocks 2 Section 58 Chapman).

This assessment also notes that the ACT SBMP identified areas for fuel management by 'slashing' for public and designated Chapman lands directly adjoining or adjacent to the subject property (see figure 7.0 as follows). This includes;

- Block 2 Section 58 (opposite side of Kathner Street),
- Block 2 Section 45 (adjoining the SW boundary), &
- Block 46 Section 1 (adjoining the SE boundary).

In this regard, these areas are considered to be managed land and would reasonably achieve fuel management standard for *Inner Asset Protection Zone*, being *Grassland maintained at <200mm height when grassland curing >70%,* as prescribed

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Figure 7.0 – ACT SBMP – Regional Fire Management Plan

(*Courtesy of ACT Government Maps - www.actmapi.act.gov.au, Strategic Bushfire Management Plan*)

4.4 External Vehicle Access

Public roadway access to the proposed development site is well established and reasonably designed for heavy vehicle and traffic anticipated to access the Chapman urban precinct. This includes Darwinia Terrace, Kathner Street and Percy Crescent.

The public roadway sections servicing the subject property are approximately a 6-10m wide single carriageway which facilitate two way access. The existing public roadway sections provide through or loop access within direct vicinity of the subject property, and otherwise through access to the larger network of internal roadway areas servicing the greater Chapman urban precinct.

Darwinia Terrace is a main arterial roadway servicing the Chapman urban precint area, linking Hindmarsh Drive to Streeton Drive, providing two-way access within ≈10m wide carriageway area.

Considering the above, the existing public roadway system servicing the subject property and proposed development would easily facilitate the safe passage of emergency services and associated vehicles seeking to access or egress the subject property under most circumstances.

5.0 PLANNING CONTEXT

Subject property is designated as within a Bushfire Prone Area (BPA) in accordance with the SBMP. Figure 8.0 as follows denotes the current BPA affecting the subject property and surrounding land.

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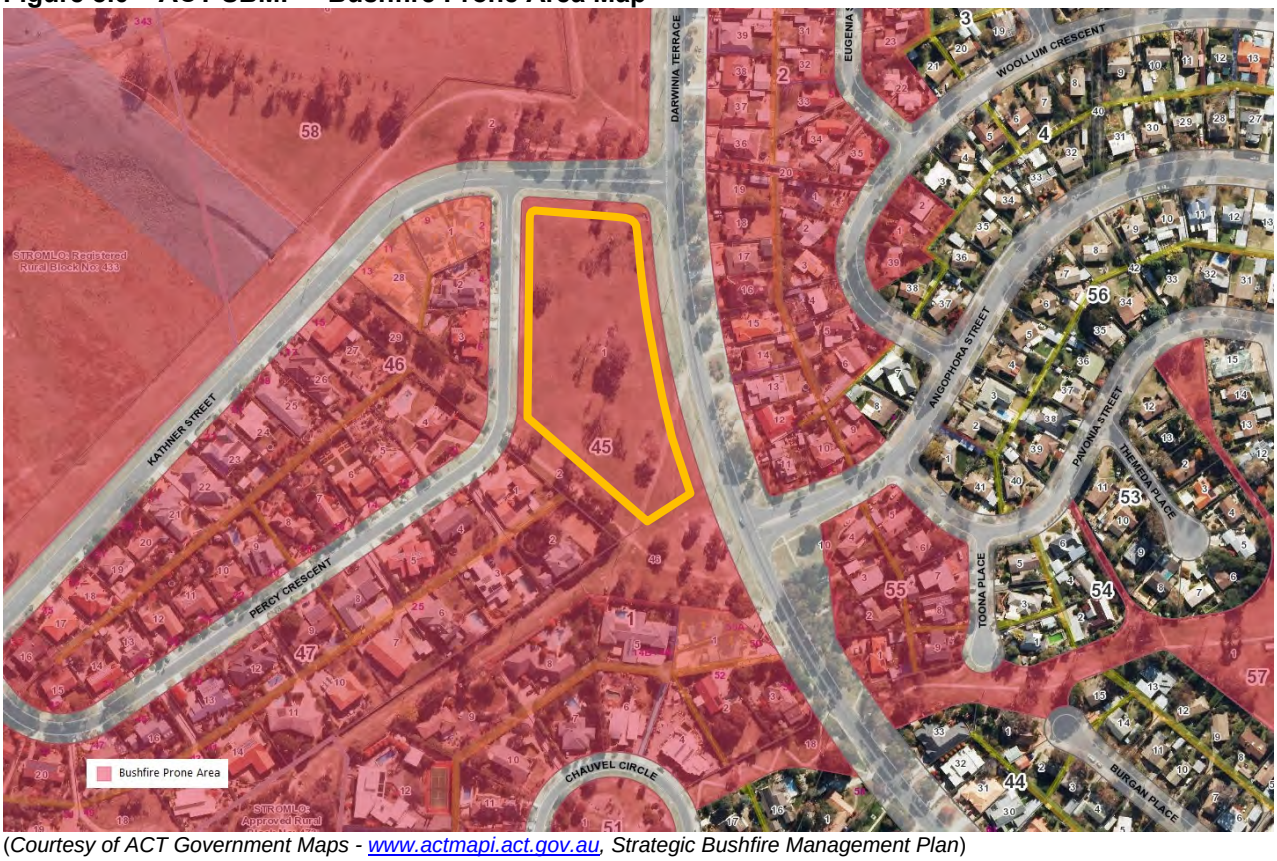
Figure 8.0 – ACT SBMP – Bushfire Prone Area Map



(*Courtesy of ACT Government Maps - www.actmapi.act.gov.au, Strategic Bushfire Management Plan*)

The SBMP states that in a BPA, it is proposed:

> *That new residences or existing residences being significantly renovated or properties being knocked down and rebuilt will be required to be assessed under AS3959 to determine standards for bushfire construction. A minimum standard of construction under AS3959 will be required to be undertaken to the lowest level of BAL, BAL 12.5.*

BMS zoning and fuel management standards outlines an *Asset Interface Classification* matrix and associated widths for APZ. For an interface potentially impacted upon by fire run in excess 350m from the N to W (as for the proposed development site), the asset interface is considered to be 'Primary'. A Primary asset interface classification requires either a 40m APZ (Inner APZ only) or 30m APZ (Inner) + 100m minimum Outer APZ.

Section 6.0 of this report details a 'Simplified Assessment' (in accordance with AS3959) for the subject development site.

Apart from AS3959 requirements, all other determined measures and/or requirements for bushfire safety and compliance are derived from the SBMP - *Integrated measures for bushfire protection at the urban edge*. Considered relevant to the proposed development, this otherwise includes

- Access (new estate developments)
- Water supply and other services (new estates and large infill developments)
- APZs in established areas
- Urban landscaping (all areas)

The listed measures and compliance comments are outlined section 7.0.

Recommendations for bushfire safety compliance are as listed Section 8.0.

6.0 ESTIMATED BUSHFIRE ATTACK LEVEL (BAL) – AS3959 SIMPLIFIED METHODOLOGY

Relevant FDI: 100 (Australian Capital Territory), as per Table 2.1 of AS3959

Vegetation Classification: GRASSLAND (Primary hazard).

The primary forest hazard would reasonably persist to the north to west of the subject property, opposite site of Kathner Street within Block 6 Section 58 Chapman and Canberra Equestrian Centre land - Rural Block 433 Stromlo).

All other areas of land within the prescribed distance of the subject property are either cleared and managed residential land, formed roadway areas, or managed (slashed) public lands.

Apart from the identified Grassland vegetation, all other surrounding land within approximately 100m of the proposed development should reasonably qualify as excluded or low threat vegetation, as per Clause 2.2.3.2 of AS3959.

Site Distance to Vegetation, Effective Slope & BAL:

Distance (m)	Vegetation (*Location / Direction*)	Effective Slope	BAL
≥ 70m	GRASSLAND Block 6 Section 58 Chapman / *N-NW*	Upslope	LOW
> 100m	GRASSLAND Rural Block 433 Stromlo / *W*	N/A	LOW

Determined BAL: BAL-LOW as per Clause 2.2.6 of AS3959.

Recommended BAL: BAL-12.5, in accordance with SBMP - *a minimum standard of construction under AS3959 will be required to be undertaken to the lowest level of BAL, BAL 12.5.*

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7.0 BMS - LISTED BUSHFIRE COMPLIANCE MEASURES

Performance Criteria	***Acceptable Solution / Referred Standard***	***Compliance Comment***
Firefighters are provided with safe all-weather access to Bushfire Prone Areas and assets.	*Refer to ESDD Estate Development Code March 2012.*	*As per recommendations No. 8-10 of this report.* *The proposed development does not necessarily require Edge Road access, albeit acknowledging that the section of Kathner Street servicing the site is arguably edge road access.* *The proposed development site would be accessed from at least two directions (Percy Crescent & Darwinia Terrace) directions are reasonably well separated away from the identified bushfire hazard.* *Vehicles or people located along the existing public roadway sections should be reasonably protected from a bushfire event within vicinity of the site* *There should also be reasonable access for emergency services vehicles at all times.*
	Public roads are two-wheel drive, all-weather roads.	**Complies** *– as per recommendation No. 10 of this report.* *The existing public roadway sections servicing the proposed development includes Percy Crescent, Kathner Street and Darwinia Terrace, all of which are significant public roadway sections servicing the subject property and surrounding Chapman residential precinct.*
Public road widths and design allow safe access and egress for firefighters while residents are evacuating an area. *Public road widths allow firefighting crews to work with firefighting equipment around the vehicle, and to allow other vehicles to pass with safety.*	*Edge road required for all new subdivisions and developments. Alternate solutions will be considered on merits of safety to public and emergency service personnel.*	**Complies** *– Kathner Street provides edge road access to the subject property.*
	Urban edge roads are two-way – that is, at least two traffic lane widths (carriageway 7.5 m minimum kerb to kerb), allowing traffic to pass in opposite directions, with parking provided in designated parking bays clear of the carriageway.	**Complies** *– Kathner Street is at least 10m wide kerb to kerb and would easily facilitate the passage of traffic in either direction. Stationary or parked vehicles could easily be positioned on the verge areas.*
	Hydrants are located clear of parking bays.	**Complies** *– as per recommendation No. 13 of this report.* *All existing / identified hydrant points that may service the proposed development are otherwise reasonably clear of any designated parking areas.*
	The edge road is linked to the internal road system at an interval of no greater than 500m in urban areas.	*N/A*
	Traffic management devices are constructed to facilitate access and egress by emergency services vehicles.	**Complies** *– as per recommendation No. 8 of this report.*
	Public roads have a cross-fall not exceeding 6%.	**Complies** *– all existing and proposed new vehicle access section directly servicing the subject property and proposed development site do not have a cross-fall >6%.*
	All roads are through roads. Dead-end roads are not recommended but, if unavoidable, dead ends are not more than 200m in length, incorporate a minimum 24m diameter unobstructed turning circle, and are clearly signposted as a dead end and direct traffic away from the hazard.	*Not considered – due to the low bushfire threat to the site and existing extent of surrounding public roadway sections directly adjacent to the site.*

	Curves of roads (other than perimeter roads) are a minimum inner radius of 6m and minimal in number, to allow for rapid access and egress.	**Complies** – *as per recommendation No. 7 of this report.* *The existing public roadway sections to service the proposed development / subject property would reasonably facilitate rapid access and egress, with roadway curves (within vicinity) having an inner radius of >6m.*
	The minimum distance between inner and outer curves is 6m.	*As above.*
	Maximum grades for sealed roads do not exceed 28%, and an average grade of not more than 18% or other gradient specified by road design standards, whichever is the lesser gradient.	**Complies** – *All roadway sections directly servicing the subject property and development site do not reasonably exceed 5° or 9%.*
	There is a minimum vertical clearance to a height of 4.2m above the road at all times.	**Complies** – *As per recommendation No. 5 of this report.* *Percy Crescent, Kathner Street and Darwinia Terrace are otherwise well separated away from overhanging or unmanaged vegetation.*
	Roads are clearly signposted (with easily distinguishable names), and buildings and properties are clearly numbered.	**Complies** – *As per recommendation No. 10 of this report.* *All existing public roadway areas servicing the subject property are currently and clearly signposted.*
	In designated Bushfire Prone Areas, cul-de-sac road design is generally not encouraged. Where they are used, however, they should not exceed 200m in length. In some instances, it may be possible to provide emergency access between cul-de-sac heads so that residents and firefighters have two-way access and egress. In this case, and provided it does not service more than 8 lots, the maximum length of a cul-de-sac can be increased to 600m. Turnaround areas should allow fire appliances to turn around safely and should be available at cul-de-sac heads, house sites and at 250m intervals along driveways and fire service accesses.	*Not considered – due to the low bushfire threat to the site and existing extent of surrounding public roadway sections directly adjacent to the site.*
	Emergency accesses may be used to link up with roads to allow alternative access and egress during emergencies where traffic flow designs do not allow for two-way access. The access should comply with minimum standards for roads and should be signposted. If gates are used to control traffic flow during non-emergency periods, they must not be locked.	*Not considered – due to the low bushfire threat to the site and existing extent of surrounding public roadway sections directly adjacent to the site.* **Otherwise can comply** – *As per recommendations No. 7 & 8 of this report.*
The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles	*The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles (approximately 30 tonnes for aerial appliances and 25 tonnes for tankers).* *Bridges shall be signposted to clearly indicate load rating.*	**Complies** – *as per recommendation No. 9 of this report.* *The internal roadway section should otherwise be designed and engineered to standard civil requirements.* *All public roadway areas currently servicing the subject property are fully formed and engineered roadway sections designed for heavy traffic and vehicle movements.*

Water supplies are easily accessible and located at regular intervals	*The Water and Sewerage Network (Design and Maintenance) Code of the Utilities Act 2000 requires the fire-fighting requirements are able to be met.* *A deed of agreement exists between ACTEW Corporation Limited and ACTF&R in relation to water supply in the built up area. This agreement details operative provisions which cover:* *Fire Hydrants – general provisions* *Flow rates* *Fire risk classification and fire hydrant spacing's* *Fire hydrant testing and maintenance* *Fire hydrant system shutdown / isolation* *Connection to domestic supplies* *Water usage by ACTF&R and ACTRFS* *Provision of plans showing location of fire hydrants* *Hydrants on the water network* *Amendments to water supply standards* *The deed of agreement is currently under review by both parties.*	**Complies** – *As per recommendation No. 13 of this report.* *The proposed development will incorporate water supplies and firefighting connection points in accordance with standard BCA requirements (AS2419) and any additional ACTFR requirements.* *At least 5 existing street hydrant connection points are located within vicinity (<90m) of the proposed development.* *The recommended internal hydrant location(s) would ensure that the nearest hydrants points to the proposed development are at a reasonable interval of 60m to facilitate the hydrant provision for F5 fire risk classification in accordance with the current ACTEW / ACTFR deed or agreement.* *Otherwise, the entire area of the proposed development site should be accessible by a 'hose laid on ground' within 90m of the identified / existing hydrant connection points.*
Parking does not obstruct the minimum paved width.	*Internal public roads 6.5m wide provide parking within parking bays, and locate services outside of the parking bays to ensure accessibility to reticulated water for fire suppression.*	**Complies** – *As per recommendations No. 7 & 13 of this report.* *All identified / existing hydrant connection points to service the proposed development are reasonably located clear of any parking areas.*
	Internal public roads between 6.5 m and 7.5m are signposted as 'No Parking' on one side, with the services (hydrants) located on this side to ensure accessibility to reticulated water for fire suppression.	*Not considered*
	One-way only public access roads are no less than 3.5m wide and provide parking within parking bays, and locate services outside of the parking bays to ensure accessibility to reticulated water for fire suppression.	*Not considered*
	Parking bays are a minimum of 2.6m wide from kerb edge to road pavement. No services or hydrants are located within the parking bays.	*Not considered*
	Public roads directly interfacing the bushfire hazard vegetation shall provide roll-top kerbing to the hazard side of the road.	*N/A - no sections of public roadway access servicing the subject property directly interface the bushfire hazard.*
location of electricity services will not lead to ignition of surrounding bush land or the fabric of buildings or risk to life from damaged electrical infrastructure	*Electrical transmission lines are underground.*	**Complies** – *as per recommendation No. 11 of this report.*
Location and installation of gas services will not lead to ignition of surrounding bushland or the fabric of buildings	*As detailed in AS3959 which notes water and gas pipes above ground, exposed water and gas supply pipes shall be metal.*	**Complies** – *as per recommendation No. 12 of this report.*
An emergency and evacuation management plan shall be prepared for Special Fire Protection Developments	*Compliance with AS 3745-2002 'Emergency control organisation and procedures for buildings, structures and workplaces' for residential accommodation'.* *Compliance with AS 4083-1997 'Planning for emergencies - for health care facilities'.*	***Not considered***

8.0 RECOMMENDATIONS

1. The proposed development shall incorporate external materials and design in accordance with Sections 3 & 5 of AS3959 Construction of buildings in bushfire-prone areas (BAL-12.5 requirements).

   AS3959 Table 3.1 (Bushfire Attack Levels & Corresponding Sections for Specific Construction Requirements) describes the predicted bushfire attack and levels of exposure as 'Ember Attack' only for a building within 100m of classified vegetation and heat flux exposure thresholds ≤12.5 kW/m^2.

   Ember attack is described as *attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris*.

   AS3959 BAL-12.5 is primarily concerned with protection from ember attack and radiant heat up to and including 12.5 kW/m^2 where the site is less than 100 m from the source of bushfire attack.

   Effectively, a building constructed to AS3959 Sections 3 & 5 (BAL-12.5) is designed and maintained to ensure airborne and/or wind driven burning embers or debris (>2mm in size / width) emanating from a bushfire or grassfire event cannot enter the structure when reasonably secured.

2. The entire area of the proposed development site shall be identified and maintained as an APZ in accordance with the ACT Bushfire Management Standards – ACT Strategic Bushfire Management Plan Version 3 (2014). This also includes proposed block 1 until such time it is formally developed.

   Vegetation and landscape management for APZ compliance should consider the principals of the document *Landscape and Building Design for Bushfire Areas, by Caird Ramsay and Lisle Rudolph published November 2003*.

3. Any vegetation landscaping to be retained or re-introduced as part of the proposed development shall ensure any readily combustible dry garden mulching and/or plantings are minimised within the proposed development site, or else should be entirely excluded.

4. Any internal landscaping shall ensure any readily combustible dry garden mulching and/or plantings are separated away from the proposed building lines by at least 2m.

5. Any internal landscaping shall ensure trees planted directly adjacent to the internal roadway area does not significantly overhang or obstruct the access of larger vehicle's entering the proposed development site. Any overhanging vegetation shall be maintained to ensure a minimum height of 4.2m above the road at all times.

6. Any internal landscaping shall ensure only fire retardant trees are reintroduced as part of the proposed development. Fire retardant plants for the ACT are as otherwise listed by the Yarralumla nursery-Garden Advice series[2].

[2] *http://www.tams.act.gov.au/__data/assets/pdf_file/0012/389937/Fire_retardant_plants_for_canberra.pdf*

7. All internal vehicle access roadway sections shall have a minimum carriageway width of 6m or else the proposed internal roadway and verge area shall facilitate an unobstructed and trafficable width of at least 6m at all times. The minimum inner radius of any roadway bend shall be ≥6m and any identified parking spaces.

8. Any gating or obstacles for traffic or pedestrian management or calming shall be designed to ensure firefighting and emergency services vehicles can safely pass through, over or remove / open the traffic management obstacle at all times. Emergency access gating used to control traffic flow during non-emergency periods shall not be locked

9. The proposed internal vehicle access roadway surface shall have a carrying capacity of at least 30 tonnes in anticipation of a standard ACTFR aerial appliance seeking to access and operate within the proposed development site.

10. The proposed development and associated internal roadway access section shall be clearly signposted at the entry point from Darwinia Terrace to identify the proposed development site and that access to Percy Drive is not provided through the site.

11. All new electrical lines and connections (including communication lines) to service the proposed development shall be located underground.

12. All external / exposed water and gas supply pipes supplying the subject development shall be metal.

13. At least one additional hydrant connection point should be located centrally within the subject development site and not within a road carriageway or designated parking space / area. The recommended location would be preferably between proposed unit blocks 4 & 5, and accessible for Unit blocks 1 & 2.

9.0 REFERENCED DOCUMENTS / LITERATURE

1. *Australian Standard 3959 Construction of buildings in bushfire prone areas (2009)* – Standards Australia.
2. *Bushfire Management Standards, Strategic Bushfire Management Plan, Version 3 (2014)* – Territory and Municipal Services, ACT Government.
3. *ACTEW / ACTFR Deed-of-Agreement (Tables 2.2 & 2.3) (1999)*.
4. *Estate Development Code (2013)* – ACT Government.
5. *Fire Retardant Plants for Canberra,* Yarralumla Nursery – Garden Advice Series.
6. *Landscape and building design for bushfire areas (2003)* - Ramsay, G. C & Rudolph, L., CSIRO Publishing, Collingwood Victoria.
7. *Planning for bush fire protection, A guide for Councils, Planners, Fire Authorities and Developers (2006)* – NSW Rural Fire Service.
8. *The ACT Strategic Bushfire Management Plan (2014)* – Territory and Municipal Services, ACT Government.

10.0 Personal Communication

Neil Willis, ACT Fire Rescue – Risk and Planning Section, 21/07/16 (phone conversation)

TREE ASSESSMENT REPORT
Block 1 Section 45

CHAPMAN

Prepared by

REDBOX DESIGN GROUP
Landscape Architects

18 July 2016
Revision A

For

Cardno

1.0 INTRODUCTION

This tree assessment evaluates individual Regulated trees located within Block 1 Section 45 Chapman (leased land) and offsite trees adjacent to the site.

Refer Tree Assessment Plans for summary

2.0 SITE DESCRIPTION

The site is on Block 1 Section 45, Chapman. It is bounded by Darwinia Terrace to the east, Percy Crescent to the west and Karthner Street to the north.

3.0 TREE ASSESSMENT INVENTORY

The following is a description of the criteria used to assess individual trees within the block and directly adjacent to the site.

TREE No: Individual trees are given a unique number shown on attached Tree Assessment Plans.

SPECIES CODE AND BOTANICAL NAME: Identification of trees on site by Species. Code is used to summarise the species name on the assessment plan

TREE HEIGHT: The estimated height of the tree (in metres) as annotated on site by Landscape architect.

TRUNK CIRCUMFERENCE The circumference (in metres) of the tree is measured on site at approximately 1 metre above ground level.

CANOPY DIAMETER: The estimated canopy diameter (in metres) as measured on site by Landscape architect.

GENERAL HEALTH: Condition is based on the present health of the tree as indicated by particular visible characteristics including: leaf health and leafiness, dieback, structural health of trunk and major branches, presence of pests and diseases. It also assesses the structural integrity of the tree in terms of its hazard potential. A tree may present a hazard due to defects in the trunk or major limbs.

Excellent (E): Extremely healthy tree in exceptional condition.

Good (G): Major trunks, branches and leafiness indicate good health with healthy new shoot growth over whole canopy.

Fair (F): Trees appears in reasonable health, though may have some characteristics as poor. Fair condition with reasonable shoot growth over whole canopy.

Poor (P): Trees of poor health and vigour exhibiting characteristics such as a large amount of growth, extensive dieback, trunk rot/defects or poor leafiness with little new shoot growth over whole canopy.

STRUCTURAL DEFECTS: Visual signs of possible or present defects present in assessed tree or group of trees

PAST DAMAGE / DISTURBANCE: Visual signs of past damage or disturbance present in assessed.

DISEASE / PEST INFESTATION: Visual signs of disease or insect infestation present in assessed tree.

TREE QUALITY: An overall assessment of the quality of the tree and its relative importance for retention within an urban context. Based on ACT Tree Protection ACT 2005 (Guidelines for Tree Management)

Exceptional (E): A tree or group of trees that:
Has natural or cultural heritage importance; or
Has high aesthetic value and will have a major contribution to the surrounding landscape; or
Is of outstanding form and condition and is an excellent example of the species; or
Has significant scientific value, including ecological importance.

High (H): A tree that:
Is of good form, structure and health;
Is without significant defect; and which has potential to make a significant contribution to the landscape

Medium (M): A tree that:
Is of reasonable form, structure and health; and whose presence contributes to the landscape but not as significantly as high / exceptional quality trees

Low (L): A tree that:
Is of poor, structure or health, is in decline; and
which has limited potential to contribute to the landscape

PROTECTED TREES:
A Protected Tree is a tree that is provided protection under the tree Protection Act 2005. The Act defines two types of Protected Tree: Registered Tree and Regulated Tree.

*A **Registered Tree** is a tree that has been identified as being exceptional for it's:*
- *(a) Natural or cultural heritage value;*
- *(b) Landscape and aesthetic value; and*
- *(c) Scientific or ecological value*

*A **Regulated Tree** is a tree that is located on leased Territory Land in an area declared as a Tree Management Precinct and is either:*
- *(a) 12m or more in height; or*
- *(b) greater than 1.5m in circumference 9approx. 0.5m in diameter) or more at 1m above natural ground level: or*
- *(c) with two or more trunks and the total circumference of all trunks, 1m above natural ground level, is 1.5m or more, or*
- *(d) 12m in crown width or more*

REGULATED STATUS: A regulated tree is a living tree (other than a registered tree or a palm tree) with one or more of criteria as noted above. For the purpose of this report tree assessment details note the regulated status as one of the following:

Y = Yes
N = No
N/A = Not applicable as the tree assessed is on UN-leased land
A tree is not a regulated tree if it is a pest plant under the Pest Plants and Animals Act 2005.

REGISTERED STATUS: Where applicable registered trees are noted and the relevant ACT Tree Register is included within the appendix of this report.

COMMENTS: Any arboriculture or other comments / notes relating to the tree or its location. Registered tree numbers are indicted and copies of the relevant sections of the ACT Tree Register are within the appendix of this report.

4.0 NOTES/DISCLAIMER

This report is to be utilised in its entirety only. Any written or verbal submission, report or presentation that includes statements taken from the findings, discussions, conclusions or recommendations made by this report, may only be used where the whole of the original report (or a copy) is referenced in and directly attached to that submission, report or presentation.

Unless stated otherwise:

The information contained in this report covers only the trees that were examined and reflects the conditions of those trees at the time of inspections during 18 July 2016, some still in dormancy.

Inspections were limited to visual examination of the subject trees without dissection, excavation, probing or coring.

There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject trees may not arise in the future.

The findings of this report may not necessarily agree with reports prepared by others, including the Government Conservator of Trees.

TREE NUMBER
01

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	7
Species Code	Epo	**Trunk circumference (m)**	1@1.3m, 1@1m, 1@1.1m
Tree Quality	Medium	**Canopy diameter (m)**	14m
Regulated Status	YES	**No. of trunks**	3

Health	Good	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	No

Comments	

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER

02

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	9m
Species Code	Epo	**Trunk circumference (m)**	1@1m, 1@1.25m, 1@1.3
Tree Quality	Medium	**Canopy diameter (m)**	9m
Regulated Status	N/A	**No. of trunks**	3

Health	Good	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	No

Comments	Growing close to storm water kerb sump

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
03

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	8m
Species Code	Epo	**Trunk circumference (m)**	1.3m
Tree Quality	Medium	**Canopy diameter (m)**	8m
Regulated Status	No	**No. of trunks**	1

Health	Good	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	No

Comments	

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
04

TREE DETAILS

Species Name	Eucalyptus polyanthemos (group)	**Tree Height (m)**	4m
Species Code	Epo	**Trunk circumference (m)**	0.7m
Tree Quality	Medium	**Canopy diameter (m)**	4-5m
Regulated Status	No	**No. of trunks**	1-2

Health	Good	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	No

Comments	Possible regeneration from adjacent mature Eucalyptus polyanthemos

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
05

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	13m
Species Code	Epo	**Trunk circumference (m)**	3.1m
Tree Quality	Low	**Canopy diameter (m)**	14m
Regulated Status	Yes	**No. of trunks**	1

Health	Poor	**Structural Defects / Decay**	Yes
Past damage / disturbance	Yes	**Disease / Pest infestation**	Yes

Comments	Extensive Lerp psyllid attack

ASSESMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
06

TREE DETAILS

Species Name	Eucalyptus polyanthemos (group)	**Tree Height (m)**	4m
Species Code	Epo	**Trunk circumference (m)**	Average 0.8m
Tree Quality	Medium	**Canopy diameter (m)**	3-4m
Regulated Status	No	**No. of trunks**	1

Health	Fair	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	No

Comments	

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
07

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	4m
Species Code	Emo	**Trunk circumference (m)**	1@0.7m, 1@0.5
Tree Quality	Low	**Canopy diameter (m)**	5
Regulated Status	No	**No. of trunks**	2

Health	Fair	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	Yes

Comments	Evidence of extensive Lerp psyllid attack

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
08

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	1.5m
Species Code	Emo	**Trunk circumference (m)**	0.9m
Tree Quality	Low	**Canopy diameter (m)**	1.5m
Regulated Status	N/A	**No. of trunks**	multi

Health	Fair	**Structural Defects / Decay**	No
Past damage / disturbance	Yes	**Disease / Pest infestation**	No

Comments	Dead upper branches, epicormic shoots from lignotuber / epicormics buds

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
09

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	6m
Species Code	Epo	**Trunk circumference (m)**	0.7m
Tree Quality	Low	**Canopy diameter (m)**	3m
Regulated Status	No	**No. of trunks**	1

Health	Fair	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	Yes

Comments	Evidence of recent Lerp psyllid attack

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER

10

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	7m
Species Code	Epo	**Trunk circumference (m)**	1.1m
Tree Quality	Medium	**Canopy diameter (m)**	4m
Regulated Status	No	**No. of trunks**	1

Health	Good	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	Yes

Comments	Evidence of recent Lerp psyllid attack

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
11

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	5m
Species Code	Epo	**Trunk circumference (m)**	1@0.8m, 1@0.7m
Tree Quality	Medium	**Canopy diameter (m)**	4m
Regulated Status	No	**No. of trunks**	2

Health	Good	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	Yes

Comments	Recent Lerp psyllid attack

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER

12

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	4m
Species Code	Epo	**Trunk circumference (m)**	1@0.4, 1@0.3, 1@0.7
Tree Quality	Low	**Canopy diameter (m)**	3m
Regulated Status	No	**No. of trunks**	3

Health	Poor	**Structural Defects / Decay**	Yes
Past damage / disturbance	No	**Disease / Pest infestation**	Yes

Comments	Possible regeneration from adjacent mature eucalyptus. Lerp psyllid attack

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
13

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	6m
Species Code	Epo	**Trunk circumference (m)**	0.7m
Tree Quality	Medium	**Canopy diameter (m)**	4m
Regulated Status	No	**No. of trunks**	1

Health	Fair	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	Yes

Comments	Evidence of recent Pysllid lerp attack

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
14

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	12
Species Code	Epo	**Trunk circumference (m)**	2.0m
Tree Quality	Low	**Canopy diameter (m)**	3m
Regulated Status	Yes	**No. of trunks**	1

Health	Poor	**Structural Defects / Decay**	Yes
Past damage / disturbance	Yes	**Disease / Pest infestation**	Yes

Comments	Epicormic growth from epicormics shoots adjacent to lopping of limbs, evidence of Pysllid lerp attack

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
15

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	16m
Species Code	Epo	**Trunk circumference (m)**	3 trunks with a combined circumference of 7.0m
Tree Quality	Exceptional	**Canopy diameter (m)**	23m
Regulated Status	Yes	**No. of trunks**	3
Registered Status	Yes (refer comments)		
Health	Excellent	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	No

Comments	Registered tree under ACT Tree Register pursuant to the Tree Protection Act 2005. Tree No. PTR104 – Refer attached report appendix.

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE GROUP NUMBER

16

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	4m
Species Code	Epo	**Trunk circumference (m)**	Average 0.6m
Tree Quality	Low	**Canopy diameter (m)**	Average 3m
Regulated Status	No	**No. of trunks**	Multi trunks within the group

Health	Poor	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	Yes

Comments	Regeneration from adjacent mature eucalypt. Evidence of recent Psyllid lerp attack.

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
17

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	16m
Species Code	Epo	**Trunk circumference (m)**	2.8m
Tree Quality	Low	**Canopy diameter (m)**	12m
Regulated Status	Yes	**No. of trunks**	1

Health	Poor	**Structural Defects / Decay**	No
Past damage / disturbance	Yes	**Disease / Pest infestation**	Yes

Comments	Past damage to tree canopy resulting in considerable amount of dead wood. Extensive epicormic shoots. Recent infestation of Psyllid lerp

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
18

TREE DETAILS

Species Name	Eucalyptus melliodora	**Tree Height (m)**	14m
Species Code	Eme	**Trunk circumference (m)**	1.6m
Tree Quality	Medium	**Canopy diameter (m)**	14m
Regulated Status	Yes	**No. of trunks**	1

Health	Good	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	Yes

Comments	

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
19

TREE DETAILS

Species Name	Eucalyptus polyanthemos	**Tree Height (m)**	25m
Species Code	Epo	**Trunk circumference (m)**	3.5m
Tree Quality	Exceptional	**Canopy diameter (m)**	20m
Regulated Status	No	**No. of trunks**	1
Registered Status	Yes (refer comments)		
Health	Excellent	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	No

Comments	Canopy overhanging Block 1 Section 45. Registered tree under ACT Tree Register pursuant to the Tree Protection Act 2005. Tree No. PTR 179– Refer attached report appendix.

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

TREE NUMBER
20

TREE DETAILS

Species Name	Eucalyptus melliodora	**Tree Height (m)**	20m
Species Code	Eme	**Trunk circumference (m)**	1@2.3m, 1@1.8m
Tree Quality	High	**Canopy diameter (m)**	12
Regulated Status	No	**No. of trunks**	2

Health	Excellent	**Structural Defects / Decay**	No
Past damage / disturbance	No	**Disease / Pest infestation**	No

Comments	Canopy overhanging Block 1 Section 45

ASSESSMENT DETAILS

Assessor	Redbox Design Group
Date of Assessment	July 2016

APPENDIX

Contents

ACT Tree Register – Tree Number's

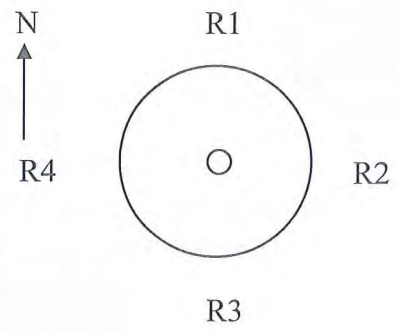
PTR104 and PTR179

ACT Tree Register

Tree Registration *Eucalyptus polyanthemos* (Red Box) Block 1 Section 45 Chapman	Nomination 104 Tree Number PTR104

Tree Details:

Street address	Bound by Percy Crescent, Kathner Street and Darwinia Terrace Chapman	
Location on block	In the middle of the block	
Botanical name:	***Eucalyptus polyanthemos***	
Common name:	**Red Box**	
Tree height:	15.5 m	
Canopy dimensions:	Broadest Diameter	18.0 m
	Radial Measurements	R1: 8.0m; R2: 9.0m; R3:10.0m; R4: 7.0m
Trunk circumference:	3 trunks with a combined circumference of 6.8m	
Number of trunks:	1	
Grid co-ordinates MGA	E 684317 N 6086491.7	



Registration Criteria that presently apply, other criteria may apply after further assessment.

(2) **Landscape and aesthetic value**

The object of this value is to identify trees that are of particular importance to the community due to their substantial contribution to the surrounding landscape.

A tree may be considered to be of landscape and aesthetic value if it is situated in a prominent location when viewed from a public place and it:

(a) contributes significantly to the surrounding landscape based on its overall form, structure, vigour and aesthetic values; or

(b) represents an outstanding example of the species, including age, size or habit; or

(c) is an exceptional example of a locally native species that reached maturity prior to urban development in its immediate vicinity.

Statement Against the Criteria

This remnant *Eucalyptus polyanthemos* (Red Box) is testimony to the strength of nature's ability to respond to the most severe of conditions. The tree survived the 2002 bush fires and an extended period of drought. Recently it has responded to more favourable wet conditions and is now flush with new growth!

The tree is an exceptional example of a remnant Red Box which is in excellent health and condition. The tree has a well-balanced canopy and appears to be devoid of defects. The tree plays an important role in the landscape, being one of only a few mature trees on the block. The tree is a remnant which existed prior to urban development in close vicinity to the tree. It is a high quality representative of the species and worthy of inclusion to the tree register.

Nomination 104
Tree Number PTR104
***Eucalyptus polyanthemos* (Red Box)**

ACT Tree Register

(Registration)

Pursuant to Division 7.2 of the *Tree Protection Act 2005* as the Conservator of Flora and Fauna the following decision has been made under section 52(1) to enter or not enter the above tree(s) to the ACT Tree Register

Registration

~~Yes~~ / ~~No~~ / **Discuss**

Penny Farnsworth 1 / 5 /2012
Conservator of Flora and Fauna

Requests for further information should be made to:

Tree Protection Unit
PO Box 158
Canberra City, ACT 2601

Telephone: (02) 6207 8145
Facsimile: (02) 6207 5956
Email: treeprotection@act.gov.au

ACT Government
Territory and Municipal Services

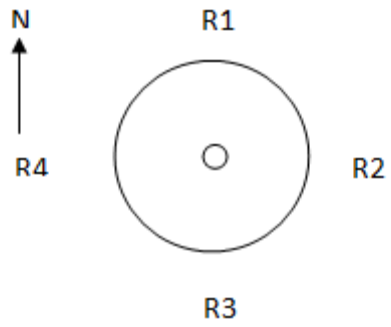
ACT Tree Register

Tree Registration

Nomination 179 PTR179

Species: *Eucalyptus polyanthemos (*Red box)
Location: Block 1 Section 45 Chapman

Location of *Eucalyptus polyanthemos* PTR179 in Chapman

Criteria	**Details of tree**
Street address	Adjacent to 15 Percy Crescent Chapman
Location on block	South west end of open space bound by Percy Crescent, Kathner Street and Darwinia Terrace
Botanical name:	*Eucalyptus polyanthemos*
Common name:	Red box
Tree height	25.0m
Canopy broadest diameter:	16.5m
Description of radial measurement	
Canopy radial measurement	R1: 7.0m R2: 11.0m R3: 9.5m R4: 5.5m
Trunk circumference:	3.45m

Criteria	Details of tree
Number of trunks:	1
Grid co-ordinates: MGA	X 684,286.351 Y 6,086,426.142

Registration Criteria that presently apply, other criteria may apply after further assessment.

(2) **Landscape and aesthetic value**

The object of this value is to identify trees that are of particular importance to the community due to their substantial contribution to the surrounding landscape.

A tree may be considered to be of landscape and aesthetic value if it is situated in a prominent location when viewed from a public place and it:
(a) contributes significantly to the surrounding landscape based on its overall form, structure, vigour and aesthetic values; or
(b) represents an outstanding example of the species, including age, size or habit; or
(c) is an exceptional example of a locally native species that reached maturity prior to urban development in its immediate vicinity.

Statement against the Criteria

This tree is an exceptional example of a remanent Eucalypt that has survived fire and drought conditions. Its majestic size dominates the surrounding landscape and the trunk is full of character. It provides valuable habitat for native birds and also a colony of bees. It meets the criteria for registration for its landscape and aesthetic value. It contributes greatly to the surrounding landscape due to its form, size and age and is an exceptional example of a locally native species that reached maturity prior to urban development in its immediate vicinity.

Nomination 179
PTR179
***Eucalyptus polyanthemos* (Red box)**

ACT Tree Register

(Registration)
Pursuant to Division 7.2 of the *Tree Protection Act 2005* as the Conservator of Flora and Fauna the following decision has been made under section 52(1) to enter or not enter the above tree(s) to the ACT Tree Register

Registration

Yes

Dr Annie Lane
Conservator of Flora and Fauna 18/8/2015

Requests for further information should be made to:

Tree Protection Unit
PO Box 158
Canberra City, ACT 2601

Telephone: (02) 6207 8145
Facsimile: (02) 6207 5956
Email: treeprotection@act.gov.au

Tree Management Plan for Registered Trees managed by City Services
PTR179 Chapman

Management responsibility

- Ensuring trees in high use urban areas continue to be inspected for health, condition and safety and are maintained as required;
- Ensuring trees are pruned with the aim of protecting public utilities, enhancing public safety and urban amenity, and improving or maintaining tree health as required;
- Carrying out remedial tree surgery and the removal of fallen or broken timber following storm events;
- Seek approval from the Conservator of Flora and Fauna (the Conservator) when required (see below).

Monitoring

Monitoring of a registered or a provisionally registered tree shall be undertaken in line with regional priorities by a qualified Arborist with a level (III) to inspect branch unions and parrot damage.

Minor Pruning

Minor pruning of a registered or a provisionally registered tree shall only be undertaken by a qualified Arborist with a level (III) certificate using current Australian Standard 4373 Pruning of amenity trees (AS-4373). Minor pruning does not require approval from the Conservator.

Section 13 (2) of the *Tree Protection Act 2005* (the Act) states that minor pruning means pruning (other than lopping or pollarding) done in accordance with AS4373 that-

i. Only involves removing deadwood; or
ii. Does not involve removing any limbs that have a diameter greater than 50mm; or
iii. Is the first pruning in the calendar year, affects less than 10% of the canopy and does not alter the overall shape of the canopy.

Major Pruning

Major pruning shall only be undertaken after consultation with the Tree Protection Unit. Pruning of a registered or a provisionally registered tree shall only be undertaken by a qualified Arborist with a level (III) certificate using current Australian Standard 4373 Pruning of amenity trees (AS-4373).
Section 13 (1) of the Act states that major pruning means pruning other than lopping, pollarding or minor pruning.

Ground works

Ground works within the Tree Protection Zone (TPZ) of a registered or provisionally registered tree shall only be permitted after a specific Tree Management Plan has been put forward and approved by the Conservator.
Australian Standard 4970-2009 – Protection of trees on development sites and the *Tree Protection (Guidelines for Tree Management Plans) Determination 2007* should be consulted in the preparation of the Tree Management Plan.

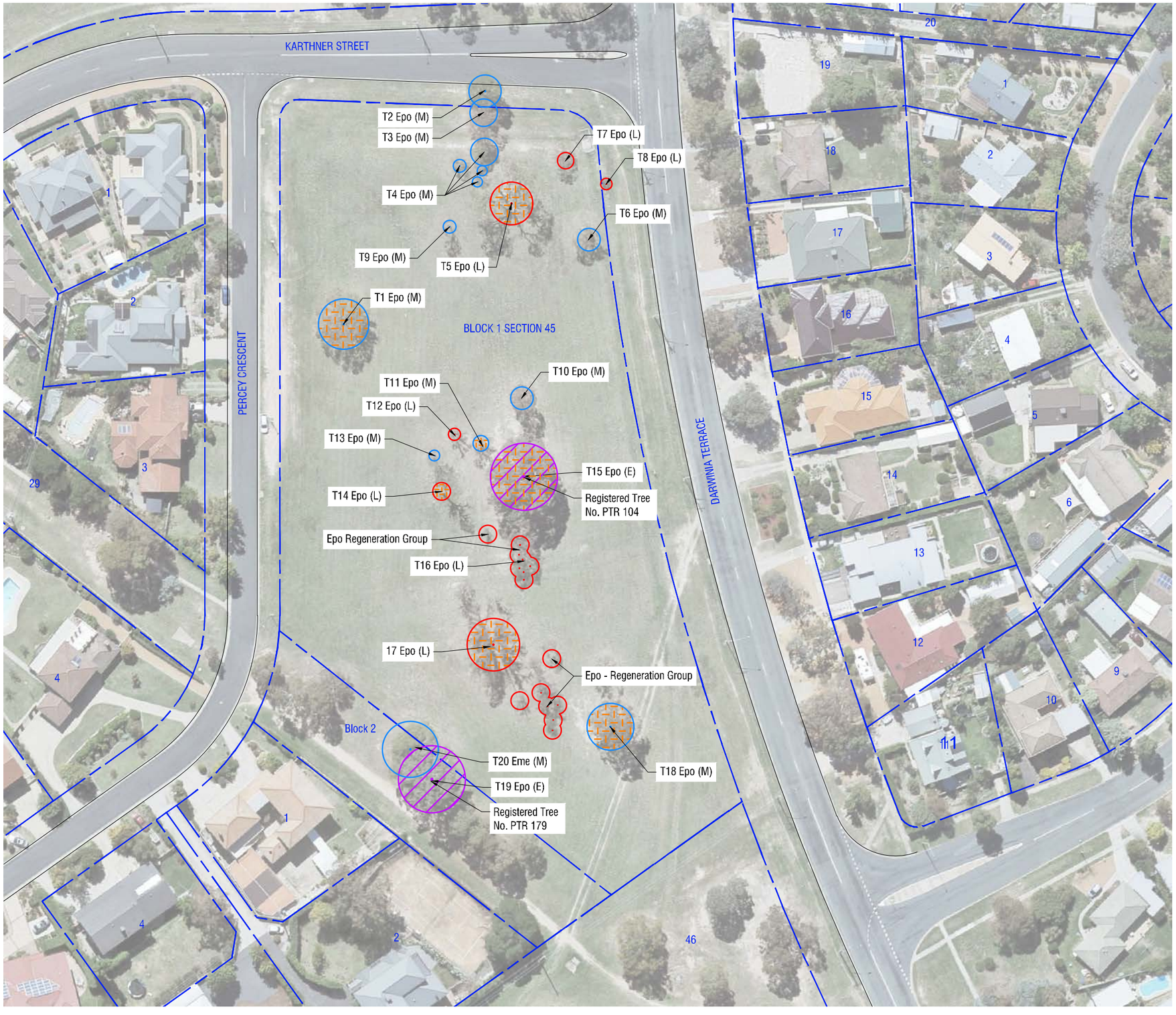
Removal

Removal of a registered or provisionally registered tree requires approval from the Conservator. Before approval can be granted the Conservator must agree to the Cancellation of the Registration.

Removal of a registered tree is permitted in emergency situations when removal is necessary and is the only option available to protect the health and safety of people, animals, or public or private property. Urgent Circumstance authorisation must be applied for through the Tree Protection Unit prior to removal. This can be given on the spot or over the phone.

Conservator of Flora and Fauna 18/8/2015

AGREED



LEGEND

LEASE BOUNDARY

EXISTING TREE (E)
(Exceptional Quality)

EXISTING TREE (H)
(High Quality)

EXISTING TREE (M)
(Medium quality)

EXISTING TREE (L)
(Low quality)

T10 Eme (M) TREE NO., TREE SPECIES CODE, TREE QUALITY CODE

TREE SPECIES

Code	Botanical Name
Eme	*Eucalyptus melliodora*
Epo	*Eucalyptus polyanthemos*

TREE ASSESSMENT CODES

Tree Quality Code	Tree Quality (see below for definition)
E	Exceptional
H	High
M	Medium
L	Low

TREE QUALITY:
An overall assessment of the quality of the tree and its relative importance for retention within an urban context

Exceptional (E) A tree of group of trees that:
Has natural or cultural heritage importance; or
Has high aesthetic value and will have a major contribution to the surrounding landscape; or
Is of outstanding form and condition and is excellent example of the species; or
Has significant scientific value, including ecological importance.

High (H) A tree that:
Is of good form, structure and health;
Is without significant defect; and which has the potential to make a significant contribution to the landscape

Medium (M) A tree that:
Is of reasonable form, structure and health; and whose presence contributes to the landscape but not as significantly as high / exceptional quality.

Poor (P) A tree that:
Is of poor, structure or health, is in decline; and which has limited potential to contribute to the landscape.

PROTECTED TREES - (under the Tree Protection Act 2005)

Registered Tree (Tree No. PTR 104 and PTR 179) - Refer Report

Regulated Tree - Refer Report

NOTE: Location of trees annotated from ACTMAPI imagery as no survey information was provided.

FOR FURTHER INFORMATION REFER TO THE TREE ASSESSMENT REPORT

ALL DIMENSIONS AND EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR BEFORE PROCEEDING WITH THE WORK

ORIGINAL SHEET SIZE A1 0 5 10 15 20 25m

ISSUE	DATE	AMENDMENT DESCRIPTION	BY
A	20.07.18	CLIENT ISSUE	LD/GB

CLIENT

ARCHITECT

CONSULTING ENGINEER
Cardno

LANDSCAPE ARCHITECT
redboxdesigngroup

PROJECT
BLOCK 1 SECTION 45 CHAPMAN

TITLE
TREE ASSESSMENT

CAD FILE G:\Proj nds - Current\1292 - Block - Section 45 Chapman CURRENT DRAWINGS
SCALE 1:500@A1 • 1:1000@A3
DRAWN LD/GB
CHECKED GB
APPROVED KK
PROJECT CODE 1292
SHEET No. 101
ISSUE A

URBAN RELEASE SITES
BLOCK 1 SECTION 45 CHAPMAN

PRELIMINARY ENVIRONMENTAL ASSESSMENT

Report prepared for

LAND DEVELOPMENT AGENCY

by

ROBERT JESSOP PTY LTD

April 2013

ROBERT JESSOP PTY LTD

ACN 156 136 355 ABN 40 156 136 355

ENVIRONMENTAL CONSULTANTS

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Document details	
Report name	Urban Release Sites Block 1 Section 45 Chapman Preliminary Environmental Assessment
Project Number	13005 Chapman
Prepared by	Kris Nash and Dr Robert Jessop
Reviewed by	Dr Robert Jessop
Status	Draft
Date	10 April 2013

EXECUTIVE SUMMARY

This preliminary ecological assessment report has been prepared by Robert Jessop Pty Ltd for the Land Development Agency (LDA) to describe the general ecological characteristics of, and identify potential ecological constraints associated with, the proposed release of Block 1 Section 45 Chapman for development.

The study site is a 1.5 ha, relatively flat parcel of unleased Territory land in Chapman, Canberra and is currently zoned for commercial use – community facilities under the Territory Plan.

The ground surface over most of the area has since been substantially modified by grazing and has been impacted by urban development.

The block contains widely spaced remnant and regenerating eucalypts above a grassy understorey comprising a mixture of native and introduced grasses and weeds.

Neither the wooded areas nor the grassy areas meet thresholds for native vegetation as defined in the *NC Act*.

Development implications under relevant legislation are:

- The site contains a registered tree. The tree is protected under the ACT *Tree Protection Act* and any proposed development would be required, subject to advice from the Conservator.
- There are no issues associated with the development that would warrant a referral under the Commonwealth *EPBC Act* or that would trigger the requirement for an EIS under the ACT *P&D Act*.

The study site is modified by past land uses but contains mature trees likely to provide habitat for common fauna species that use tree hollows as nesting sites.

It is recommended that development planning considers the retention of the mature hollow bearing trees to provide habitat for common native fauna and the areas surrounding the trees to support native grasses and forbs, and regenerating trees.

Contents

Appendices

Figures

Tables

1. Introduction

This preliminary ecological assessment report has been prepared by Robert Jessop Pty Ltd for the Land Development Agency (LDA) to describe the general ecological characteristics of, and identify potential ecological constraints associated with, the proposed release of Block 1 Section 45 Chapman (the study site) for development (Figure 1).

The study site is a relatively flat parcel of unleased Territory land that has an elevation between 627 m and 634 m asl. It is bound by Kathner Street to the north, Percy Crescent to the west, Darwinia Terrace to the east and urban open space to the south. The block is approximately 1.5 ha in size and is currently zoned for commercial use – community facilities under the Territory Plan.

The report provides a basis on which to assess the potential for the proposal to have a significant impact on any matters of national environmental significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (*EPBC Act*), and to identify potential development constraints under the ACT *Planning and Development Act* (*P&D Act*). The report also addresses issues raised by the Conservation Planning and Research (CPR) Section of the ACT Government.

The ecological issues identified as relevant and addressed in the report are:

- native groundcover vegetation quality;
- presence of threatened ecological communities, in particular the critically endangered *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* ecological community listed under the *EPBC Act* and / or the *Yellow Box – Blakely's Red Gum Grassy Woodland* ecological community listed as endangered under the ACT *Nature Conservation Act* (*NC Act*);
- presence of healthy mature trees, including a registered tree (i.e. PTR104) that may provide an important refuge for fauna; and
- presence of threatened species or habitat, in particular the pink-tailed worm-lizard (*Aprasia parapulchella*).

The report describes the study site's ecological characteristics to the extent permitted by seasonal conditions. It is based on field surveys undertaken on 12 and 21 March 2013, and a desk top analysis to identify any additional ecological matters pertaining to the site and surrounding area. The field survey included a meandering traverse that closely examined areas most likely to contain remnant native plant species, such as near trees and in the drier, more elevated areas. The remnant trees and general vegetation adjoining the site (to the north, south-east and south-west) were also examined. Total survey effort was approximately 90 minutes.

The field surveys were conducted in accordance with *Survey guidelines for determining lowland vegetation classification and condition in the ACT* (ACT Government, 2012a), which recommend that vegetation surveys requiring the condition assessment or determination of threatened ecological communities be conducted from the start of September to the end of December, or from the start of March to the end of April. Surveys that only require vegetation community

classification or determination of whether or not vegetation is native under the *NC Act* can be performed at any time of year.

Surveys for threatened species, however, are best undertaken during those times when the specific species is most likely to be active or, for plants, most likely to show diagnostic features. The report therefore includes recommendations as to whether further targeted surveys to verify the conclusions of the assessment would be required.

The ecological assessment is not intended to provide a detailed and comprehensive plant species list but to identify the dominant vegetation apparent at the time of the field inspection. The species identifiable or growing in a particular location at any one time depend on climatic and seasonal conditions, and are subject to change. The type of plant species present, however, can be used to assess the site's general condition and to predict to some extent the likelihood that threatened or uncommon species occur. A plant species list is included as Appendix A.

It is probable that, prior to European settlement, the general area contained woodland dominated by yellow box (*Eucalyptus melliodora*), red box (*E. polyanthemos*) and Blakely's red gum (*E. blakelyi*) (ACT Government, 2004). The ground surface over most of the area has since been substantially modified by grazing and has been impacted by urban development. The block contains widely spaced remnant and regenerating eucalypts above a grassy understorey. Figure 2 presents the study site's main features. Figure 3 shows a view of the site from the south-eastern corner.

ACTmapi

CHAPMAN

Legend

- Pink Tailed Worm Lizard (*Aprasia parapulchella*)
- EPBC Woodland
- Box Gum Woodland
- Site Boundary

1: 28,086

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DISCLAIMER

The map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current or otherwise reliable.

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ACT Government

Figure 1. Chapman site location and significant species data

Figure 2. Study site main features

Figure 3. Study site from the north showing registered tree PTR107

2. Site Description

2.1 Groundcover Characteristics

In general, the groundcover vegetation within the study area is a mixture of native and introduced grasses and weeds. The recent weather conditions have favoured introduced species, as they have overgrown or displaced the native grasses and are dominant in large swards, particularly in areas that are relatively low lying or poorly drained, and in areas adjacent to the surrounding roads where mowing is more frequent. Native grasses remain dominant in isolated patches only, generally immediately outside the drip lines of the eucalypts, but are evident in other areas as a minor component.

The introduced perennial grasses that dominate relatively large areas include African lovegrass (*Eragrostis curvula*) and paspalum (*Paspalum dilatatum*). The latter occurs primarily in the lower lying parts of the block. Grasses such as goose grass (*Eleusine tristachya*), couch (*Cynodon dactylon* var. *dactylon*) and cocksfoot (*Dactylis glomerata*) occur in isolated patches or are scattered across the site. Consistent with current seasonal conditions, the incidence of introduced annual grasses is low. Brome grasses (*Bromus* spp.) and pigeon grass (*Setaria* sp.) were occasionally observed. Annual grasses are likely to be abundant across the site in spring / early summer.

The site contains a moderate abundance of weed species, the most common being catsear (*Hypochaeris radicata*) and plantain (*Plantago lanceolata*). Other weeds, such as fleabane (*Conyza bonariensis*), sheep sorrel (*Acetosella vulgaris*), dandelion (*Taraxacum* sect. *Ruderalia*), whitlow (*Paronychia brasiliana*) and umbrella sedge

(*Cyperus eragrostis*), have colonised small areas or are scattered in low abundance. Occasional garden escapes (e.g. violet (*Viola* sp.), gazania (*Gazania* sp.)) were observed in the southern part of the site.

The most commonly occurring native grass is redleg (*Bothriochloa macra*), but there are other grasses such as wallaby grasses (*Rytidosperma caespitosum*, *R. racemosum*), spear grasses (*Austrostipa bigeniculata*, *A. scabra*), hairy panic (*Panicum effusum*), weeping grass (*Microlaena stipoides*), windmill grass (*Chloris truncata*) and native lovegrass (*Eragrostis* sp.) that are dominant in isolated patches or otherwise have a scattered distribution. The diversity of native herbaceous species (i.e. forbs) is relatively low in comparison to the understorey species diversity observed on 20 March 2013 within a less modified woodland patch (Appendix A). The forbs tend to be restricted to disturbance tolerant species such as bluebells (*Wahlenbergia communis*, *W. gracilenta*), variable raspwort (*Haloragis heterophylla*), grassland wood sorrel (*Oxalis* sp.), finger rush (*Juncus subsecundus*), fireweed (*Senecio quadridentatus*) and climbing saltbush (*Einadia nutans*). Yellow rush lily (*Tricoryne elatior*) and native St John's wort (*Hypericum gramineum*), identified as important species in the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Grassland Ecological Community species list (Australian Government, 2006b), were observed in several locations. In general, native forbs had a limited distribution and were found in association with patches dominated by native grasses.

While nine forbs were observed and it is possible that additional species may be recorded during a spring survey (i.e. when a higher diversity of native forbs are known to flower or be otherwise detectable), no native grass species that are indicative of a site with conservation significance, such as kangaroo grass (*Themeda triandra*) or less disturbance tolerant wallaby grasses (e.g. *Rytidosperma carphoides*, *R. laeve*), were observed. The most common native grass is redleg, a colonising species characteristic of degraded areas (Prober *et al.* 2005).

The study site, in particular the areas adjoining the roads, is regularly mown / slashed and there is a thick thatch layer in most areas. The thatch is likely to suppress native forb emergence but also indicates that an abundance of annual grasses are likely to emerge in spring.

2.2 Native Groundcover Quality

This assessment considers groundcover vegetation that is substantially native comprises more than 50% perennial native species. This is consistent with CPR guidelines (ACT Government, 2012a) and guidelines for assessing woodland vegetation under the *EPBC Act* (Australian Government, 2006a).

The block was assessed as a single polygon as described under CPR guidelines for the following reasons:

- The site is a small parcel of unfenced urban open space that was once part of a larger area of woodland that occupied the surrounding valley.
- The tree spacing meets criteria to be considered as a single structural polygon. The trees are generally consistently spread across the site and the canopy cover within the site meets the cover crown class of 3-20% (open woodland).

- While the existing groundcover vegetation includes small patches where native grasses are dominant, it also includes areas where no native grasses are evident, and areas where native and introduced species are intermixed. Although the groundcover vegetation is highly variable, the patchiness is consistent across the entire site.

A step-point transect survey to determine the ground layer's native component was undertaken on 12 March 2013, i.e. autumn. The survey involved collecting data from 170 sampling points along two transects (i.e. 100 samples plus 70 samples) located within representative areas. Table 1 presents the step-point transect results. Figure 1 shows the transect locations.

Table 1. Transect survey results

	Number of samples	Perennial vegetation	Native perennial vegetation	Non-native vegetation (perennial species)	Non-native vegetation (annual species)	Other - thatch	Native vegetation cover
Total	170	152	51	101	7	11	34%

The proportion of native groundcover vegetation across the study site is 34%[1].

This proportion may be higher under different seasonal conditions, for example after a dry spring season which favours native grasses over more water-dependant species such as paspalum, but the proportion may also be lower should the season again favour introduced grasses. The groundcover has been disturbed to the extent that it is likely to continue to fluctuate according to prevailing conditions. Under the current management regime (i.e. frequent mowing, no removal of mown grass), however, invasive grasses such as African lovegrass are likely to continue to displace native species.

Under current management, it is unlikely that the native groundcover vegetation would reach a proportion greater than 50% and is therefore unlikely to be regarded as native vegetation under the *NC Act*.

2.3 Trees and Habitat Features

According to ACT survey guidelines, an area is considered to be native vegetation, as defined in the *NC Act*, if trees or shrubs indigenous to the area have a canopy cover of 10% or greater in any stratum (ACT Government, 2012a).

The site contains four remnant eucalypts, and younger trees, saplings and seedlings that are native to the site. Species include yellow box, red box and Blakely's red gum (*E. blakelyi*). The mature tree canopy cover has been estimated from aerial photography and is about 4.5%. If young trees are included, the total canopy cover is approximately 8%, which is less than the 10% native vegetation threshold.

Although the mature trees show signs of dieback, they contain small to moderately sized habitat hollows. Tree hollows are an important habitat feature in urban

[1] Calculated by the number of samples with perennial native vegetation (i.e. 51) divided by the total number of samples with perennial vegetation (i.e. 152, the sum of 51 and 101). Annual species are excluded from the calculations as outlined in the ACT survey guidelines (ACT Government, 2012a).

environments, as they provide habitat for fauna such as birds, bats and possums. In woodlands, they are known to provide nesting and / or shelter sites for more than 300 invertebrate species (Lindenmayer *et al.* 2005). While the actual use of the hollows was not assessed in the current survey, hollow formation in eucalypts is a slow process and the loss of a hollow-bearing tree can take more than 100 years to replace.

Other than tree hollows, the site contains few habitat features likely to support a wide range of native fauna, including threatened woodland birds. Tree branches have been trimmed and removed from the site, and therefore fallen logs, branches or twigs are absent. Leaf litter is restricted to areas immediately under trees but they are not extensive. The site does not support shrubs or thickets, although a few large wattles have been planted outside the south-western boundary. Rocky outcrops or areas containing scattered rock do not occur. The understorey contains a limited abundance of native food sources such as grasses and forbs.

The presence of a small amount of kangaroo scats suggests that kangaroos at least occasionally graze the site.

2.4 Surrounding Area

Block 1 Section 45 Chapman is located near the western edge of the developed area of Weston Creek (and south-west Canberra). The Cooleman Farm equestrian centre is located to the north, while regenerating mixed pine and eucalypt forest is located further north, on the site of the forestry pine plantation destroyed in the 2003 Canberra bushfire, i.e. Narrabundah Hill.

The Cooleman Ridge Nature Reserve is located approximately 500 m to the south-west of the study site, with residential housing in between. The land further to the west and south of the nature reserve, between the nature reserve and the Murrumbidgee River Corridor, is under rural lease.

A remnant eucalypt stand, including scribbly gum (*E. rossii*), red box, yellow box and Blakely's red gum, is located to the north of the study site, on the northern side of Kathner Street. Native understorey vegetation occurs under the trees and up to 6 m beyond the drip line. Otherwise introduced grasses similar to those observed within the study area dominate the groundcover.

A small triangular area of urban open space adjoins the study site to the south east. Trees have been planted within that reserve and outside the south-western boundary of the block. The trees include a range of eucalypts, only some of which are species that occur naturally in the original woodland community. Introduced grasses dominate the understorey.

There are narrow easements / walkways between the residential blocks that link the southern corner of the study site to the Cooleman Ridge Nature Reserve and the south-western corner to rural lands west of Kathner Street.

The 2003 Canberra bushfire destroyed some of the houses to the west and south of the study site. While the stand of remnant trees located to the north of the study area and many of the trees (i.e. pines and natives) within the surrounding area and the Cooleman Ridge Nature Reserve were destroyed or otherwise impacted by the

fire, those within the study site survived relatively unscathed. As a consequence, a healthy mature red box tree within the study site was included on the ACT Tree Register (i.e. PTR104). Figure 1 and Plate 1 show the location of this eucalypt.

3. Assessment of the Potential for Threatened Woodland

3.1 Assessment of the Woodland Under the ACT *NC Act*

The endangered yellow box – red gum grassy woodland community is described in the *ACT Woodland Conservation Strategy* (ACT Government, 2004) as a community where:

- yellow box and/or red gum contribute 40% or more of the crown cover;
- there is a species-rich understorey of native tussock grasses, herbs and scattered shrubs and the understorey is not exotic pasture or degraded beyond recovery; and/or
- the trees have been removed or reduced but the species-rich understorey remains.

Current ACT survey guidelines suggest that, in addition to the above criteria, 50% or more of the perennial ground cover must be native (ACT Government, 2012a).

The study site has not been previously identified as supporting yellow box – red gum woodland (ACT Government, 2004). The ACT Government's interactive mapping service (ACTmapi) provides maps that indicate the location of threatened ecological communities within the ACT (ACT Government, 2012b). The mapping shows the study site and surrounds as not supporting any woodland vegetation, substantially modified or otherwise (Figure 2). The nearest area of yellow box – red gum grassy woodland is a small 0.36 ha patch located about 750 m to the south-west, within the Cooleman Ridge Nature Reserve.

Table 2 provides an assessment of the site against the relevant criteria listed above under the assumption that the site comprises a single polygon.

Table 2. Assessment of the study site against the *NC Act*

Criteria	Comments
Yellow box and/or red gum contribute 40% or more of the crown cover (current or past)	**Yes.** Although the block contains red box, the dominant tree species are yellow box and/or red gum.
50% or more of the perennial ground cover is native	**No.** The perennial ground cover has been assessed as less than 50% under current seasonal conditions (Section 2.2).
A species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the understorey is not exotic pasture or degraded beyond recovery.	**No.** Native shrubs do not occur within the study site and the understorey is not species-rich (Section 2.1). The existing ground cover quality does not indicate a site of conservation significance or a site that is likely to improve in diversity and condition in the long term. Without an input of significant resources (e.g. additional planting, substantial weed removal) the site is unlikely to recover.

In conclusion, while yellow box and / or red gum are the dominant tree species within the study site, the understorey is not dominated by native grasses and is not species-rich. Large parts of the site (e.g. road verges, African lovegrass dominant patches) are highly modified and are likely to be degraded beyond recovery.

Block 1 Section 45 Chapman does not meet the criteria for inclusion as yellow box – red gum grassy woodland community listed under the *NC Act*.

3.2 Assessment Against *EPBC Act* Criteria for White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands

Table 3 provides assessments of the study site against the criteria provided in EPBC Act policy statement 3.5 - *White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands* (Australian Government, 2006a).

Table 3. Assessment of the study site against the *EPBC Act*

Criteria	Comments
The most common overstorey species is or was white box, yellow box or Blakely's red gum	**Yes.** Yellow box and Blakely's red gum dominate the tree species present.
A predominantly native understorey	**No.** The perennial ground cover is less than 50% under current seasonal conditions (Section 2.2).
Patch is greater than 0.1 ha and contains 12 or more native understorey species excluding grasses	**Possible.** Nine native forbs were observed within the patch, including two regarded as important. While the diversity observed is less than that currently visible in a less modified woodland patch (Appendix ...), it is possible that other forbs would be detected during a spring survey. The additional forbs are likely to be species tolerant of disturbance and unlikely to be significant species (Section 2.1).
Is greater than 2 ha and contains 20 or more mature trees per hectare or natural regeneration	**No.** Although mature and regenerating eucalypts occur, the study site is approximately 1.5 ha.

Based on the above assessment and under current conditions, the study site does not meet the criteria to be considered as *White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands* (box – gum grassy woodland) under the *EPBC Act*. While the eucalypts within the study site are commonly yellow box and Blakely's red gum, and there is some potential for 12 or more native forb species to be present, the understorey is not predominately native.

4. Potential for Threatened Species

4.1 General

Threatened species are listed under both the ACT *NC Act* and the Commonwealth *EPBC Act*, with some species appearing on one list and others appearing on both lists. Table 4 lists threatened species associated with woodlands and that may be relevant to the proposal. The list is based on a *Protected Matters Report* (created 13 March 2013, Appendix B) and species associated with woodland vegetation in the ACT (ACT Government, 2004)

Threatened species associated primarily with habitat features not found within the study area, i.e. water bodies, riparian corridors, shrubby understorey, rocky outcrops, natural temperate grasslands or are themselves shrubs not recorded during the field survey, are not relevant to the report and have been excluded from further discussion unless CPR has identified them as a specific species of interest.

Table 4. Status of relevant threatened species

Scientific Name	Common Name	Status	
		NC Act	*EPBC Act*
Woodland birds			
Climacteris picumnus	Brown treecreeper	V	
Melanodryas cucullata	Hooded robin	V	
Hieraaetus morphnoides	Little eagle	V	
Grantiella picta	Painted honeyeater	V	
Anthochaera phrygia	Regent honeyeater	E	E
Polytelis swainsonii	Superb parrot*	V	V
Lathamus discolor	Swift parrot*	V	E
Daphoenositta chrysoptera	Varied sittella	V	
Lalage sueurii	White-winged triller	V	
Plants			
Thesium australis	Austral toadflax*		V
Rutidosis leptorrhynchoides	Button wrinklewort	E	E
Leucochrysum albicans var. *tricolor*	Hoary sunray*		E
Swainsona recta	Small purple pea*	E	E
Prasophyllum petilum	Tarengo leek orchid	E	E
Reptiles			
Aprasia parapulchella	Pink-tailed worm-lizard*	V	V
Delma impar	Striped legless lizard*	V	V
Insects			
Synemon plana	Golden sun moth*	E	CE

*Species listed in the *EPBC Act* Protected Matters Report (Appendix B)
CE=Critically endangered, E=Endangered, V=Vulnerable

There are no records of any threatened species occurring within the study area (ACT Government, 2004; ACT Government, 2012b) and the potential for the site to support such species has been substantially diminished through previous land uses. In addition, the area is highly modified and lacks the diversity of native forb species and a range of suitable habitat attributes that may indicate the presence of uncommon or threatened native plants, or threatened fauna associated with woodlands.

Nevertheless, the potential for the species listed in Table 1 to occur is addressed below. Information pertaining to habitat requirements has been obtained from Action Plan No. 27 (ACT Government, 2004) or from the species profile and threats database (Australian Government, 2013) unless otherwise referenced.

4.2 Woodland Birds

4.2.1 Overview

The presence of habitat hollows and mature trees suggests that the site has the potential to support hollow-dependant species such as woodland birds. Most threatened birds, however, require other habitat features that are not present within the study site. The hollows are therefore more likely to be used by common species, including introduced species.

4.2.2 Brown treecreeper

The brown treecreeper is known from relatively high quality woodland sites around Canberra. Critical habitat features include a relatively undisturbed grassy woodland with native understorey, eucalypts with hollows, and fallen timber. While the study

site supports eucalypts with hollows, there is little fallen and standing dead timber and the understorey is not native. The brown treecreeper is unlikely to occur within the study site.

4.2.3 Hooded robin

In the ACT, the hooded robin is generally associated with better quality box – gum grassy woodlands which retain a native understorey, scattered low shrubs and fallen logs. The study site does not have sufficient habitat quality or diversity to be suitable for the hooded robin and the species is unlikely to occur.

4.2.4 Little eagle

The little eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. The species nests in tall living trees within a remnant patch, but rarely nests in isolated trees. Little eagle records have been declining consistently within the ACT, with urban encroachment on habitat considered to be a key threat (ACT Government, 2011). Due to the small size of the study site, its relative isolation from more intact woodland / forested areas and the degraded understorey, the little eagle is unlikely to occur within the study site.

4.2.5 Painted honeyeater

The painted honeyeater is a mistletoe-dependent species associated with a range of woodland types. As the site does not support mistletoe, it is unlikely to support the painted honeyeater.

4.2.6 Regent honeyeater

The regent honeyeater's range has declined significantly in recent decades and, while once relatively common in small numbers in the ACT, the species is now only recorded intermittently. The regent honeyeater is a partially migratory species and movements are generally associated with the flowering of a number of proliferous flowering eucalypts including yellow box and Blakely's red gum. As a consequence, movements are erratic and irruptive. Regent honeyeaters are generally associated with fertile woodland sites along creeks, valleys and lower slopes. Urban encroachment on woodland habitat is recognised as a key threat to the regent honeyeater in the ACT region.

It is highly unlikely that the regent honeyeater would use the scant resources provided within the study site.

4.2.7 Superb parrot

The superb parrot mainly inhabits forests and woodlands dominated by eucalypts, especially river red gums (*Eucalyptus camaldulensis*) and also yellow box or Blakely's red gum. There is a positive correlation between the locations of superb parrot nest sites and the occurrence of extensive tracts of suitable foraging habitat (Webster 1988). Critical habitat features for the superb parrot include clusters of large living and dead trees for nesting sites.

In the ACT, superb parrot sightings are concentrated in Belconnen and eastern Gungahlin (Nash et al., 2011) where they may forage in eucalypts found in urban environments. Although the study site contains suitable eucalypt species with hollows, the trees are relatively widely spaced and the site is a small isolated patch located away from extensive tracts of foraging habitat known to be used by the

superb parrot. The species is unlikely to occur with any frequency within the study site.

4.2.8 Swift parrot

The swift parrot is a highly mobile species which breeds in Tasmania, and migrates to the mainland during the winter. It generally only occurs in Canberra during its seasonal migration, particularly in April and May, although it has been recorded during the winter. The swift parrot largely feeds on winter flowering eucalypts. The species is recorded with some regularity in the inner Canberra suburbs.

The eucalypts within the study site are spring to summer flowering species (Brooker and Kleinig, 2006). It is unlikely that swift parrots use the resources within the study site.

4.2.9 Varied sittella

The varied sittella is an uncommon breeding resident found throughout the ACT. In the ACT, the species has demonstrated a preference for areas with red stringybark (*E. macrorhyncha*) and it is considered that isolated and sparse woodland patches may not provide sufficient resources to support family groups of this species. The study site is unlikely to support varied sittella.

4.2.10 White-winged triller

The white-winged triller is an uncommon breeding summer migrant which inhabits woodlands in the Canberra region. White-winged trillers generally inhabit high quality woodlands, often feeding in the trees, and close to the ground amongst shrubs and fallen timber. It is unlikely that the study site provides suitable foraging habitat for the white-winged triller.

4.3 Threatened Plants Associated with Woodlands

4.3.1 Overview

While field surveys were completed in autumn when not all of the relevant plant species were flowering or were otherwise evident, the range of species present during the surveys is a good indication of the area's floristic quality. In general, the native grasses and forbs found within the study site are those regarded in Action Plan No. 27 as disturbance tolerant, with two moderately disturbance tolerant species (i.e. yellow rush lily, small St John's wort) found in localised patches. It is highly unlikely that species less tolerant of disturbance would occur.

4.3.2 Austral toadflax

The species appears to be strongly associated with a kangaroo grass dominated herbaceous understorey within woodlands and grasslands. All known populations in the ACT occur in nature reserves (i.e. Mulligans Flat Nature Reserve, Kambah Pool Reserve, Tidbinbilla Nature Reserve and Namadgi National Park). The study site does not support kangaroo grass and therefore austral toadflax is unlikely to occur.

4.3.3 Button wrinklewort

The button wrinklewort occurs on the margins of open stands of yellow box – red gum woodland although it is a poor competitor amongst tall sward-forming grasses such as kangaroo grass. Areas that contain likely habitat for this species within the ACT have been extensively surveyed. There are no known records of button

wrinklewort in the Chapman area and the species was not observed within the study site during the current survey. Button wrinklewort has diagnostic features that allow it to be readily identified in the field in autumn.

4.3.4 Hoary sunray

This species does not tolerate moderate grazing although responds to disturbance as a coloniser and is commonly located on roadsides. Large hoary sunray populations are located on the Mount Ainslie and Mount Majura foothills. It was not found under favourable conditions during the field surveys, hence is unlikely to occur within the study site.

4.3.5 Small purple pea

The small purple pea is found in open woodland with a native grassy understorey dominated by kangaroo grass, spear grasses or Poa grasses. The only known location identified in Action Plan No. 27 in which the plant occurs within the ACT is in the Canberra – Williamsdale district, a considerable distance from the study site. The plant has since been found in other locations, although these are predominantly in southern Canberra. Given the lack of suitable habitat for this species, it is highly unlikely to occur within the study site.

4.3.6 Tarengo leek orchid

In the ACT, the rare Tarengo leek orchid is known to occur only in the Hall Cemetery. The orchid has a preference for moist sites and is threatened by invasion of exotic grasses. Given that exotic grasses dominate the moist sites within the study site and the large distance from locations where the orchid is known to occur, the orchid is unlikely to occur on the study site.

4.4 Reptiles

4.4.1 Pink-tailed worm-lizard

The pink-tailed worm-lizard is most commonly found sheltering under small rocks, shallowly embedded in the soil. Some individuals have been found under larger rocks embedded up to 30 cm deep. A cover of predominantly native grasses characterise most sites where pink-tailed worm-lizards occur. Kangaroo grass is a key botanical indicator of suitable habitat in the ACT, along with redleg and mat rush (*Lomandra filiformis*). The presence of other plant species, including spear grasses and weeds decreases the likelihood of pink-tailed worm-lizard presence.

The potential for the lizard to occur was raised by CPR based on the proximity of a large area of known habitat located to the south. The study area itself, however, does not contain rocks or other suitable habitat features. The pink-tailed worm-lizard is highly unlikely to be present within the study site.

4.4.2 Striped legless lizard

The striped legless lizard is found primarily in lowland native grasslands but may occur in secondary grassland within 2 km of primary grasslands. Perennial, tussock-forming grasses such as kangaroo grass, spear grasses and wallaby grasses generally dominate suitable habitat but the species is also found in some areas dominated by exotic grasses (mostly phalaris).

The study site is regularly mown and is not dominated by grasses that develop a tussock structure, other than African lovegrass which is not known to be associated with striped legless lizard habitat. The study site is not connected to suitable grassland habitat and is not located within 2 km of natural temperate grassland. Available evidence suggests that this lizard does not occur within the study site.

4.5 Invertebrates

4.5.1 Golden sun moth

Although the golden sun moth is typically associated with natural temperate grassland, the species is also known to occur within secondary grassland habitat. The study site does not contain a substantial abundance of wallaby grasses, spear grasses or Chilean needle grass (*Nassella neesiana*); plant species associated with the golden sun moth. The nearest known habitat is approximately 4 km to the north-east, well beyond the moth's known flying range. The site is highly unlikely to support golden sun moth.

5. Protected Tree

A large red box tree located in the centre of the study site is listed as registered tree PTR104 on the ACT Tree Register under Part 7 of the ACT *Tree Protection Act*. The tree, (Figure 3), is identified as being an exceptional example of a remnant red box which is in excellent health and condition despite being impacted by the 2003 Canberra bushfire.

The *Tree Protection Act* prohibits damaging a protected tree without approval. The term 'damage' includes killing, destroying, felling, removing, ring barking, lopping, pollarding, poisoning, major pruning, or anything else that causes the tree to die, reduces its expected life span or significantly and adversely affects the tree's health. In addition, certain groundwork is prohibited without approval within the tree protection zone. The tree protection zone is deemed to be under the canopy of the tree, within a two metre radius out from the canopy, within a four metre radius surrounding the trunk as measured at one metre above natural ground level or as defined in a tree management plan for the tree (Miller and Rawson, 2009).

6. Status under Threatened Species Legislation

No known features of ecological significance occur within the study site that have been identified in the *ACT Lowland Woodland Conservation Strategy* (ACT Government, 2004) or on the ACT map of significant plants or animals (ACT Government, 2012b) The study site does not contain a threatened woodland community.

In addition, there is no evidence to suggest the presence of any threatened fauna or flora listed under the *NC Act* or the *EPBC Act* on the site, and further targeted surveys for such species are not considered warranted.

Site development including the removal of all vegetation, while not recommended, would not affect any matters of national environmental significance, and therefore the submission of a referral under the *EPBC Act* is not warranted.

7. Implications under the *Planning and Development Act*

The study site is not identified as within a Future Urban Area under the Territory Plan. The relevant condition under Schedule 4 Part 4.3 of the *P&D Act*, that would trigger the requirement for an Environmental Impact Statement (EIS), are proposals that:

- involve the clearing of more than 0.5 ha of native vegetation.

The site does not contain any area that has a substantial cover of native species as trees, understorey plants or groundcover, therefore the study site is not considered to contain native vegetation. Development that involved the clearing of existing vegetation would not trigger the requirement for an EIS under the *P&D Act*.

In relation to the registered tree, the *P&D Act* requires that the Conservator receive a copy of any development application in the impact track or in the merit track if the application relates to any part of a declared site. In addition, if the Conservator believes that the development is likely to result in damage to a protected tree or affect a tree protection zone or declared site, the Conservator can give written advice on the matter. This advice needs to be considered by the ACT Planning and Land Authority in making its decision on the development application. Development approvals which are inconsistent with the Conservator's advice in relation to a registered tree or a declared site cannot be given (Miller and Rawson, 2009)

8. Conclusions and Recommendations

There are no issues associated with the development that would warrant a referral under the Commonwealth *EPBC Act* or that would trigger the requirement for an EIS under the ACT *P&D Act*.

The study site is modified by past land uses but contains mature trees likely to provide habitat for common fauna species that use tree hollows as nesting sites.

The site contains a registered tree. The tree is protected under the ACT *Tree Protection Act* and any proposed development would be required, subject to advice from the Conservator who may approve tree removal, to ensure the tree was not damaged or that no prohibited activities were undertaken within the tree protection zone.

From an environmental perspective, it is recommended that development planning considers the retention of the mature hollow bearing trees and as much of the areas immediately surrounding the trees as is practicable. The trees contain important habitat for common native fauna and the areas surrounding the trees are most likely to support native grasses and forbs, and regenerating trees.

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Appendices

Appendix 1: Plant Species List

Scientific Name	Common Name	E/N	Chapman	Woodland comparison
Acaena ovina	Sheep's burr	N		✓
Acetosella vulgaris	Sheep sorrel	E	✓	
Arctotheca calendula	Capeweed	E	✓	
Asperula conferta	Common woodruff	N		✓
Austrostipa bigeniculata	Tall spear grass	N	✓	
Austrostipa scabra	Rough speargrass	N	✓	
Bothriochloa macra	Redleg grass	N	✓	
Carex appressa	Tall sedge	N		✓
Cheilanthes austrotenuifolia	Rock fern	N		✓
Chrysocephalum apiculatum	Yellow buttons	N		✓
Chrysocephalum semipapposum	Clustered everlasting	N		✓
Conyza sp.	Fleabane	E	✓	
Cynodon dactylon	Couch grass	E	✓	
Cyperus eragrostis	Umbrella sedge	E	✓	
Dactylis glomerata	Cocksfoot	E	✓	
Desmodium varians	Tick trefoil	N		✓
Einadia nutans	Creeping saltbush	N	✓	✓
Eleusine tristachya	Goose grass	E	✓	
Eragrostis curvula	African lovegrass	E	✓	
Eragrostis sp.	Lovegrass	N	✓	
Euchiton sp.	Cudweed	E		✓
Gazania linearis	Gazania	E	✓	
Geranium solanderi	Native geranium	N		✓
Glycine tabacina	Glycine pea	N		✓
Gonocarpus tetragynus	Common raspwort	N		✓
Goodenia hederacea	Ivy goodenia	N		✓
Haloragis heterophylla	Swamp raspwort	N	✓	
Hydrocotyle laxiflora	Stinking pennywort	N		✓
Hypericum gramineum	Native St John's wort	N	✓	✓
Hypochaeris radicata	Catsear	E	✓	
Juncus subsecundus	Finger rush	N	✓	
Lepidium africanum	Common peppercress	E	✓	
Leptorhynchos squamatus	Scaly button	N		✓
Leucochrysum albicans	Hoary Sunray	N		✓
Lomandra filiformis subsp. *coriacea*	Matrush	N		✓
Lomandra filiformis subsp. *filiformis*	Matrush	N		✓
Melichrus urceolatus	Urn heath	N		✓
Microlaena stipoides	Weeping grass	N	✓	
Oxalis perennans	Wood sorrel	N	✓	✓
Panicum sp.		E	✓	
Paronychia brasiliana	Whitlow	E	✓	
Paspalum dilatatum	Paspalum	E	✓	
Plantago lanceolata	Narrow leaf plantain	E	✓	
Poa bulbosa	Poa grass	E	✓	
Polygonum sp.	Wireweed	E	✓	
Rytidosperma laeve	Bare-backed wallaby grass	N	✓	
Rytidosperma racemosum	Striped wallaby grass	N	✓	
Rytidosperma sp.	Wallaby grass	N		✓
Schoenus apogon	Fluke bogrush	N		✓
Senecio quadridentatus	Cotton fireweed	N	✓	
Setaria sp.	Pigeon grass	E	✓	
Solengyne dominii	Smooth solenogyne	N		✓

Scientific Name	Common Name	E/N	Chapman	Woodland comparison
Sporobolus africanus	Parramatta grass	E	✓	
Taraxacum sect. *Ruderalia*	Dandelion	E	✓	
Themeda triandra	Kangaroo grass	N		✓
Tricoryne elatior	Yellow rush lily	N	✓	✓
Viola odorata	Common violet	E	✓	
Vittadinia cuneata	Fuzzweed	N		✓
Vittadinia muelleri	Narrow-leaved New Holland daisy	N		✓
Wahlenbergia communis	Tufted bluebell	N	✓	✓

Note: E – Exotic species, N – Native species

Appendix 2: *EPBC Act* Protected Matters Report

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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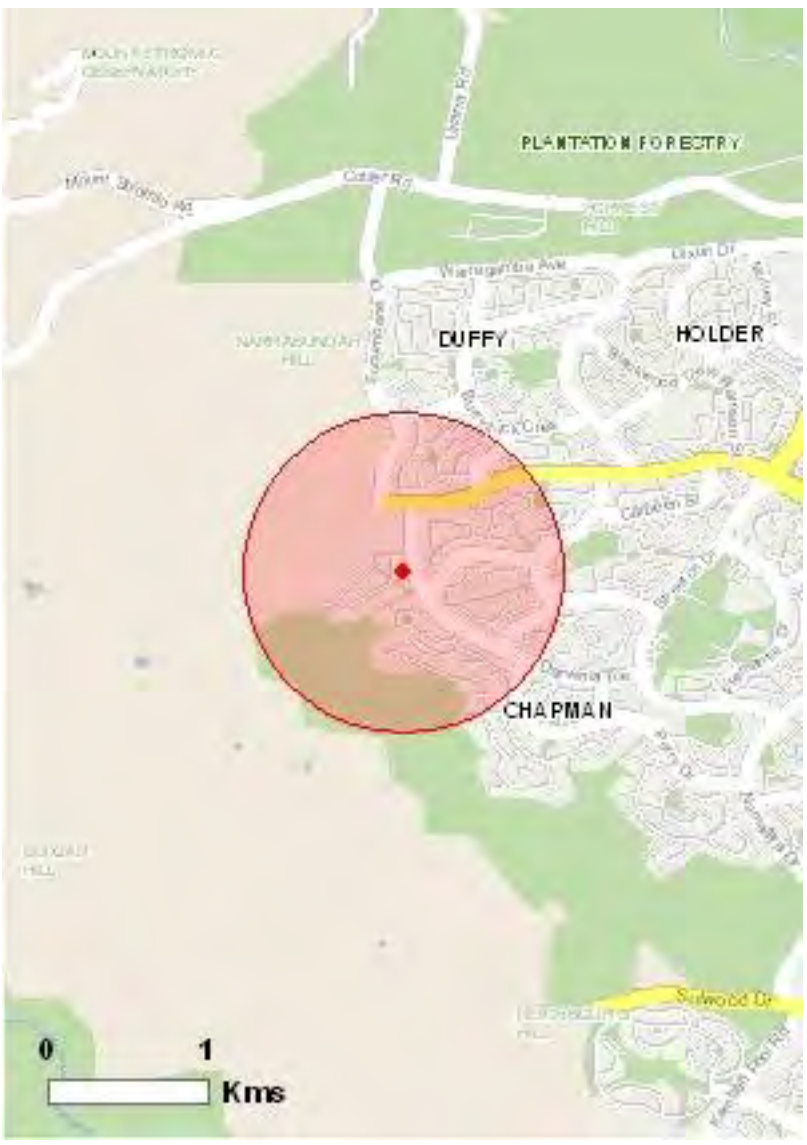

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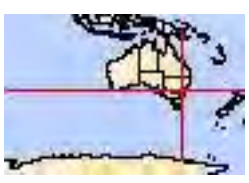

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	2
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	18
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	1
State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	13
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Historic		
Canberra - Central National Area and Inner Hills/ Canberra the Planned	ACT	Nominated place
Canberra and Surrounding Areas	ACT	Nominated place

Wetlands of International Importance (RAMSAR) [Resource Information]

Name	Proximity
Banrock station wetland complex	Upstream from Ramsar
Coorong and lakes alexandrina and albert	Upstream from Ramsar
Riverland	Upstream from Ramsar

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
Fish		

Name	Status	Type of Presence
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria castanea		
Yellow-spotted Tree Frog, Yellow-spotted Bell Frog [1848]	Endangered	Species or species habitat likely to occur within area
Insects		
Synemon plana		
Golden Sun Moth [25234]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Leucochrysum albicans var. tricolor		
Hoary Sunray [56204]	Endangered	Species or species habitat likely to occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345)		
Omeo Stork's-bill [84065]	Endangered	Species or species habitat may occur within area
Pomaderris pallida		
[13684]	Vulnerable	Species or species habitat likely to occur within area
Swainsona recta		
Small Purple-pea, Mountain Swainson-pea [7580]	Endangered	Species or species habitat likely to occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Aprasia parapulchella		
Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat known to occur within area
Delma impar		
Striped Legless Lizard [1649]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Cooleman Ridge	ACT	Indicative Place

State and Territory Reserves [Resource Information]

Name	State
Canberra Nature Park	ACT

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Coordinates

-35.34785 149.02819

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Mott MacDonald

PRELIMINARY INVESTIGATION – OVERLAND STORMWATER FLOW OPTIONS

Chapman
Block 1Section 45

PRELIMINARY INVESTIGATION – OVERLAND STORMWATER FLOW OPTIONS
Chapman Section 45 Block 1

Introduction

This report investigates options for catering with the existing stormwater overland flow paths on Chapman Section 45 Block 1. This block is located on the south western corner of Darwinia Terrace and Kathner Street.

Background

The Site Investigation Report of July 2012 for Chapman Section 45 Block 1 identified an existing swale drain located along the eastern block boundary parallel to Darwinia Terrace. This swale collects overland flows from the nearby open space service corridor (Chapman Section 1 Block 46) including adjacent residential land with the catchment extending up to the lower reaches of Cooleman Ridge Nature Park.

In December 2012 Mott MacDonald compiled an initial report on the potential implications of the existing stormwater overland flow paths on Chapman Section 45 Block 1, refer attached. The purpose of that previous investigation was to determine the feasibility of realigning the existing block boundary and provide for the overland flow path to be accommodated within the existing swale drain. The initial report found that the overland flow affected a significant area of the existing block.

Purpose of this Report

The purpose of this report is to determine the two best options to cater for the overland flow and the associated costs.

Figure 1: Existing swale aligned parallel to the northern boundary of Block 1 adjacent to Kathner Street

Figure 2: Existing swale aligned parallel to the eastern boundary of Block 1 adjacent to Darwinia Terrace

Two Options to Cater for Overland Flow

The two options considered to address the stormwater flow issues are detailed in the table below :

	Option 1	Option 2
Description	Realign existing route of overland flow path	Retain existing route of overland flow path
Features	• Short length of new swale drain south eastern corner of block • New stormwater pipe in verge of Darwinia Terrace • Remove existing stormwater headwall located in north eastern corner of block and provide new headwall further to the south	• Increase capacity of existing swale drain • Retain existing stormwater pipework • Retain existing stormwater headwall in north eastern corner of block
Overland Flow Path Routes	Overland flow path realigned into Darwinia Terrace road carriageway	Essentially the same as existing with only minor variations
Trees	Taper/shape earthworks in vicinity of existing registered tree	Taper/shape earthworks in vicinity of two existing registered trees
Fill on Block	• Minor fill to maximum depth of 0.5m • Fill existing swale adjacent to Kathner Street • Fill existing swale adjacent to Darwinia Terrace	• Minor fill to maximum depth of 0.5m • Fill existing swale adjacent to Kathner Street
Loss of Block Area	900m2	2,250m2
Revised Block Area	14,040m2	12,690m2
Drawing Reference	FW-0001	FW-0002
Advantages	• Minimal loss of block area • Minimal fill in vicinity of existing registered trees	• Minimal construction work and cost, construction consists of earthworks only no pipework required
Disadvantages	• Irregular shape of block at southern boundary	• Irregular shape of block at southern boundary • Significant loss of block area • Location of swale drain along entire block frontage to Darwinia Terrace
List of Works	• 450mm stormwater pipe • Connect to existing 4500 stormwater • 450mm stormwater headwall • Short length swale drain • Remove existing headwall • Fill on block • Fill existing swale adjacent to Kathner Street • Fill existing swale adjacent to Darwinia Terrace	• Long length of swale drain • Fill on block • Fill existing swale adjacent to Kathner Street
Indicative Cost Estimate	$290,000	$210,000

The estimate based on concept plan work to date only and further design development may impact on the above quantities and estimates.

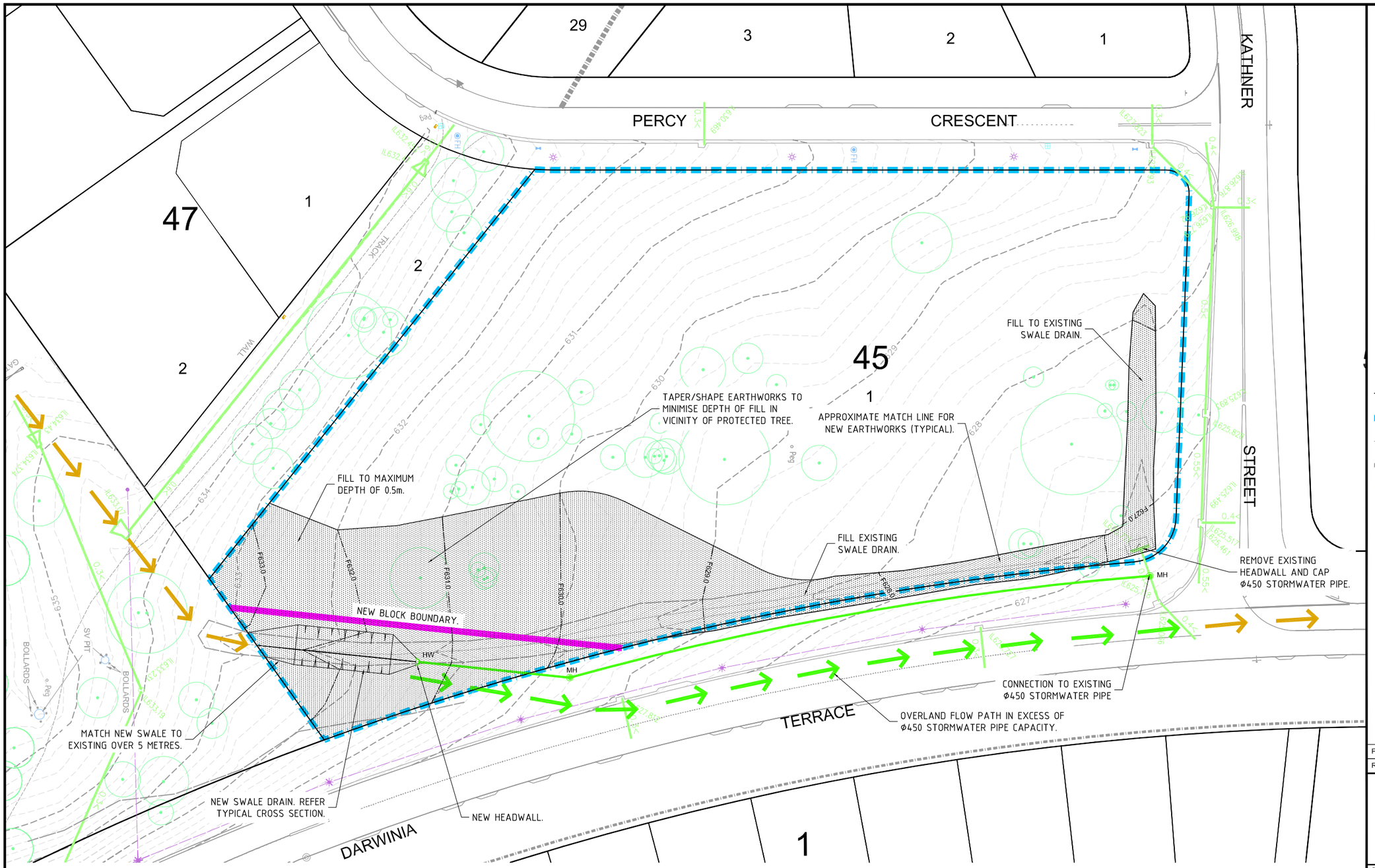
On the basis of the information contained in the table above the recommended option is Option 1 based on the following :

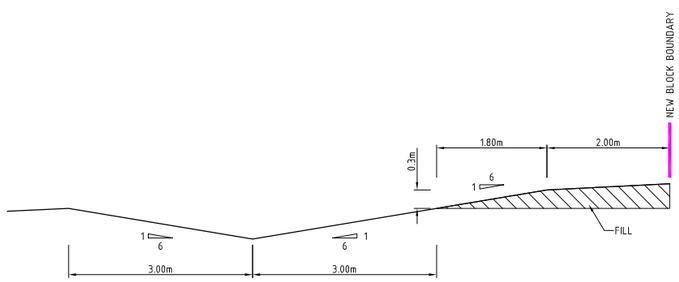
- Option 1 has minimal loss of block area
- Opiton 1 removes the majority of the existing swale drain along the entire block frontage to Darwinia Terrace

Mott MacDonald
MIKE BREEN
TECHNICAL DIRECTOR (CIVIL)

Attached–
Attachment A - Overland Flow Option Plans
Attachment B - Preliminary Investigation Report – Overland Stormwater Flow, Chapman Section 45 Block 1

Attachment A – Overland Flow Option Plans





PROPOSED SWALE DRAIN
TYPICAL CROSS SECTION
1:50

LEGEND

PROPOSED FEATURES

- BLOCK BOUNDARY
- F631.0 — MAJOR CONTOUR
- SWALE DRAIN
- HW — MH — Ø450 STORMWATER RCP HEADWALL MAINTENANCE HOLE
- STORMWATER OVERLAND FLOW PATH
- EXTENT OF EARTHWORKS

EXISTING FEATURES

- BLOCK BOUNDARY
- BOUNDARY BLOCK 1
- KERB
- EXISTING PATH
- STORMWATER OVERLAND FLOW PATH

BLOCK AREA

EXISTING	14,940m^2
LOSS	900m^2
NEW	14,040m^2

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1		NC	INFORMATION	MB	MB

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Client: Land Development Agency

Title: CHAPMAN SECTION 45 BLOCK 1

OVERLAND FLOW OPTION 1

Designed	N.Cortese		Eng check	M.Breen	
Drawn	N.Cortese		Coordination	M.Breen	
Dwg check	M.Breen		Approved	M.Breen	
Scale at A1	1:400	Status	PRE	Rev	P1

Drawing Number: MMD-311006-C-DR-CC01-FW-0001

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PLAN SCALE 1:400 @ A1

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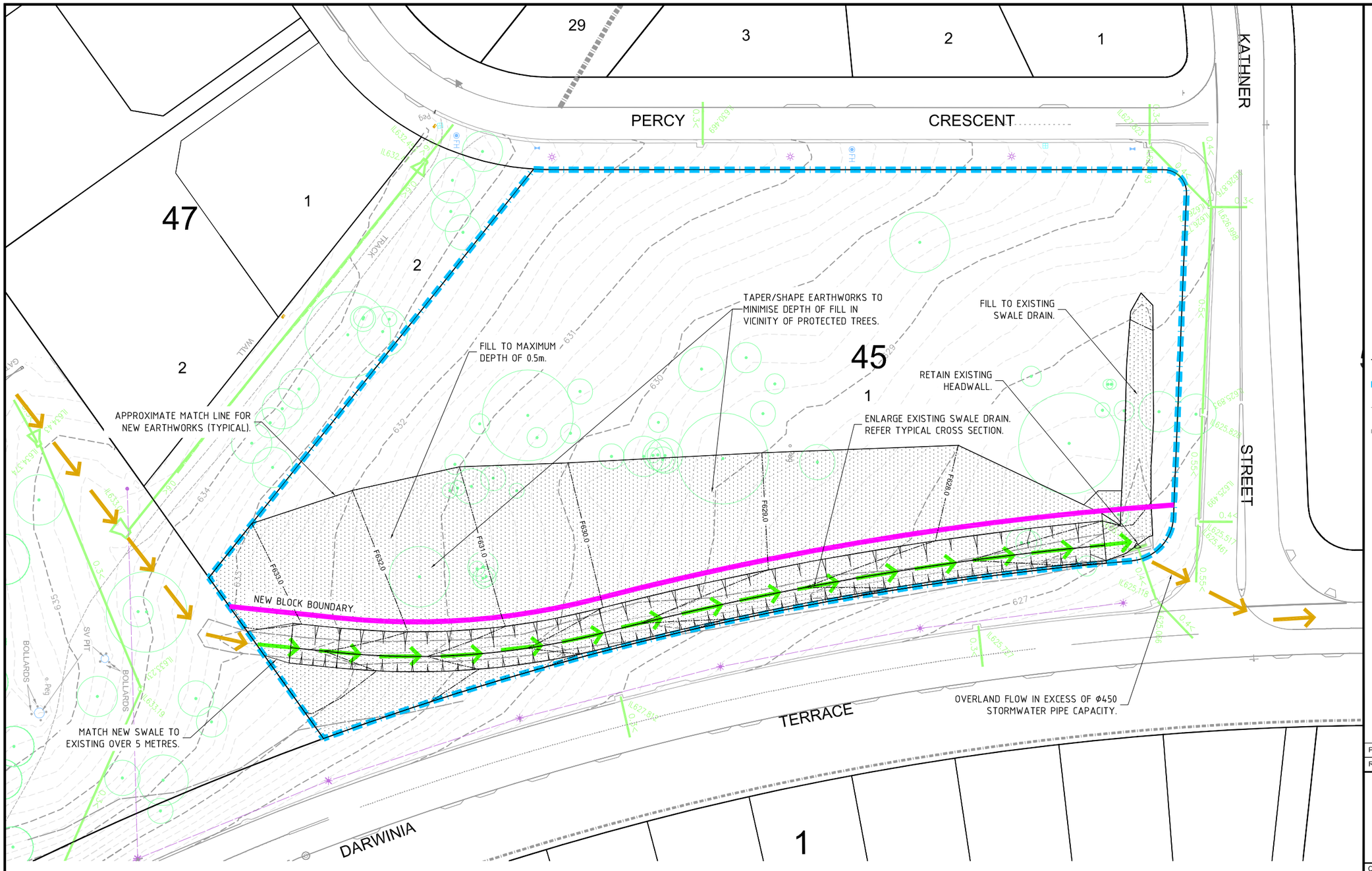

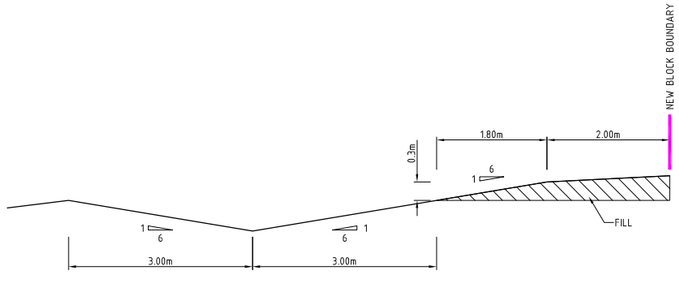

PROPOSED SWALE DRAIN
TYPICAL CROSS SECTION
1:50

LEGEND

PROPOSED FEATURES

- BLOCK BOUNDARY
- F631.0 MAJOR CONTOUR
- SWALE DRAIN
- STORMWATER OVERLAND FLOW PATH
- EXTENT OF EARTHWORKS

EXISTING FEATURES

- BLOCK BOUNDARY
- BOUNDARY BLOCK 1
- KERB
- EXISTING PATH
- STORMWATER OVERLAND FLOW PATH

BLOCK AREA

EXISTING	14,940m^2
LOSS	2,250m^2
NEW	12,690m^2

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1		NC	INFORMATION	MB	MB

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Client: Land Development Agency

Title: CHAPMAN SECTION 45 BLOCK 1

OVERLAND FLOW OPTION 2

Designed	N.Cortese		Eng check	M.Breen	
Drawn	N.Cortese		Coordination	M.Breen	
Dwg check	M.Breen		Approved	M.Breen	

Scale at A1	Status	Rev
1:400	PRE	P1

Drawing Number: MMD-311006-C-DR-CC01-FW-0002

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PLAN SCALE 1:400 @ A1

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Mott MacDonald

Attachment B – Preliminary Investigation Report – Overland Stormwater Flow, Chapman Section 45 Block 1

Mott MacDonald

PRELIMINARY INVESTIGATION – OVERLAND STORMWATER FLOW
Chapman Section 45 Block 1

Introduction

This report provides for an initial investigation of the potential implications of existing stormwater overland flow paths on Chapman Section 45 Block 1. This block is located on the south western corner of Darwinia Terrace and Kathner Street.

Background

The Site Investigation Report of July 2012 for Chapman Section 45 Block 1 identified an existing swale drain located along the eastern block boundary parallel to Darwinia Terrace. This swale collects overland flows from the nearby open space service corridor (Chapman Section 1 Block 46) including adjacent residential land with the catchment extending up to the lower reaches of Cooleman Ridge Nature Park.

Figure 1: Swale drain running parallel to eastern boundary of Block 1

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The Site Investigation Report of July 2012 considered an arrangement where the existing overland flow path is diverted requiring the service corridor within Block 46 being re-graded to convey overland flows to Darwinia Terrace. Upon completion of these works the existing swale within Block 1 could be filled in as part of development on the block. To confirm the feasibility of this diversion of the overland flow service potholing/location would be required. There is potential for service relocation to be required. With this arrangement the existing boundary to Block 1 could be retained as is.

Purpose of this Report

The purpose of this preliminary investigation is to determine the feasibility of realigning the existing block boundary and provide for the overland flow path to be accommodated within the existing swale drain.

Topographic Survey

A topographic survey (attached) of the site has been undertaken this survey indicates that :

- Swale drain is mostly contained within the boundary of Block 1 and clear of the road reserve.
- Swale drain is generally parallel and located just inside the eastern boundary of Block 1.
- Swale drains to an existing concrete headwall located 2m within the north-eastern corner of Block 1.
- The headwall contains an outlet pipe which drains the swale to the street system via a 375mm dia stormwater line.
- The swale varies in shape but is generally 200mm-400mm deep with a width of 4 to 5 metres.

Catchment

A review has been undertaken of existing catchment information including topographic plans and site visit, this check found :

- Catchment Area = 3.5Ha
- Catchment area is a mixture of open space and residential
- Two existing cut off drains are located in the upper reaches of the catchment which significantly limit the extent of the catchment within the Cooleman Ridge Nature Park.

100 year ARI flow

An assessment of the 100 year ARI flow has been undertaken taking into account catchment size, land uses, slope of terrain etc. On this basis the 100 year ARI overland flow is estimated to be 0.8m3/s. This flow is based on the two existing cut off drains located in the upper reaches of the catchment are maintained in good condition with sufficient capacity to cut-off 100 year ARI flows from the Cooleman Ridge Nature Park.

Section 1.7.4 of the Design Standards for Urban Infrastructure Part 1 Stormwater indicates that for drainage swales 100mm minimum freeboard above the 100 year ARI design flood level is required.
On this basis the likely 100 year ARI flood level is estimated to extend up to 50m into the Block 1 from the eastern boundary. The extent of the existing 100 year ARI flow is shown on the attached plan. Note that the estimated depth of flow external to the swale and within the block boundary is relatively shallow ie 100-200mm.

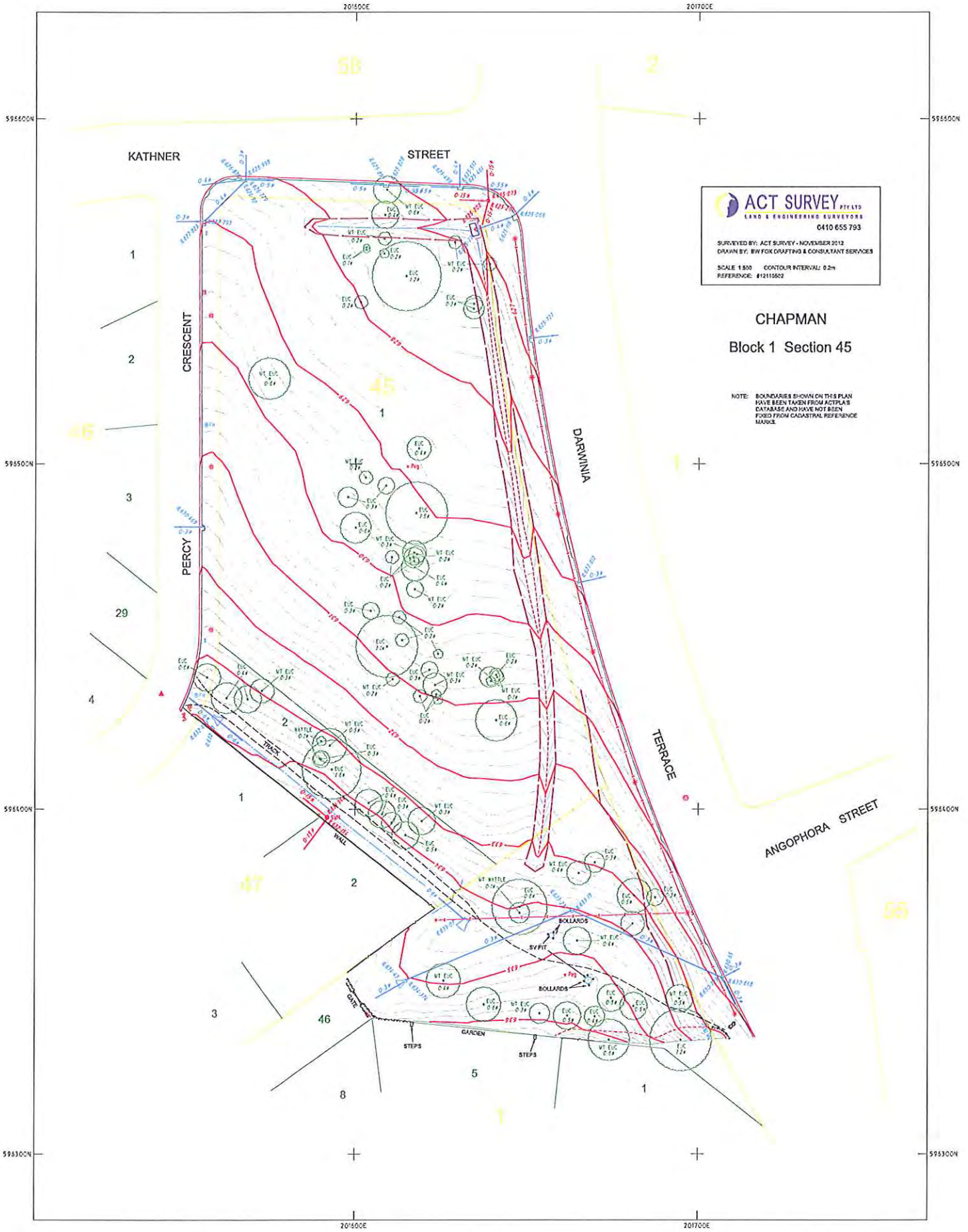
Block Boundary

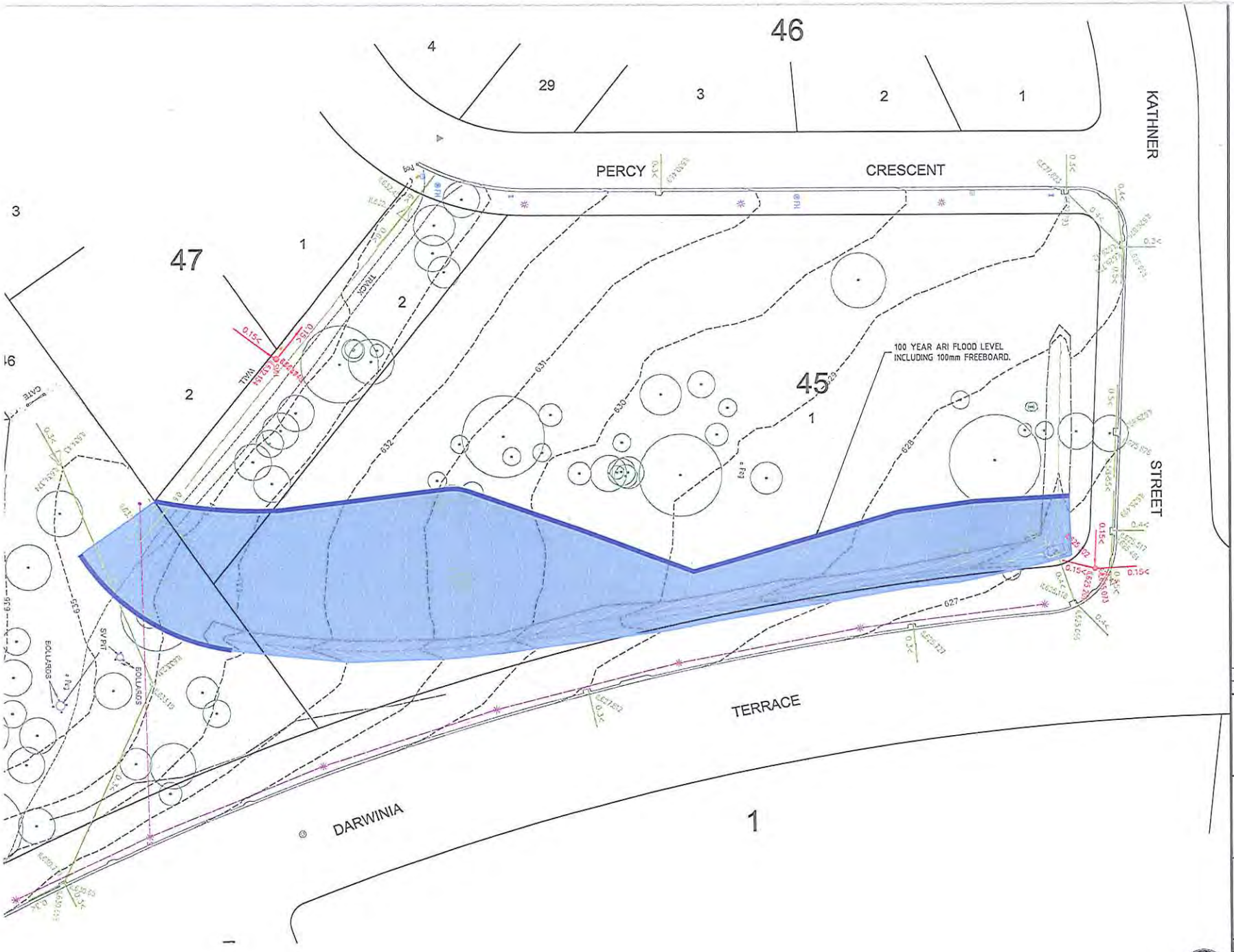
The realignment of the existing block boundary to provide for the existing overland flow path to be accommodated external to the block would result in a significant loss of developable area.

The preferred alternative approach to minimise the loss of developable area could consist of filling of the block in the areas adjacent to the swale drain and reshaping the swale to provide 100 year ARI capacity.

Mott MacDonald
MIKE BREEN
TECHNICAL DIRECTOR (CIVIL)

Attached–
Topographic Survey Chapman Section 45 Block 1
Extent of the existing 100 year ARI flood


201500E
201700E
596600N
596500N
596400N
596300N
KATHNER STREET
CRESCENT
PERCY
DARWINIA
TERRACE
ANGOPHORA STREET
TRACK
WALL
BOLLARDS
SV PIT
GATE
STEPS
GARDEN
ACT SURVEY PTY LTD
LAND & ENGINEERING SURVEYORS
0410 655 793
SURVEYED BY: ACT SURVEY - NOVEMBER 2012
DRAWN BY: BW FOX DRAFTING & CONSULTANT SERVICES
SCALE 1:500 CONTOUR INTERVAL: 0.2m
REFERENCE: #12115502
CHAPMAN
Block 1 Section 45
NOTE: BOUNDARIES SHOWN ON THIS PLAN HAVE BEEN TAKEN FROM ACTPLA'S DATABASE AND HAVE NOT BEEN FIXED FROM CADASTRAL REFERENCE MARKS.



P1	-	NC	INFORMATION	MB	MB
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Client

Title
CHAPMAN SECTION 45 BLOCK 1

EXTENT OF EXISTING
100 YEAR ARI FLOWS

Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		

Scale at A1	Status	Rev
1:400	PRE	P1

Drawing Number
MMD-311006-C-SK-CC01-XX-0001

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PLAN SCALE 1:400 @ A1

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CHAPMAN Section 45
Block 1

Fill on Block Flood Protection

March 2014

Land Development Agency

Mott MacDonald

CHAPMAN Section 45 Block 1

Fill on Block Flood Protection

March 2014

Land Development Agency

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
1	04/03/2014	MB	BH	MB	Draft

Content

Executive Summary

Mott MacDonald has been engaged by the Land Development Agency to investigate the issues associated with providing fill on Block 45 Section 1 Chapman as a method of flood protection by containing overland flow on the adjacent Section 1 Block 46. Chapman Section 1 Block 46 provides for urban open space and also acts as a services corridor. Section 45 Block 1 is intended to be developed for community use which likely to be for retirement purposes.

This report has been prepared in accordance with Mott MacDonald's fee proposal dated 21 February 2014.

Proposed Works

The proposed features for retention of the existing Block 1 above flood level would consist of realigning the swale / overland flow path from Block 1 to Block 46 including :

- Fill within Block 1 to a maximum depth of 0.6m with the fill extending as a minor batter into the adjacent Block 46.
- Fill within Block 1 adjacent to the verge of Darwinia Terrace for the purpose of removing existing swale/overland flow path.
- Fill existing swale within Block 1 adjacent to Kathner Street.
- Provide stormwater pipe in verge of Darwinia Terrace between the reshaped overland flow path in Block 46 and the existing stormwater network at the intersection of Darwinia Terrace and Kathner Street.

Existing Services

The proposed minor fill batter extending into Block 46 from Block 1 is not expected to have a significant impact on the existing underground services that are aligned adjacent to the boundary separating the two blocks. These existing services consist of 150mm water supply and a 40mm gas line.

Future Design Development

Future design development of the proposed block filling should consider the following :

- Potholing of existing water and gas mains with the proposed fill envelope on Block 46 to obtain service authority approval of fill above the services.
- The type and number of inlet sumps to ensure the new 375mm dia stormwater pipe is utilised to capacity thus minimising overland flow in Darwinia Terrace.
- Assessment of whether the redirected overland flow path is within the capacity of the Darwinia Terrace carriageway. This assessment would require detail survey of the Darwinia Terrace road reserve from Block 1 to Kathner Street.

Cost Estimate

The indicative cost estimate to provide fill to the site and construct new stormwater pipework is approximately $310,000 excluding landscaping and pump/pipework.

1. Existing Block

1.1 Introduction

This report investigates the issues associated with providing fill on Chapman Section 45 Block 1 to contain an existing overland flow path on the adjacent Section 1 Block 46. Refer Figure 1 below for the location of the two blocks.

Chapman Section 1 Block 46 provides for urban open space and also acts as a services corridor. Section 45 Block 1 is intended to be developed for community use which likely to be for retirement purposes.

Figure 1: Chapman, Section 1 Block 46 and Section 45 Block 1

Source: ACTMAPi accessed on 27th February 2014

1.2 Background

The Site Investigation Report of July 2012 for Chapman Section 45 Block 1 identified an existing swale drain located along the within the eastern boundary of the block aligned parallel to Darwinia Terrace. This swale collects overland flow from the nearby open space service corridor (Chapman Section 1 Block 46) including adjacent residential land with the catchment extending up to the lower reaches of Cooleman Ridge Nature Park.

In December 2012 and March 2013 Mott MacDonald reported on the potential implications of the existing stormwater overland flow path on Chapman Section 45 Block 1. These investigations estimated the extent of overland flow within the block and considered treatment including earthworks and modifications to the block boundary.

In October 2013, at the request of the LDA, Mott MacDonald reported on the possible inclusion of an offsite detention / retention pond within Block 46. LDA sought advice on whether this pond would assist with the stormwater overland flow issue and negate the land fill /reshaping of Block 1.

The investigation found that it appeared feasible for a pond to be provided on Block 46. However, the constraints of the site, the existing services and sloping topography, dictates that the water storage volume achieved would be minimal and it is expected that there would be significant periods when no water is stored during prolonged dry periods. On this basis the benefits of the pond appeared to be limited. In addition, TaMs did not provide in principle support to the proposed pond based primarily on concerns related to the implications associated with the precedent of a private development taking water from a storage on public land for private use.

Subsequently the Land Development Agency requested investigation of another option (Overland Flow Option 3) with the purpose of retaining the full extent of Section 45 Block 1 above the 100 year ARI flood level by the provision of fill within the block.

1.3 Scope of Report

The purpose of this report is to undertake the following investigations accordance with the Mott MacDonald fee proposal dated 21 February 2014 :

- Determine fill depth required on the block boundary to provide flood protection
- Determine grading of fill on block
- Determine grading adjacent to the block to cater for filled block
- Prepare list of works required including stormwater pipe connections
- Prepare overall site plan indicating extent of works
- Prepare detailed plan of fill and grading of overland flow path
- Prepare Cost Estimate

Figure 2: Block 46 from Darwinia Terrace with Block 1 on the right

1.4 Catchment

An assessment has been undertaken of the existing catchment information including topographic plans and site visit, this check found the following :

- Catchment Area = 3.5Ha
- Catchment area is a mixture of open space and residential
- Two existing cut off drains are located in the upper reaches of the catchment which significantly limit the extent of the catchment within the Cooleman Ridge Nature Park.

The catchment area is based on the two existing cut off drains located within Cooleman Ridge Nature Park being maintained in good condition so that upstream sheet flow is intercepted.

1.5 100 Year ARI flow

An assessment of the 100 year ARI flow has been undertaken taking into account catchment size, land uses, slope of terrain etc. On this basis the 100 year ARI overland flow is estimated to be 0.8m3/s. This flow is based on the two existing cut off drains located in the upper reaches of the catchment are maintained in good condition with sufficient capacity to cut-off 100 year ARI flows from the Cooleman Ridge Nature Park.

Figure 3: Cut Off Drain within Cooleman Ridge Nature Park which limits the extent of the catchment

2. Proposed Works

2.1 Proposed Works

The proposed features for retention of the existing Block 1 above flood level would consist of realigning the swale / overland flow path from Block 1 to Block 46 including :

- Fill within Block 1 to a maximum depth of 0.6m with the fill extending as a minor batter into the adjacent Block 46.
- Fill within Block 1 adjacent to the verge of Darwinia Terrace for the purpose of removing existing swale/overland flow path.
- Fill existing swale within Block 1 adjacent to Kathner Street.
- Remove existing stormwater headwall located in north eastern corner of Block 1.
- Provide stormwater pipe in verge of Darwinia Terrace to collect water from the realigned swale drain.

The design controls on the grading of the fill on Block 1 and the fill batter into the adjoining Block 46 consist of :

- Maximum batter grade of 1:6 on from the boundary of Block 1 to the kerb of Darwinia Terrace.
- Earthworks not to extend into the canopy of trees located on both Block 46 & Block 1.

This investigation has found that it appears feasible to provide fill on Block 1 to provide flood protection during a 100 ARI event.

Figure 4: Southern side of Block 1 to be filled

2.2 Overland Flow Path

The existing overland flow path travels eastwards through Section 1 Block 46 (urban open space) through the southern and eastern edges of Section 45 Block 1 in a defined swale drain before entering a 375mm dia piped headwall located on the north eastern corner of Block 1. Any flow in excess of the pipe capacity spills across Darwinia Terrace verge onto the intersection of Kathner Street and Darwinia Terrace.

The proposed works would contain the overland flow within Block 46 before it spills onto Darwinia Terrace carriageway and flow northwards towards the intersection with Kathner Street.

The preliminary design of the swale for the realigned overland flow path is shown on the drawings in Appendix A. The design of the swale is in accordance with the Urban Services Design Standards for Urban Infrastructure (Stormwater) as demonstrated in the table below.

ITEM	DETAILS	PROVIDED
Freeboard	The minimum freeboard above the 100 year ARI design flood level for swales = 100mm.	200mm **COMPLIES**
Minimum Grade	To ensure that ponding and/or the accumulation of silt does not occur the minimum longitudinal grades for swales = 0.5%	4.5% **COMPLIES**
Longitudinal Grades	Longitudinal grades shall not produce velocities less than 0.8 m/s in low flow inverts flowing full. To minimise dangerous conditions for the public and the erosion of grass and/or topsoil maximum flow velocities swales shall not exceed 2m/s.	1 m/s **COMPLIES**
Flow Depth	The flow depth shall not exceed 0.9 m	0.25m **COMPLIES**
Batter Slope	Maximum batter slope = 1(V) / 4(H)	1(V) / 10(H) **COMPLIES**

Figure 5: Existing Stormwater Structures on Overland Flow Path within Block 46

2.3 Stormwater Pipe Connection

It is proposed to provide a new 375mm dia stormwater pipe in the verge of Darwinia Terrace between the reshaped overland flow path in Block 46 and the existing stormwater network at the intersection of Darwinia Terrace and Kathner Street. This new stormwater line would connect into the existing 375mm dia pipe that joined the headwall at the north eastern corner of Block 1 to the stormwater pipe network.

The purpose of retaining and extending the new 375mm dia pipe is to ensure that that proposed works cater for a similar magnitude of both pipe and overland flows that as the existing case. As part of detailed design of these works consideration would need to be given to the type and number of plantation sumps to ensure the new 375mm dia stormwater pipe is utilised to capacity, a high capacity inlet structure maybe required.

2.4 Existing Services

The proposed minor fill batter extending into Block 46 from Block 1 is not expected to have a significant impact on the existing underground services.

The existing services within the extent of the proposed minor fill batter are as follows :

- 150mm water supply (additional fill in the order of 500mm)
- 40mm gas (additional fill less than 300mm)
- 900mm trunk water supply (additional fill less than 50mm)

The exact location and depths of these services has not yet been determined. As part of the next stage of design development it is recommended that the 150mm water supply and 40mm gas mains be potholed for location and depth. This information could be utilised to obtain more accurate information regarding the total fill that would form part of a formal submission to the relevant service authorities as part of obtaining approval for the proposed filling in this area.

2.5 Trees

No trees are required to be removed to accommodate the proposed works.

It is proposed that were the proposed fill comes in close proximity to existing trees that the earthworks would be tapered / shaped to minimise depth of fill in the vicinity of trees.

2.6 Future Design Development

Future design development of the proposed block filling should consider the following :

- Potholing of existing water and gas mains with the proposed fill envelope on Block 46 to obtain service authority approval of fill above the services.
- The type and number of inlet sumps to ensure the new 375mm dia stormwater pipe is utilised to capacity thus minimising overland flow in Darwinia Terrace.
- Assessment of whether the redirected overland flow path is within the capacity of the Darwinia Terrace carriageway. This assessment would require detail survey of the Darwinia Terrace road reserve from Block 1 to Kathner Street.

2.7 Indicative Cost Estimate

ITEM	DETAILS	COST
Stormwater	New 375mm dia stormwater line and new sumps	$200,000
Earthworks	Earthworks including cut to fill, importing of fill and compaction of suitable fill and disposal of unsuitable soil for fill	$85,000
Landscaping	Topsoil, grassing and mulching of disturbed areas	$25,000
TOTAL		$310,000

These indicative cost estimates are allowances only and do not allow for potential service relocation other than stormwater. Further design development may amend the design and associated cost estimates. For example the presence of contaminated material on site would add additional cost to the construction. This indicative cost estimate is qualified on that basis.

The indicative cost estimate includes :

- 10% GST;
- 10% to account for preliminaries;
- 20% allowance for construction contingencies; and
- 20% allowance has been included in the estimates to account for design and supervision.

Appendices

Appendix A. Overland Flow Option 3

Appendix A. Overland Flow Option 3

A.1. Overland Flow Option 3 Plan

A.2. Overland Flow Option 3 Detail

PERCY CRESCENT

KATHNER STREET

TERRACE

DARWINIA

29 3 2 1

47 1 2

45 1

46 1

REFER DRAWING MMD-311006-C-DR-CC01-FW-0003.

FILL TO MAXIMUM DEPTH OF 0.6m.

(URBAN OPEN SPACE)

APPROXIMATE MATCH LINE FOR NEW EARTHWORKS (TYPICAL).

FILL TO EXISTING SWALE DRAIN.

REMOVE EXISTING HEADWALL AND CAP Ø375 STORMWATER PIPE.

CONNECTION TO EXISTING Ø375 STORMWATER PIPE

OVERLAND FLOW PATH IN EXCESS OF Ø375 STORMWATER PIPE CAPACITY.

FILL EXISTING SWALE DRAIN.

TAPER/SHAPE EARTHWORKS TO MINIMISE DEPTH OF FILL IN VICINITY OF PROTECTED TREE.

MH

PS

LEGEND

PROPOSED FEATURES

- F631.0 — FINISHED MAJOR CONTOUR
- PS SW MH — Ø375 STORMWATER RCP PLANTATION SUMP MAINTENANCE HOLE
- STORMWATER OVERLAND FLOW PATH
- EXTENT OF EARTHWORKS
- AREA WHERE FILL EXCEEDS 400mm

EXISTING FEATURES

- BLOCK BOUNDARY
- BOUNDARY BLOCK 1
- KERB
- EXISTING PATH
- STORMWATER OVERLAND FLOW PATH
- PROTECTED TREE
- TREE
- INLET SW MH HW — STORMWATER

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1		NC	INFORMATION	MB	MB

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Client: Land Development Agency

Title

CHAPMAN SECTION 45 BLOCK 1

OVERLAND FLOW OPTION 3

Designed	N.Cortese		Eng check	M.Breen	
Drawn	N.Cortese		Coordination	M.Breen	
Dwg check	M.Breen		Approved	M.Breen	

Scale at A3	Status	Rev
1:400	PRE	P1

Drawing Number: MMD-311006-C-DR-CC01-FW-0003

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PLAN SCALE 1:800 @ A3

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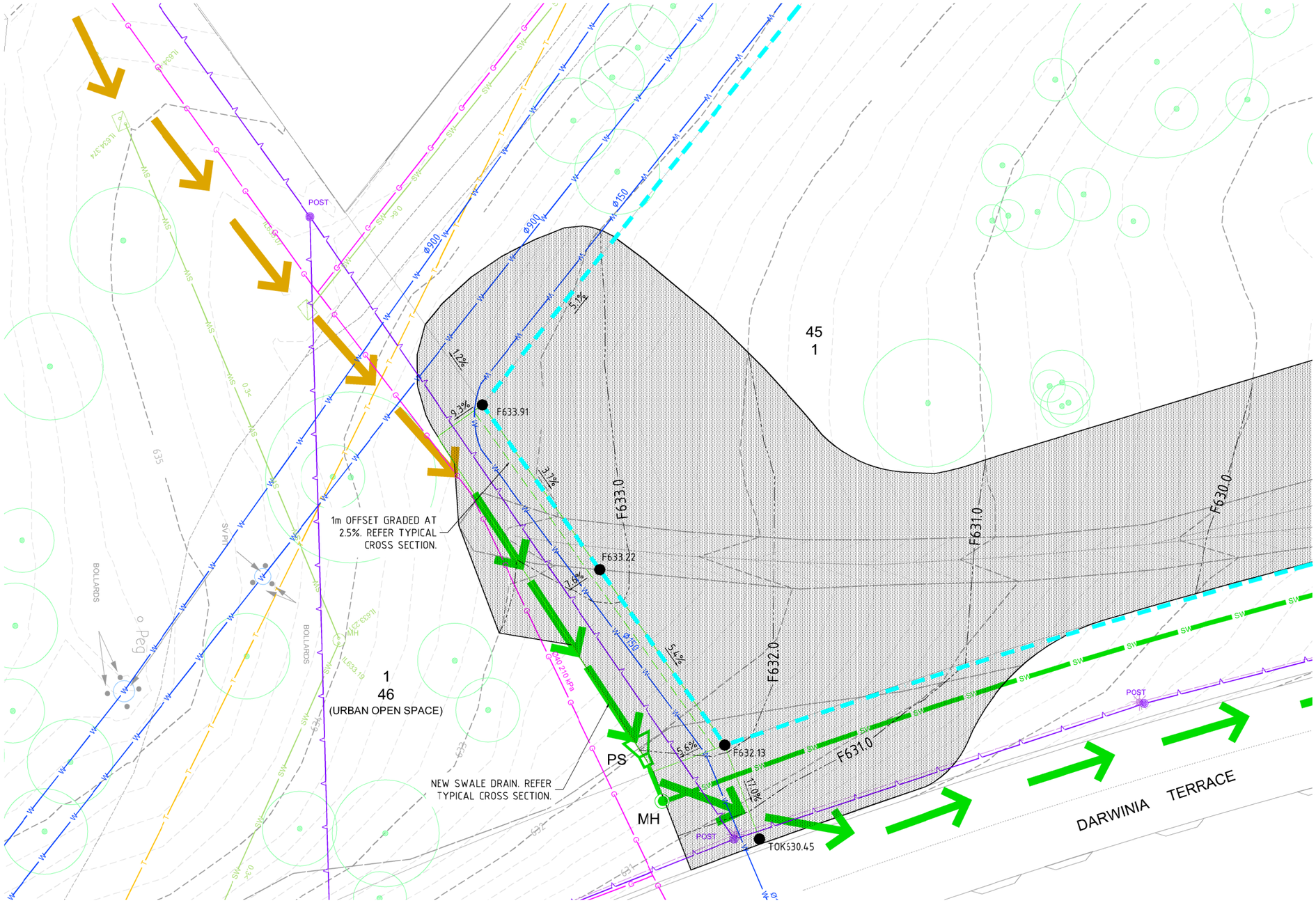

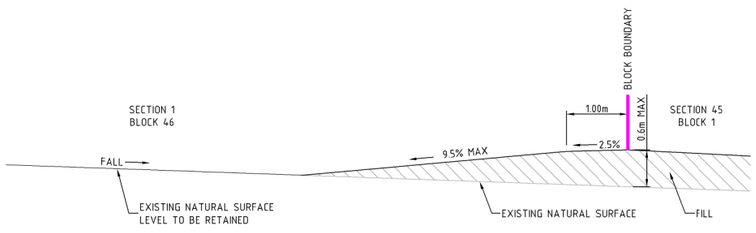

PROPOSED SWALE DRAIN
TYPICAL CROSS SECTION
1:50

LEGEND

PROPOSED FEATURES

- FINISHED MAJOR CONTOUR
- Ø375 STORMWATER RCP PLANTATION SUMP MAINTENANCE HOLE
- STORMWATER OVERLAND FLOW PATH
- EXTENT OF EARTHWORKS

EXISTING FEATURES

- BLOCK BOUNDARY
- BOUNDARY BLOCK 1
- KERB
- STORMWATER OVERLAND FLOW PATH
- TREE
- SEWER, TRUNK, OPERATIONAL
- GAS LINE, PRIMARY MAIN
- DISTRIBUTION MAIN (WATER)
- ELECTRICITY UG
- STREET LIGHTING UG
- STORMWATER
- TELSTRA COMMUNICATION

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1		NC	INFORMATION	MB	MB

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Client: Land Development Agency

Title: CHAPMAN SECTION 45 BLOCK 1

OVERLAND FLOW OPTION 3 DETAIL

Designed	N.Cortese		Eng check	M.Breen	
Drawn	N.Cortese		Coordination	M.Breen	
Dwg check	M.Breen		Approved	M.Breen	

Scale at A3	Status	Rev
1:400	PRE	P1

Drawing Number: MMD-311006-C-DR-CC01-FW-0004

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PLAN SCALE 1:400 @ A3

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Chapman, Section 45,
Block 1 MU - Stage 2
SIR

APPENDIX E

CALCULATIONS

Cardno
Shaping the Future

Sanitary Drainage Design Calculations

Project: Chapman Section 45 Block 1 - Stage 2 Site Investigation Report (Multi Residential)

Project #: 50517005

Sanitary Drainage calculations based on AS3500, Part 2, Sanitary Plumbing & Drainage (AS3500) and ICON Water & Sewerage Service Standards and Guidelines (WSSS)

	Value	Unit	
SUDs =	29	dwellings	Residential Development
Density =	Medium	Pop / Dwelling	25.4385964912281 Dwellings Per Ha
EP =	2.5	Pop / Dwelling	*Equivalent Population (EP) WSSS, Clause 3.1, Table 3-5*
TEP =	73	Population	*Total Equivalent Population (EP) WSSS, Clause 3.1, Table 3-6*
ADWFg =	0.252	L/s	*Average Dry Weather Flow (ADWFg) WSSS, Clause 3.1.1 iii*
PDWFg =	0.96	L/s	*Peak Dry Weather Flow (PDWFg) WSSS, Clause 3.1.1 iii*
NSA =	1.140	Ha	*Net Sewered Area (NSA) (Block Area)*
PII =	1.590	L/s	*Peak Infiltration and inflow (PII) WSSS, Clause 3.1.1 iii*
PWWFg =	2.546	L/s	*Peak Wet Weather Flow (PWWFg) WSSS, Clause 3.1.1 iii*
Q =	2.546	(L/s)	*Design Sewer flow rate*

Pipe sizing calculations based on Appendix 3-4A - Actew General Design Standards

S (Gradient)	2.000	%	*Minimum Sewer Tie Grade*
Pipe Diameter	0.100	m	
R (Hydraulic Radius)	0.025	sq.m/m	
Area	0.008	sq.m	
n (Pipe Roughness)	0.011	n	
V (Velocity)	1.099	m/s	
Q (Flow Rate)	8.633	L/s	*Manning's Equation*

A DN100 pipe will have sufficient capacity to service the proposed Residential Development

Water Services Design Calculations

Project: Chapman Section 45 Block 1 - Stage 2 Site Investigation Report (Multi Residential)

Project #: 50517005

Water services calculations based on AS3500, Part 1, Water Services (AS3500) and ICON Water & Sewerage Service Standards and Guidelines (WSSS)

	Value	Unit	
SUDs =	29	dwellings	Residential Development
PSD =	3.390	L/s	*Probable Simultaneous Demand (PSD) Table 3.2 AS3500*
HP level =	643.000	m	*High point level, allowance made for fixture height*
Water Tie Level =	629.000	m	*Depth of tie at main*
Difference =	14.000	m	*Difference in High point level to water tie level*
Pressure head at tie during peak =	50.000	m	*Static head at tie during peak demand (assumed to be 30)*
Pressure Drop (h) =	26.000	m	
Index Length =	220.000	m	*Conservative length to furthest fixture*
Head Loss Gradient=	6.364	m/100m	*Head loss gradient formula, Clause D1, Appendix D, AS3500 Pt 1*
Existing Internal Pipe Size =	20.000	mm	*Existing water tie internal diameter based on WAE*
Req Pipe Size =	49.666	mm	*Required water tie internal diameter based on Table D1, AS3500*
Capacity of Required Tie =	3.750	L/s	*Capacity of required water tie based on Table D1, AS3500*

Therefore a 49.67mm ID water service tie will be required to service the proposed development.

Fire risk design

Desc	Value	Unit	
Fire Risk Type =	F5		*Based on Table 2-2, ICON Water Technical Guidelines for Water Supply*
F demand	45.000	L/s	*Based on Table 2-2, ICON Water Technical Guidelines for Water Supply*
Pressure at main during peak demand and firefighting draw off	42.000	m	*Icon require 10m head at main (minimum) during peak demand and firefighting draw off. Peak pressures + drawoff values obtained from Icon Water*
Requirement for F5	10.000	m	*Section 3.5.3 Actew Standards*

The pressure obtainable at block boundary is 42m head pressure, including peak demand draw off.
Standard requirements are for 10m residual head with 45L/s plus peak demand therefore the pressures are sufficient.
Refer Appendix C for ICON (Actew) correspondence in relation to pressures achievable at the block boundary.

Stormwater Design Calculations based on TaMS Design Standards

Project: Chapman Section 45 Block 1 - Stage 2 Site Investigation Report (Multi Residential)

Project #: 50517005

Block catchment flow calculations based on TaMS Design Standards - Stormwater

	Value	Unit	
ARI =	5.000	Years	*Average Recurrence Intervals, Table 1.2 Minor System Design ARI*
RI =	98.000	mm/hr	*Rainfall Intensity, Table 1.14 Canberra Rainfall Intensities (mm/hr)*
Ci =	0.900		*Impervious Area Run off Coefficient, Figure 1.1*
Cp =	0.650		*Pervious Area Run off Coefficient, Table 5.4.6(B) AS3500 Part 3*
Ratio =	60.000	%	*Assumed percentage of impervious area (Table 1.3)*
	40.000	%	*Assumed percentage pervious area*
Area =	11399.000	sq.m	*Catchment Total Area (sqm)*
Area I =	6839.40	sq.m	*Impervious area*
Area p =	4559.60	sq.m	*Pervious area*
Q =	248.24	(L/s)	*Design Stormwater flow rate Clause 5.4.8 (d)*

Pipe sizing calculations based on Manning's Equation

S (Gradient)	2.000	%
Pipe Diameter	0.375	m
R (Hydraulic Radius)	0.094	sq.m/m
Area	0.110	sq.m
n (Pipe Roughness)	0.011	n
V (Velocity)	2.653	m/s

Q (Flow Rate)	0.293	m3/s
	293.04	L/s