7. Further Considerations; Development Design and Construction

7.3 Canopy Works

Minor amounts of canopy work may be required on a number of the Trees as part of the development process.

To some degree, the extent of canopy works on each Tree is however very much dependent on the eventual landscape around the Tree and what potential targets (people, structures etc.) may eventually be within the given Tree's projected fall zone.

At this stage canopy works are likely to be restricted to the removal of any larger diameter deadwood (i.e. any dead branches 50mm or greater in diameter) and/or the raising of canopy's where necessary to provide clearances for future footpaths, structures and/or roads.

All canopy works are recommended to be undertaken by suitably qualified and experienced tree surgeons, who possess a minimum qualification of AQF certificate 3 arboriculture or recognised equivalent qualification.

All canopy pruning works must also comply with Australian Standards 4373; Pruning of Amenity Trees.

Attachments to the Report

Attachment 1; Location Guide with Retention Value overlaid

Attachment 2; Glossary of arboricultural terms

Attachment 3; Company Information & Disclaimer

Attachment 1; Location Guide with Retention Value overlaid

Key

- High Retention Value Tree
- Suitable Tree
- Unsuitable Tree
- Very Low Retention Value (remove)

Client;	Four landscapes Studio
Site;	Dayton Primary School
Drawn by;	J Royal
Revision;	0
Date;	12/02/2020
Arial Source;	Nearmap.com
Scale;	1:1750

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Attachment 2; Glossary of Commonly Used Arboricultural Terms

Absorbing Root Smaller root structures that are utilised in the uptake of water and essential elements and soil minerals from the surrounding soil profile.

Bark All tissue outside the vascular cambium. Bark can be divided into 'inner bark' (active phloem) and 'outer bark' (aging and dead phloem).

Basal Lower trunk area of the tree.

Branch Part of the tree which supports its leaves flowers and fruit organs.

Can be further classified into:

Primary Branch Structures; meaning the larger first order branches that arise off the main stem or trunk of the tree.

Secondary Branch Structures; meaning smaller diameter sized branches that arise off the Primary Branch Structures.

Branch Collar Bark tissue that forms around the base of a branch where it meets its 'parent source' be it the main stem/trunk of the tree or primary branch structure. Formed as the bark layers of both sections of the plant meet and by their expansion as part of their natural growth processes and radial expansion.

Branch Bark Ridge Bark tissue that forms at the union of a branch where it meets its 'parent source' be it the main stem/trunk of the tree or another branch structure. Formed as the bark layers of both sections of the plant meet and by their expansion as part of their natural growth processes.

Canopy The part of the crown of a tree composed of the branch and leaf mass.

Cavity An open wound, characterized by the presence of decay and resulting in a hollow. (Matheny & Clarke, 1994).

Co-dominant stem A primary branch structure of about the same size as the trunk, arising from the trunk and competing to become the main dominant leading stem/trunk.

Compaction Compaction of soils causes roots to die due to lack of oxygen and water.

Compartmentalization Dynamic tree defence process involving protection features that resist the spread of pathogens.

Decay Degeneration and delignification of plant tissue, including wood, by pathogens and/or micro organisms.

Decline Decline is a general loss of vitality over the entire tree either caused by a systemic disease or by a series of events that disrupt the essential plant processes.

Epicormic shoots Shoots produced by dormant buds within the bark or stems of a tree as a result of stress, lopping or increased light factors. Epicormic shoots usually have a weaker form of branch attachment.

Furcation A point where two (or more) trunk or branch structures arise from the same point of union and subsequently compete for the same physical space at the point of attachment.

Glossary of Commonly Used Arboricultural Terms

Hollows Hollows from when wood-digesting microorganisms digest wood within the boundaries set by the reaction zone or the barrier zone.

Included bark Inwardly formed bark or bark found in between the union of a co-dominant or 'furcated' branch/trunk. Typically (although not always) this leads to an area of decay forming at the point of union leading to an increased risk of failure.

Kino A dark red to brown resin-like substance produced by the trees in the genera *Eucalyptus* and *Corymbia*. Kino forms when living cells are injured and infected.

Live Crown Ratio The volume of canopy of the tree relative to its overall height.

Lopping Random cutting of branches or a tree's trunk between a union or not at a proper pruning point or in accordance with Australian Standards Guidelines.

Main Stem Structure The main stem section of the tree. Also commonly referred to as the trunk of a tree.

Mycorrhiza A symbiotic non pathogenic (or weakly pathogenic) relationship between fungi and the non-woody absorbing roots of plants. Note: Research has shown that certain mycorrhiza can aid a tree with mineral absorption, especially phosphorus.

Micro-organisms An organism of microscopic size.

Pathogen Any agent that causes disease or adversely affects the health of the plant. Can include insect, fungal, viral and bacterial agents.

Photosynthesis A process where a combination of water, sunlight and carbon dioxide are utilised by the plant for the production of simple sugars.

Scaffolding Limbs/Branch Structures The parts of the tree that provide support to the smaller secondary branch structures. Can also be sometimes referred to as the primary branch structures, or stems.

Supportive Root Structures An organ of a tree that serves to maintain the mechanical support and in-ground stability of the plant.

Stem The parts of the tree that provide support to the smaller secondary branch structures. Can also be sometimes referred to as the primary branch structures, or 'scaffolding' limbs/branch structures.

Tree Long lived woody perennial plant greater than (or potentially greater than) 3m in height with one or relatively few stems.

Trunk The main stem section of the tree. Also commonly referred to as a stem or main stem.

Wound An opening that is created when the bark is cut, removed or injured.

Attachment; Company Information and Disclaimer

Company Name:	ARBOR logic
A.C.N.:	107 194 061
A.B.N.:	66 566 369 687

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General Liability;	Woodina	$20 million
Professional Indemnity;	Woodina	$5 million
Personal Protection;	Zurich	

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QTRA Registered User Lisc. No. 1743

Disclaimer

This Report has been provided in good faith and based upon the material information provided by the Client to Arbor logic, and/or based on the visual inspection of the tree(s) at the time this advice was prepared.

The contents of this Report should be read in full, and at no time shall any part of the Report be referred to unless taken in full context with the remainder of the document.

The contents of this Report may not be reissued to another party or published in part or full without Arbor logic's written permission.

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- The provision of misleading or incorrect information by the Client or any other party to Arbor logic upon which this advice was prepared.
- This advice being used by the Client or any other party in circumstances or situations other than the specific subject of this advice.
- Failure by the Client to follow this advice.
- The action(s) or inaction(s) of the Client or any other party that gives rise to the loss of, or damage to, the tree(s) that are the subject of this advice.

It is also important to take into consideration that all trees are living organisms and as such there are many variables that can affect their health and structural properties that remain beyond the scope of reasonable management practices or the advice provided in this Report based on the visual inspection of the tree(s).

As such a degree of risk will still remain with any given tree(s) despite the adoption of any best management practices or recommendations made in this Report.

Dayton Primary School

Civil Design Report

Civil Engineering

Prepared for: Christou Design Group Pty Ltd

Attention: Herman Boon

Date: 4 May 2021

Prepared by: Bronwyn Clements & Daniel Malone

Ref: 301250182

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Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
001	15/03/2021	65% Schematic Design Issue	BC & DM	Darren Pesich
002	04/05/2021	65% Design Development Issue	BC & DM	Darren Pesich

Contents

1. Introduction

1.1 General

This Civil Design Report has been prepared for Christou Design Group for the Civil works design for the proposed Dayton Primary School development, located at 11 Blundell Street, Dayton.

This report sets out the parameters of Stantec's technical design and client service for the Civil design and documentation of the above project.

This document serves as the benchmark which our services must achieve. We request you read this carefully so that you have a clear understanding of the scope of our work and that we have understood your project requirements.

Please note that we will be proceeding with the design and documentation of the appointed services works on the basis of this Report unless otherwise advised.

We would welcome any comments or queries you may have on the information provided in this report so that it may be updated to suit during subsequent design phases.

1.2 Site Location

The proposed development site is located in the City of Swan, some 16km north east of Perth CBD. This site comprises an area of approximately 5.7ha, bordered by Blundell Street to the east, Cranleigh Street to the south, Arthur Street to the west and vacant lots to the north.

1.3 Safety in Design

Stantec operates a Safety in Design (SID) procedure based on "Code of Practice - Safe Design of Buildings & Structures 2008" published by the Commission for Occupational Safety & Health, Western Australia.

Compliance with this Code of Practice will ensure that all designs will be safe to install, operate, maintain and dismantle by appropriately experienced contractors.

Any hazards that cannot be eliminated by design will be identified and the appropriate work practices, protection and work methods required should be formulated by the contractor. The Civil SID report is attached within Appendix A.

1.4 Verification Procedures

This project falls into category B as determined by Stantec Australia's Quality Manual. Accordingly, all drawings and specifications will be reviewed by the Project Engineer prior to issuing.

2. Project Overview

The current Masterplan for the proposed Dayton Primary School development comprises eight new single storey buildings, three designated transportable building areas (providing for twelve proposed and future transportables), with associated playgrounds, breakout areas, courtyards, sports courts, practice nets, sports oval, and off-street car parking facilities.

There is provision for a future 2 storey building situated at one of the transportable building areas, and also a future Educare site.

The south east corner of the site has been nominated as a 1 in 100year drainage detention basin site, with a restricted outlet to the Local Authority stormwater drainage network, in accordance with the West Swan East Local Water Management Strategy. However, as instructed by Christou, the design intent is to manage stormwater on site within swales and underground storage units, rather than via a detention basin.

On-street parallel car parking bays within the road reserves of Arthur and Cranleigh Streets are proposed adjacent to the site. A school bus parking bay is also proposed within the Arthur Street road reserve, directly north of the primary school site adjacent to existing vacant land which is designated as future district open space.

Provision has been made within the Masterplan for a proposed 5.0m widening to the eastern side of the Arthur Street road reserve adjacent to the site, to accommodate future pavement upgrade works to cater for future potential projected traffic volumes. Due to changes in the wider road network, it is understood the projected traffic volumes in Arthur Street may never eventuate, however the City of Swan has advised provision for the future widening and pavement upgrade is still required.

The alignment and construction timing of proposed on-street embayed parking on the eastern side of Arthur Street has been discussed between the Department of Finance and the City of Swan. It is our understanding that the construction of the Arthur Street carbays and the proposed school bus bay are to proceed in conjunction with the Dayton Primary School Development, with their location adjoining the existing 7.4m pavement, in accordance with the current Masterplan. We note that the carbays, adjacent paths and crossovers would require reconstruction should road upgrade works proceed in the future.

3. Civil Services

3.1 Objectives

We confirm that the Client's objectives are is to achieve high-quality educational facilities with efficient design solutions that balances functionality, the Architecture, construction requirements and budgetary constraints. In order to achieve this, we will:

- Provide innovative civil solutions to ensure that the development progresses in a cost efficient, time efficient and safe manner, for the following Civil related scope of work elements.

3.2 Design Standards, Site Conditions and Constraints

3.2.1 Applicable Standards

The Civil services will be undertaken in accordance with the following documents:

- Australian Rainfall & Runoff – 1987
- Department of Water: - Stormwater Management Manual
- Australian Standards: - AS 2890.1:2004 – Parking Facilities, Part 1: Off-street car parking
- Australian Standards: - AS 2890.2:2002 – Parking Facilities, Part 2: Off-street commercial vehicle facilities
- Australian Standards: - AS 2890.6:2009 – Parking Facilities, Part 6: Off-street parking for people with disabilities
- AS3500.3 – Plumbing and Drainage – Stormwater Drainage
- ACT Design Standards for Urban Infrastructure 24 Sportsground Design, Edition 1 Revision 2
- Relevant Local Authority design codes

3.2.2 Basis of Design Information

- Douglas Partners' Report on Geotechnical Investigation (201389.00-R.001.Rev 0, dated 12 March 2021)
- Brown McAllister Surveyors' Feature Survey (drawings 20606-1F Rev 0, Sheets 1-4, dated 21/01/2021)
- West Swan East Local Water Management Strategy (LWMS), Figure 14: Proposed Stormwater Management: Cranleigh St Catchment, dated July 2014, as received from the City of Swan on 17/02/2021 (attached within Appendix B)
- Average Annual Maximum Groundwater Levels (AAMGLs) as depicted in JDA Consultant Hydrologists' Figure 1 Pre-Development AAMaxGL plan (attached within Appendix C)
- JDA Consultant Hydologists' Site Water Management Plan *(report currently being finalised)*
- Architectural and other relevant consultant design plans and documents

3.2.3 Site Description

Based on the feature survey, the eastern half of the site, Lot 557, grades at approximately 1 in 40 south and west from 26.25m AHD at the north-eastern corner to approximately 21.0m AHD along the southern and western boundaries of the lot. The western half of the site, Lot 558, is generally flat around the perimeter at around 21.0m AHD along the eastern and southern boundaries and 20.0m at the north west corner. Lot 558 grades gently down to a central depression with a low point of around 19.1m AHD to 19.3m AHD.

Existing development within the site comprises of a single storey brick and tile residence and associated driveway, tanks and outbuildings located at the north-eastern boundary of the site. This residence and its surrounds are soon to be demolished and removed as part of a separate demolition package.

The balance of the site is vacant land, grassed and vegetated, including several significant stands of trees located along the northern, western and southern boundaries of the site, and along the central north-south boundary between Lots 557 and 558. Another row of trees extends east-west within the centre of Lot 558, and there are several trees located around the residence in the north western corner of the site.

It is the Client's intention is to retain and protect many of the existing trees, and this decision has informed and influenced the Masterplan layout.

Low rural-style starpicket and wire-strand fencing is located around the perimeter of the site. A low post and panel (Twinside) retaining wall is located on the southern boundary of the site at the eastern end of Cranleigh Street.

3.2.4 Geotechnical Site Conditions

Douglas Partners carried out a geotechnical investigation on the site on 15 and 16 February 2021. The investigation was limited to the proposed primary school development area within the western two-thirds of the site, i.e. excluding the area from the existing dwelling and surrounds in the north-east corner of the site, down to the south east corner.

Based on a review of the Geotechnical Investigation and reporting received on 12 March 2021, we provide the following high-level summary.

The ground conditions encountered at the site generally comprise of:

- Fine to medium grained sandy topsoil (SP-SM) with high organic content (5%), approximately 100mm to 200mm thick; overlying
- Fine to medium grained, generally medium dense to dense sand (SP-SM), to depths of between 1.8m and 2.9, with a number of locations having a shallow surficial loose layer, varying between 0.3m to 0.6m in thickness in the western half of the site, increasing to up to 1.6m in thickness below proposed pavement, practice nets and courts footprints, and up to 2.4m in thickness within the proposed sports oval footprint; overlying
- In three test locations (test pits 6, 8 and 9 within the low-lying area in the centre and south of Lot 558), fine to medium grained, generally medium dense clayey sand (SC) and sand (SP-SC) (Guildford Formation) low plasticity clay, to a depth of 3m (test pit termination depth)
- Weakly cemented to well cemented silty sand (SM) layers (coffee rock), varying between approximately 0.1m and more than 1.25m in thickness, were encountered below the topsoil layer within the western third of the site
- Fine to medium grained, loose to medium dense, uncontrolled sandy fill (SP-SM), containing building materials and large pieces of concrete slabs, was encountered at two test locations (test pits 1 and 6 within the north-west and central east of Lot 558) to depths of 0.25m and 0.8m respectively

The Geotechnical Report provides recommendations for site preparation and earthworks including:

- Stripping of topsoil, vegetation and organic materials, and stockpiling of sandy topsoil for possible reuse as described below
- Excavation and chasing up of uncontrolled fill (containing building materials, concrete slabs etc), screening and removal of foreign materials from site
- Proof-compaction of in-situ material using a heavy (16 tonne or heavier) vibrating smooth drum roller to densify the loose soils for proposed buildings, pavements, practice nets, courts and oval, including removal of any unsuitable material and replacement with structural fil
- Further compaction of footing excavations using hand-held compaction equipment

- The use of a powerful excavator (20 tonne or heavier), together with provisions for ripping tynes and hydraulic hammer attachments for excavations, within well cemented silty sand (SM) layers (coffee rock)
- The sandy topsoil may potentially be considered suitable for reuse as general or structural fill, following screening of large organic particles and adequate blending at a suitable ratio with non-organic sand or other granular structural fill, subject to regular on-site geotechnical supervision and assessment during the blending process
- The sandy fill material from uncontrolled fill areas may potentially be considered suitable for reuse as general or structural fill, following screening and removal of building materials, concrete slabs etc
- In-situ sands are considered suitable for reuse as structural fill
- In-situ clayey sands and Guildford Formation clays have significantly lower permeability and lower pavement bearing capacity than the in-situ sand materials. It is therefore recommended that any re-use of these materials be limited to deeper parts of proposed fill areas, outside of building footprints

The recommended earthworks and drainage parameters for the purpose of Civil Design are as below:

- Preliminary soil permeability of 0.8m/day for in-situ sands*
- In-situ sands considered suitable for onsite infiltration systems using soakwells**
- Provide 0.5m minimum clearance from base of soakwells to coffee rock and Guildford Formation clayey soils
- CBR value of 12%
- A site classification of ‘Class P” for the proposed oval area, due to the presence of the deeper underlying loose natural sand
- A site classification of ‘Class A’ for all other areas of the development

*We note that JDA Consultant Hydrologists have reviewed the recommended soil permeability rate, together with in-situ soil and groundwater conditions, and recommend that 0.8m/day for in-situ sands be adopted for below ground infiltration storage calculations.

We note that the in-situ sands would typically not be considered suitable for below ground infiltration storage from a Civil perspective due to their low permeability. A minimum permeability of 5m/day would typically be required. **The low insitu permeability and proximity to groundwater will result in larger below infiltration storage footprints than would typically be expected.

3.2.5 Groundwater

The Geotechnical Report states groundwater was observed within the majority of test pit locations within the western half of the site (Lot 558), at depths of 1.75m to 2.8m, and notes investigations were undertaken when groundwater was likely near its low seasonal level.

The Perth Groundwater Atlas October 1997 shows the maximum historical groundwater level within the vicinity of the site to vary between RL 17.0 AHD in the north-western corner, to RL 16.0 AHD in the south-eastern corner, and conceptual earthworks modelling was based on this information. The Perth Groundwater Atlas contours are contained within Appendix C.

As the groundwater atlas contours are prepared on a regional scale, they may not reflect local variations in groundwater levels. Accordingly, it is typically recommended that a specialist consultant be engaged to confirm groundwater levels in areas where groundwater is likely to impact development, as earthworks and drainage costs can be very sensitive to groundwater levels.

JDA Consultant Hydrologists have previously undertaken groundwater monitoring of the local area as part of their West Swan East LWMS reporting, which includes the Dayton Primary School site. A pre-development Average Annual Maximum Groundwater Level (AAMGL) contour plan for the site was provided by JDA on 22 April 2021, based on their groundwater studies for the area. The plan shows AAMGLs grading across the site from approximately RL19.0 in the

north-western corner of Lot 558, to RL17.7 in the south-eastern corner of Lot 557 (approximately 2.0m higher than groundwater atlas contours). A copy of JDA's pre-development AAMGL contour plan is attached withing Appendix D.

Given the sloping nature of the existing terrain, the depth to pre-development AAMGLs varies across the site from approximately 0.7m below the low-lying area within the centre of Lot 558, to approximately 7.7m at the high point in the north-eastern corner of Lot 557.

Perched water on the coffee rock and Guildford Formation clays at the site would be common during the rainy season and following periods of heavy rainfall.

Based on the above findings, groundwater will have an effect on the development, particularly on earthworks and drainage designs, including below ground infiltration storage structures, and also during excavations deeper than about 1m below existing ground levels in the lower areas of the site. Dewatering during excavation works and subsoil drainage systems may be required. The current preliminary earthworks and drainage designs have been updated, based on the AAMGL contours provided by JDA.

The Geotechnical Report recommends that earthworks are undertaken prior to the onset of winter rains to minimise the impact of groundwater. If earthworks are proposed in winter, the Report recommends that groundwater levels be assessed prior to earthworks to assess the likelihood of encountering groundwater within proposed excavation depths.

3.2.6 Acid Sulfate Soils

A desktop review of the Department of Water and Environmental Regulation's Acid Sulfate Soils (ASS) risk mapping indicates the site has a moderate to low risk of ASS. A copy of ASS risk mapping for the area is included within Appendix C.

ASS Investigations undertaken by Douglas Partners determined the in-situ soils were not indicative of actual or potential ASS soil conditions within 2m of the existing surface.

Based on the geotechnical findings, Douglas Partners do not anticipate that an ASS Management Plan would be necessary for site development, provided excavations for construction do not exceed 2m depth and dewatering is not required.

The Geotechnical Report states further detailed investigation for ASS would be required for the following:

- Excavations of greater than 2m depth; and / or
- Dewatering is proposed to be undertaken; and / or
- To address a development condition requiring investigation and management of ASS

3.2.7 Existing Service Infrastructure

The following summary of existing services and infrastructure adjacent to the site has been obtained from GIS Software, the Water Corporation's ESinet mapping database, Dial Before You Dig enquiries, feature survey information and a review of aerial imagery. Pertinent GIS / DBYD information is included within Appendix C.

Existing Water Corporation wastewater infrastructure:

- DN150 PVC-U gravity sewer reticulation main on the western side of Arthur Street, north of Aurum Parade
- DN150 PVC-U gravity sewer reticulation main on the eastern side of Arthur Street
- DN150 PVC-U gravity sewer reticulation main on the eastern side of Blundell Street

Existing Water Corporation water infrastructure:

- DN150 PVC water reticulation main on the western side of Arthur Street
- DN200 PVC water reticulation main on the northern side of Cranleigh Street

- DN150 PVC water reticulation main on the eastern side of Blundell Street

Existing ATCO gas infrastructure:

- DN160 PE high pressure gas main on the western side of Arthur Street
- DN110 PE high pressure gas main on the northern side of Cranleigh Street
- DN110 PE high pressure gas main on the eastern side of Cranleigh Street; crossing to the western side of Cranleigh Street at the south-east corner of the site, before extending south away from the site, along this alignment

Existing telecommunications infrastructure:

- Telstra conduits on the western side of Arthur Street
- Telstra conduits on the north and south side of Cranleigh Street
- Telstra conduits on the eastern side of Blundell Street, with conduits crossing the road to two pits located at the north-eastern corner of the site and to one pit located at the south-eastern corner of the site

Existing Western Power infrastructure:

- Timber power poles and aerial LV power cables on the eastern side of Arthur Street
- Timber power poles and aerial LV power cables on the western side of Blundell Street
- Streetlight poles on both sides of Arthur Street, southern side of Cranleigh Street and eastern side of Blundell Street, and at the intersections of Arthur/Cranleigh and Cranleigh/Blundell Streets adjacent to the site
- Underground LV and HV power cables on both sides of Arthur Street
- Underground LV and HV power cables on the eastern side of Blundell Street with cables crossing the road into the western side of Blundell Street at the south-east corner of the site
- Underground LV and HV power cables on both sides of Cranleigh Street
- Transformers and switchgear on the southern side of Cranleigh Street, west of Synandra Way and east of Featherflower Avenue

Existing Local Authority Stormwater Drainage infrastructure:

- Traditional pit and pipe stormwater drainage infrastructure is located within Arthur Street to the west, Cranleigh Street to the south and Blundell Street to the east
- Four linear stormwater drainage swales within Local Authority drainage reserves on the southern side of Cranleigh Street. The western two linear swales opposite Lot 558 are depicted as combined storage basin CR5 on Figure 14 of the West Swan East LWMS.
- Based on discussions with the City of Swan, the outlet for the linear swales is currently piped to a temporary basin on the southern side of Cranleigh Street, approximately 150m east of Blundell Street. It is proposed that pipework will be extended a further 240m to an existing Local Authority open drain within Malvern Street, as adjacent development progresses.

3.3 Design Intent

The design intent for Civil earthworks, roadworks and stormwater drainage is outlined below.

Amendments to the Civil design will be made to incorporate changes to architectural layout and landscaping on an as needed basis during design development, as directed by the Project Manager during consultation meetings.

3.3.1 Earthworks Design

- Incorporation of advice from Geotechnical Investigation
- Site levels and bulk earthworks will be designed to accommodate the proposed Architectural design layout including minimum levels required for Hydraulics wastewater servicing, Civil stormwater servicing and to meet the Local Authority's minimum freeboard requirements to anticipated 1 in 100-year ARI flood levels
- The earthworks design will incorporate retention of nominated existing trees where possible, and tie into adjacent existing adjacent verge and pavement levels. Future verge levels within Arthur Street associated with the potential future pavement upgrade works will also be considered
- Earthworks levels will be provided to underside of structural slabs for proposed buildings and to underside of proposed carpark pavements, pathways, playgrounds, breakout areas, courtyards, sports courts, practice nets, and off-street car parking facilities
- Earthworks for the future Educare site will be limited to batters around the north, west and south of the site to tie in with adjacent development levels, as instructed by Christou
- Earthworks levels and grading requirements for the primary school sports oval are based on the ACT Design Standards for Urban Infrastructure 24 Sportsground Design
- Grading of site access routes, on site carparking and roadways will be undertaken to ensure satisfactory overland flow and to mitigate surface ponding

We note that the south east corner of the site has been nominated as a 1 in 100year drainage detention basin site, with a restricted outlet to the Local Authority stormwater drainage network, in accordance with the West Swan East Local Water Management Strategy. However, as instructed by Christou, the design intent is to manage stormwater on site within swales and underground storage units, rather than via a detention basin. Accordingly, the basin has been removed from the preliminary earthworks model, and the earthworks design updated to accommodate stormwater design requirements.

The preliminary Earthworks Plan attached within Appendix E shows preliminary finished surface levels and preliminary cut and fill volumes required to satisfy the requirements of the site. Preliminary earthworks sections along the western site boundary are also attached within Appendix E, showing indicative finished surface levels based on existing and potential future pavement levels in Arthur Street.

The earthworks model will be further refined in consultation with the Architect, Landscape, Hydraulics and Hydrologist consultants, and Earthworks plans and sections updated to suit, as design development progresses.

3.3.2 Roadworks Design

- The proposed crossover entrances and exits and on-ground parking horizontal and vertical geometry will be designed in accordance with the relevant Australian Standards and Local Authority design requirements. We note that horizontal turning analyses for the relevant design vehicles for off-street parking facilities and crossover entrances and exits will be undertaken by the Traffic consultant
- Proposed on-street car and bus parking bays within the Arthur Street and Cranleigh Street road reserves will be designed in accordance with the relevant Australian Standards and Local Authority design requirements
- All external-to-building impervious surface areas will be suitably drained to suit local conditions
- Pavement profiles will be confirmed during the detailed design stage to suit design vehicle loading parameters, and will be designed in accordance with Local Authority requirements. This will include asphalt pavements within the development, vehicle crossovers and proposed on-street car and bus parking bays within Arthur Street and Cranleigh Street.
- Based on geotechnical advice received, we expect pavement construction will be 200mm limestone or road base basecourse, 50mm thick AC14 intermediate course and 30mm AC10 wearing course, founded on a subgrade of 300mm (minimum) free drainage sand fill.

- All pavement areas will be kerbed and drainage to Local Authority requirements.
- It is our understanding that road widening along Arthur Street to include a proposed median island and on-road cycle lanes will not be required as part of the School Site development, nor in the foreseeable future. However allowance for the future road upgrade works will be made in respect of ultimate verge levels at the future road reserve boundary, based on preliminary advice from the Traffic Consultant in respect to future pavement/cycleway lanes and median island widths

The preliminary Roadworks Plan attached within Appendix E shows the preliminary road pavement, on and off-street parking, crossovers and path layouts. The Roadworks Plan will be updated as design development progresses.

3.3.3 Stormwater Design

The following drainage measures are proposed to facilitate drainage of the site and provide protection of the property and built form from stormwater run-off within the site:

- Stormwater runoff for the proposed buildings (by Hydraulic), hard landscaping areas (by Landscape) and carpark areas (by Civil) will be designed in accordance with the City of Swan development guidelines and specifications, relevant Development Approval conditions, the West Swan East LWMS and the site Water Management Plan (WMP)
- Stormwater will be required to be detained on site with the post-development outflows to match the predevelopment outflows for up to the 1 in 100-year ARI event, in accordance with the LWMS
- The LWMS proposes a drainage detention basin located in the south east corner of the site to attenuate stormwater runoff for up to the 1 in 100-year ARI event from Lots 557 and 558, with a restricted outflow to the existing local authority network within Cranleigh Street, to maintain pre-development outflows from the Lots. However as noted previously in this report, the design intent for the proposed primary school development site is to manage stormwater attenuation on site within swales and below-ground infiltration storage units, rather than via a detention basin. Accordingly, the preliminary stormwater design reflects this
- Traditional pit and pipe networks and swales will be used for conveyance of stormwater from minor / frequent runoff events to the proposed below-ground storage units within the site
- Below-ground storage units will be sized based on an infiltration rate of 0.8m/day, as recommended within the geotechnical report. A minimum separation of 0.5m from the underside of storage units to AAMGLs is expected to be required, in accordance with preliminary Hydrologist advice
- A restricted outflow pipe to existing local authority drainage infrastructure within Cranleigh Street will be provided
- Modelling and review of the preliminary stormwater drainage design will be undertaken by the appointed consultant Hydrologist as part of the site Urban Water Management Plan preparation. The preliminary design may be subject to change depending on final hydrological analysis
- Subsoil drainage for some areas of the site may potentially be required. This will be confirmed during design development and preparation of the WMP
- Events greater that the design storm event will be flood routed to adjacent road reserves via non-destructive overland flow paths
- Regular maintenance will be required for all stormwater drainage pits and any underground storage units and swales/basins. Annual inspection and clean out prior to the onset of winter rains is recommended

The preliminary Earthworks and Drainage Plan attached within Appendix E shows the preliminary stormwater drainage layout. The Earthworks and Drainage Plan will be updated as design development progresses.

3.4 Earthworks Estimates

We advise the following earthworks estimates are based upon preliminary FFL's required to achieve preliminary site stormwater requirements and are based upon the feature survey performed by Brown McAllister Surveyors on 21 January 2021, and the overall site plan (Masterplan) produced by Christou Design Group on 21 April 2021.

The earthwork quantities assumed for the estimates are based upon preliminary Civil terrain modelling for the proposed development at the time of release of this report (including proposed buildings pads, carpark pavements, pathways, playgrounds, breakout areas, courtyards, sports courts, practice nets, sports oval, future Educare site and off-street car parking facilities). Refer to Appendix E for preliminary FFL's and earthworks cut and fill sketches.

It is important to note that these estimates are provided for information purposes only, and should be verified by the Quantity Surveyor as part of their overall project budget estimate and reporting.

For the purpose of the estimates, we have made a number of assumptions, including the following:

- We have currently assumed that all cut material will be suitable for re-use as fill material, however this may not be the case.
- We have allowed $9/m3 for cut to fill on site, and $24/m3 for imported fill material.
- We have assumed 150mm topsoil has been stripped from the site.
- We have made no allowance for bulking or compaction factors.
- We have made no allowance for topsoil stripping costs, and no allowance for clearing, removal of topsoil or screening/blending/reuse of sandy topsoil, removal of unsuitable material, removal and screening of uncontrolled fill, or proof compaction etc.

Element	Cut required (m3)	Fill required (m^3)	Net Cut to Fill (m3)	Net Imported Fill (m3)	Cost ($)
Lot 557 (incl. sports oval, sports courts, practice nets, future transportable area, future Educare Centre, eastern carpark, adjacent on-street carparking)	-6,239	538			
Lot 558 (incl. 8 building pads, 2 transportable areas, playgrounds, breakout areas, courtyards, western and central carparks, adjacent on-street carparking)	-219	29,958			
Total	**-6,458**	**30,496**	**6,458**	**24,038**	**$635,034**

We advise that the preliminary earthworks design will require retaining along the northern and eastern boundary of the sports oval, as indicated on the earthworks plans. Current Landscape advise is that a portion of the retained section will be implemented as tiered seating.

Retaining may also be required in other areas of the site, including within the built form. This will be confirmed during design development.

Retaining requirements have not been included as part of this analysis.

3.5 Outstanding Information/Risk

The following items have currently been identified for review / action:

- Detailed review of the Geotechnical Report by Douglas Partners, to incorporate into the Civil design **(Complete)**
- Confirmation of vehicle-specific details for service vehicles (including waste trucks, supply vehicles, school bus etc) for horizontal and vertical turning analyses
- Coordination of Landscape and Civil earthworks, stormwater and footpath designs
- Coordination with Structural with respect to structural footing requirements
- Coordination of Hydraulic services with respect to stormwater drainage design
- Confirmation of City of Swan stormwater drainage and crossover requirements
- Confirmation of City of Swan requirements for alignment and construction timing of carbays within Arthur Street **(Complete)**
- Confirmation of requirements for potential future temporary carparking within Educare site (**Complete – temporary carparking not required)**
- Engagement of Hydrology consultant to prepare a WMS for the site and confirm drainage requirements **(Engagement undertaken, WMS currently being prepared)**

The following items have currently been identified as risks to the proposed development:

- Additional services or location of existing services being different to those shown on DBYD information
- In-situ soil permeability and/or presence of sub-surface coffee rock and Guildford Formation clays (cementation of coffee rock, depth, extent) may constrain stormwater drainage design
- Potential for earthworks and excavations in sub-surface coffee rock and Guildford Formation clays which may impact construction program and development costs
- Potential for earthworks and excavations in groundwater which may impact construction program and development costs
- Potential for excavations of greater than 2m depth, requirement for dewatering and/or a development condition necessitating further detailed ASS investigations and the development and implementation of an ASS Management Plan
- Potential for extent of uncontrolled fill and associated removal and screening works to impact construction program and development costs
- Potential for extent of shallow surficial loose material and associated remediation to impact construction program and development costs
- Potential for Local Authority requirement to combine proposed primary school and district open space ovals into one larger oval, to impact design and construction program and development costs
- Local Authority advice or requirements extra-over or different to expectations

Appendix A Safety In Design (SID)

Dayton Primary School

Civil Report

Risk Management

Final

Prepared for:	Christou Design Group Pty Ltd
Attention:	Herman Boon
Date:	04-05-21
Prepared by:	Darren Pesich
Ref:	301250182

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Stantec

Revision

Revision	Date	Comment	Approved by
0	16-02-21	Preliminary	Darren Pesich
1	04-05-21	Final	Darren Pesich

Introduction

In accordance with the principles of safe design for work, this report documents the key information concerning actions taken to address safety within the civil design services on this project. The purpose of this process is to mitigate or manage the known Health and Safety hazards inherent in this project at the design stage.

The Residual Risk Summary at the end of this report is a record for all people involved in later lifecycle phases of this project and contains details about residual risks that Stantec are aware of which may present a health and safety risk beyond the completion of the design phase.

The report details the risks that have been mitigated by virtue of compliance with the applicable codes and standards.

It also details the other risks identified and their status at the completion of the design phase for each of the following phases of the project lifecycle:

- Construction and Commissioning
- Use for its intended purpose.
- Maintenance.
- Decommissioning/demolition.

While our design is compliant with the relevant Australian Standards and Codes of Practice this does not eliminate health and safety risks to people using these works. In particular the design standards associated with natural events including wind, earthquake, rainfall and runoff are based on the principle that the probability of a design event being exceeded in any one year is suitably low as to be acceptable to the wider community. This does not mean that they can't and won't be exceeded. Rather that they will be exceeded very rarely. In the context of climatic change and the relatively short historical sample of natural event intensities it is probable that a construction that has a life of 50-60 years will experience natural events that exceed the conditions for which it was explicitly designed. In these circumstances there can be a high or extreme risk to people using these facilities and it is the responsibility of the owners/managers of these facilities to have in place suitable disaster management plans to mitigate the impact of such extreme events.

Similarly, even with a code compliant design, catastrophic failure of plant or equipment is possible and may result in injury or death. Such rare events cannot be eliminated by virtue of our design as they are beyond the designer's control.

In all instances except the "Use for its intended purpose", our risk assessment is based on the assumption that work will be carried out by competent and experienced Contractors. Where conventional hazards are referred to in this report, they are deemed to be those that competent and experienced contractors would routinely manage. Responsibility for engaging competent and experienced Contractors lies with the building owner/developer and should be a critical part of the risk management process of the building owner/developer in selecting all Contractors.

To this end, we note that conventional hazards are not explicitly tracked in this report. Only those hazards that present an unconventional risk are explicitly dealt with. All conventional risks are dealt with in a collective and general sense.

Similarly, our assessment of hazards is based on the assumption that all plant, equipment and infrastructure will be maintained in accordance with all manufacturer's and legislative requirements. The responsibility for this compliance rests with the owner and/or operator and/or contractor engaged for this purpose. Failure to comply is not a Safety in Design issue covered by our assessment.

Note that this report assesses risks for only those components and elements included in the original design. People using this report at later stages of the project's life must determine if additional elements have been added to the building/project that may impact on the residual risks noted herein.

For hazards associated with "Use for its intended purpose" risk ratings have been assessed for each hazard identified generally in accordance with the matrix overleaf. Any hazards with a rating greater than moderate at the completion of the design have their residual risk detailed and the party responsible for managing that risk identified within the Residual Risk Summary at the end of this report.

This is the first stage in the integrated risk management process which OS&H legislation mandates. In presenting the Residual Risk Summary to you Stantec has discharged its obligations under the Act and responsibility for completing this integrated process passes to the building developer/owner. If you are unclear as to your responsibilities and liabilities under Health and Safety Legislation, please contact the author and we will be pleased to advise you further.

Risk Rating

	Consequence				
Likelihood	Insignificant 1	Minor 2	Moderate 3	Significant 4	Major 5
Almost Certain A	Moderate	High	Extreme	Extreme	Extreme
Likely B	Moderate	High	Extreme	Extreme	Extreme
Moderate C	Low	Moderate	High	Extreme	Extreme
Unlikely D	Low	Low	Moderate	High	Extreme
Rare E	Low	Low	Low	Moderate	High

Extreme	Immediate attention required, cease activity
High	Additional controls required to reduce the risk to moderate or below
Moderate	Maximum acceptable level of risk. Additional controls may be implemented to improve.
Low	Risks managed by routine procedures.

Risk Management Report

Code Compliance - Civil

Safety risks mitigated through compliance with relevant Australian Codes and Standards either in design or as required of the Contractor by virtue of referencing these standards in the project specification.

Scope of Risk Assessment	Date	Attending (Name and Position)
Dayton Primary School	04-May-21	Project Engineer Darren Pesich

HAZARD IDENTIFIED/RELEVANT CODES	LIKELIHOOD	CONSEQUENCE	RISK RATING	RESIDUAL RISK	RESPONSIBILITY
Dust / Erosion	D	4	H	Dust or erosion affecting safety of person as a result of extreme weather event not contemplated in design.	Local Authority or Land Owner
Relevant Federal, State and Local Authority Environmental Guidelines					
Stormwater inundation of buildings or infrastructure	E	5	H	Persons injured as a result of flooding from extreme storm event not contemplated in design.	Local Authority or Asset Owner
Australian Rainfall and Runoff / IPWEA / Local Authority Standards					
Roads unsafe or impassable due to flooding	E	5	H	Persons being trapped or injured by flooding over or within roads from extreme storm event not contemplated in design.	Local Authority or Asset Owner
Australian Rainfall and Runoff / IPWEA / Local Authority Standards / relevant State Department of Main Roads					
Required maintenance works adjacent or beneath underground/overhead power	E	5	H	Electrocution as a result of poor work practises.	Asset Owner
Relevant State Power Authority Guidelines / Local Authority Standards					
Pedestrian, cyclist and/or vehicle accident on a road way, cycleway or path	D	5	E	Injury to persons due to collision as result of negligence.	Local Authority or Asset Owner
AustRoads / relevant State Department of Main Roads / Local Authority Standards / AS 1742: Manual of uniform traffic control devices (Parts 1-14) / AS 1743: Road Signs - Specifications / AS 3845: Road Safety Barrier Systems / AS 1428: Design for Access and Mobility (Parts 1 - 5) / AS 2890: Parking Facilities (Parts 1 - 6) / AS 2353: Pedestrian Push Button Assemblies / AS 5100.1: Bridge Design - Scope and General Principals.					
Road pavement failure	D	5	E	Eventual traffic loading or volumes differ to that agreed and approved as part of design resulting in pavement failures and subsequently persons injured due to traffic accident.	Local Authority or Asset Owner
AustRoads / Local Authority Standards / IPWEA / relevant State Department of Main Roads / AS 3727 - Guide to Residential Pavements					
Earthworks and/or retaining structure failure	D	5	E	Building, batter or retaining failure due to loading, undermining or use not contemplated in design resulting in injury to persons.	Local Authority or Land Owner
AS 3798: Guidelines on earthworks on commercial and residential developments / AS 4678-2002: Earth Retaining Structures / Local Authority Standards					
Residual Site Contamination	E	5	H	Remnant contaminated soils or groundwater, or the presence of unexploded ordinances not completely identified and addressed.	Local Authority or Land Owner
Local Authority Standards / EPA Standards / AS 3798: Guidelines on earthworks on commercial and residential developments					
Contamination of water supply, or non-potable water used as potable	E	5	H	Person falls critically ill as a result of poor work practises, not observing warnings or uses water source inappropriately.	Asset Owner
Local Water Authority Standards / WSAA Standards / AS 3500.1 Water Services / AS 3500.2 Sanitary Plumbing and Drainage					

Code Compliance - Civil

Safety risks mitigated through compliance with relevant Australian Codes and Standards either in design or as required of the Contractor by virtue of referencing these standards in the project specification.

Scope of Risk Assessment	Date	Attending (Name and Position)
Dayton Primary School	04-May-21	Project Engineer Darren Pesich

	HAZARD IDENTIFIED/RELEVANT CODES	LIKELIHOOD	CONSEQUENCE	RISK RATING	RESIDUAL RISK	RESPONSIBILITY
	Drowning within stormwater device or infrastructure	E	5	H	Injury to persons due to unauthorised access or as a result of extreme storm event not contemplated in design.	Local Authority or Asset Owner
	Australian Rainfall and Runoff / IPWEA / Local Authority Standards / relevant State Department of Main Roads					
	Public Open Space Civil Elements and Infrastructure	D	4	H	Injury to persons due to inappropriate and/or unauthorised access or use.	Local Authority or Land Owner
	Local Authority Standards / IPWEA / Australian Rainfall and Runoff / WSAA Standards / AS 1428: Design for Access and Mobility (Parts 1 - 5) / AS 3798: Guidelines on earthworks on commercial and residential developments / AS 4678-2002: Earth Retaining Structures / AS 2890: Parking Facilities (Parts 1 - 6) / AS 3500.1 Water Services / AS 3500.2 Sanitary Plumbing and Drainage					
	Access to civil stormwater and sewerage chambers and infrastructure	D	5	E	Injury to persons due to unauthorised access or use.	Asset Owner
	Local Authority Standards / Local Sewer Authority Standards / WSAA Standards / IPWEA / relevant State Department of Main Roads / Australian Rainfall and Runoff / AS 3500.2 Sanitary Plumbing and Drainage / AS 3996: Access Covers and Grates					
	Inadequate fire hydrant distribution	D	5	E	Injury to persons as a result of tampering with, or inadequate maintenance of hydrants.	Asset Owner
	Local Water Authority Standards / Local Authority Standards / AS 2419.1: Fire Hydrant Installations / WSAA Standards					
	Induced voltage onto metallic structures adjacent power infrastructure	D	5	E	Injury to persons as a result of inappropriate installation of future metallic structure in close proximity to power infrastructure.	Asset Owner
	Local Power Authority Standards / Local Authority Standards					
	Burst Authority Water or Sewer Main in Basement	E	5	H	Injury to person as a result of collision/breakage of main.	Asset Owner
	Local Water / Sewer Authority Standards / WSAA Standards / AS 3500.1 Water Services / AS 3500.2 Sanitary Plumbing and Drainage / AS 2890: Parking Facilities (Parts 1 - 6) / AS 3845: Road Safety Barrier Systems / AS 1742: Manual of uniform traffic control devices (Parts 1-14)					

Risk Management Report

Construction and Commissioning - Civil

Scope of Risk Assessment			Date	Attending (Name and Position)			
Dayton Primary School			04-May-21	Project Engineer Darren Pesich			
	PRE-DESIGN RISK RATING			POST-DESIGN RISK RATING			
HAZARD IDENTIFIED	MAYBE UNCONVENTIONAL	UNCONVENTIONAL	DESIGN MITIGATION	CONVENTIONAL	UNCONVENTIONAL	RESIDUAL RISK (do not include specific mitigation strategies unless you are an expert in managing this sort of hazard)	RESPONSIBILITY
Hazardous substances specified or produced as part of works coming into contact with persons							
The following hazardous substances are specified:	◉	○		◉	○		
- "Insert"	◉	○	Reference to Environmental / Geotechnical Reports within design documentation.	◉	○	Safety of persons affected.	Contractor
Hazardous waste is produced as part of the works and requires management.	◉	○	Reference to Environmental / Geotechnical Reports within design documentation.	◉	○	Safety of persons affected.	Contractor
Conventional risks exist.				◉	○		Contractor
Hazardous substances inherent in the site coming into contact with persons							
No testing has been done. Contractors should take appropriate precautions.	◉	○	Notification within design documentation.	◉	○	Safety of persons affected.	Contractor
Testing of the site has revealed hazardous substances and requires management.	◉	○	Reference to Environmental / Geotechnical Reports within design documentation.	◉	○	Safety of persons affected.	Contractor
Asbestos potential in fencing, soils and demolition materials.	◉	○	Notification within design documentation.	◉	○	Safety of persons affected.	Contractor
Unexploded ordinances may exist on site.	◉	○	Reference to Environmental / Geotechnical Reports within design documentation.	◉	○	Safety of persons affected.	Contractor
Conventional risks exist.				◉	○		Contractor
Excavations work causing injury to persons.							
Hazards may include one or combination of:							
- Adjacent structures/railway/main road.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
- Unstable ground conditions.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
- Excavation below the water table in unstable soils.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
- Depth of excavation exceeds 5m.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
- Tunnelling or jacking.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
- Use of explosives.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Conventional risks exist.				◉	○		Contractor
Risk of injury due to noise or vibration							
Hazards may include one or combination of:	◉	○		◉	○		
- Deep or high energy impact compaction.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
- Compaction adjacent existing structures and/or brittle services.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Conventional risks exist.				◉	○		Contractor
Risk of injury to person due to electrocution/explosion/fire							
Existing services adjacent/through site not located.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Works adjacent flammable liquids or gases.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Works adjacent pressurised services.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor

Construction and Commissioning - Civil

Scope of Risk Assessment			Date	Attending (Name and Position)			
Dayton Primary School			04-May-21	Project Engineer Darren Pesich			
	PRE-DESIGN RISK RATING			POST-DESIGN RISK RATING			
HAZARD IDENTIFIED	MAYBE UNCONVENTIONAL	UNCONVENTIONAL	DESIGN MITIGATION	CONVENTIONAL	UNCONVENTIONAL	RESIDUAL RISK (do not include specific mitigation strategies unless you are an expert in managing this sort of hazard)	RESPONSIBILITY
Works adjacent or beneath underground/overhead power.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Mulching stockpile self-combusting.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Conventional risks exist.				◉	○		
Risk of injury due to vehicle impact for works adjacent highly trafficked area							
Inadequate traffic and pedestrian management controlling existing or construction traffic.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Conventional risks exist.				◉	○		Contractor
Risk of Injury due to modification of existing structures or services							
No assessment of capacity of existing structures or services to support construction or demolition loads.	◉	○	Undertake assessment or place a notification within design documentation.	◉	○	Injury to persons	Contractor
No assessment of capacity of existing structure to resist earthquake loads.	◉	○	Undertake assessment or place a notification within design documentation.	◉	○	Injury to persons	Contractor
No existing drawings or information of existing structures or services.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
No detailed investigation of existing structures or services.	◉	○	Undertake assessment or place a notification within design documentation.	◉	○	Injury to persons	Contractor
Existing structures or services old or in poor condition.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Possible retaining wall collapse due to undermining or adjacent works.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Conventional risks exist.				◉	○		Contractor
Conventional risks exist.				◉	○		Contractor
Risk to safety during lifting and erection of materials							
Ground conditions are poor to support crane outriggers.	◉	○	Design suitable support pavement or place a notification within design documentation.	◉	○	Injury to persons	Contractor
Large components with large windage specified.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Conventional risks exist.				◉	○		Contractor
Working in confined spaces							
Access to deep structures during construction (either proposed or existing).	◉	○	Notification within design documentation	◉	○	Injury to persons	Contractor
Risk of inappropriate isolation of existing services.	◉	○	Notification within design documentation	◉	○	Injury to persons	Contractor
Work required in excavations with 3 or more of the following hazards: - Surcharging structure/live services. - High water table. - Contaminated soils. - Excavation over 2m deep. - Soils prone to instability eg saturated ground, peat etc.	◉	○	Notification within design documentation	◉	○	Injury to persons	Contractor
Conventional risks exist.				◉	○		Contractor
Working in Remote Areas							
Inadequate amenities and access to Emergency Services at site.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Cyclonic or severe weather conditions experienced at the site during work periods.	◉	○	Notification within design documentation.	◉	○	Injury to persons	Contractor
Conventional risks exist.				◉	○		Contractor
Earthworks, preload, site influences, topography, location of site							

Construction and Commissioning - Civil

Scope of Risk Assessment				Date	Attending (Name and Position)			
Dayton Primary School				04-May-21	Project Engineer Darren Pesich			
		PRE-DESIGN RISK RATING			POST-DESIGN RISK RATING			
	HAZARD IDENTIFIED	MAYBE UNCONVENTIONAL	UNCONVENTIONAL	DESIGN MITIGATION	CONVENTIONAL	UNCONVENTIONAL	RESIDUAL RISK (do not include specific mitigation strategies unless you are an expert in managing this sort of hazard)	RESPONSIBILITY
	Contaminated ground / acid sulphate soils.	◉	○	Reference to Environmental / Geotechnical Reports within design documentation.	◉	○	Safety of persons affected	Contractor
	Unusual Geotechnical Conditions (unstable ground, steep existing batters etc.).	◉	○	Reference to Geotechnical Reports within design documentation and inclusion of recommendations in design approach.	◉	○	Safety of persons affected	Contractor
	Interface with adjoining properties / risk of undermining or overloading existing structures.	◉	○	Undertake assessment or place a notification within design documentation.	◉	○	Safety of persons affected	Contractor
	Conventional risks exist.				◉	○		

Risk Management Report

Use for its intended purpose - Civil

Scope of Risk Assessment					Date	Attending (Name and Position)					
Dayton Primary School					04-May-21	Project Engineer Darren Pesich					
	PRE-DESIGN RISK RATING				POST-DESIGN RISK RATING						
HAZARD IDENTIFIED	LIKELIHOOD	CONSEQUENCE	RISK RATING	DESIGN MITIGATION	LIKELIHOOD	CONSEQUENCE	RISK RATING	RESIDUAL RISK	RESPONSIBILITY
Hazard identified that cannot be mitigated by compliance with relevant industry standards and codes due to project specific constraints.									
Vehicle, cyclist and/or pedestrian conflicts									
Inadequate pedestrian/vehicle/cyclist separation and delineation provided to each other or another object/formation.	E	5	H	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority or Asset Owner
Pedestrian crossings and infrastructure not to standard.	D	5	E	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority or Asset Owner
Road design doesn't consider expected vehicle size and movements.	D	5	E	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority or Asset Owner
Conventional risks exist.			M				M		Local Authority or Asset Owner
Hazards associated with sewer system failure									
Overflow sites in event of pump/system failure are not remote to public areas and water sources.	E	5	H	TBC with relevant Authority.	A	1	M	Injury or illness to persons	Local Sewer Authority
Conventional risks exist.			M				M		Local Sewer Authority
Risks due to stormwater									
Depth and velocities of flows in open drains excessive.	E	5	H	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority
Detention storage areas at unsafe depth, slope and/or have inadequate public protection.	E	5	H	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority
Permanent water bodies at unsafe depth, slope and/or have inadequate public protection.	E	5	H	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority
Large drainage headwalls are inappropriately protected with covers/grates to restrict entry.	E	5	H	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority
Conventional risks exist.			M				M		Local Authority
Risks due to Fire									
Inadequate egress routes.	D	5	E	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority and Emergency Services Authority
Inadequate separation to fuel zones.	D	5	E	TBC with relevant Authority.	A	1	M	Injury to persons	Local Water Authority & Emergency Services Authority
Water source for fire fighting not reliable.	D	5	E	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority and Emergency Services Authority
Conventional risks exist.			M				M		Local Authority and Emergency Services Authority
Earthworks and retaining walls									
Inadequate grades and/or access for pedestrians and people with disabilities.	E	5	H	TBC with relevant Authority.	A	1	M	Injury to persons	Local Authority or Asset Owner
Conventional risks exist.			M				M		Local Authority or Asset Owner
Electrocution									
"Insert"	A	1	M		A	1	M		
Conventional risks exist.			M				M		Local Authority or Asset Owner

Risk Management Report

Maintenance & Servicing - Civil

Scope of Risk Assessment			Date			Attending (Name and Position)	
Dayton Primary School			04-May-21			Project Engineer Darren Pesich	
	PRE-DESIGN RISK RATING			POST-DESIGN RISK RATING			
HAZARD IDENTIFIED	MAYBE UNCONVENTIONAL	UNCONVENTIONAL	DESIGN MITIGATION	CONVENTIONAL	UNCONVENTIONAL	RESIDUAL RISK (do not include specific mitigation strategies unless you are an expert in managing this sort of hazard)	RESPONSIBILITY
Hazard identified that cannot be mitigated by compliance with relevant industry standards and codes due to project specific constraints.							
Risks to safety associated with maintaining sewer works							
Pit openings or depth provide inadequate space for entry.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Sewer Authority
Ladders cannot be positioned to allow entry/exit whilst facing oncoming traffic.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Sewer Authority
Location of pits mean they are not readily and safely accessible.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Sewer Authority
Adequate clearances to other infrastructure cannot be achieved.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Sewer Authority
Conventional risks exist.				◉	○		Local Sewer Authority
Risk to safety associated with maintaining stormwater system							
Pit openings or depth provide inadequate space for entry.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority
Ladders cannot be positioned to allow entry/exit whilst facing oncoming traffic	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority
Location of pits mean they are not readily and safely accessible	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority
GPT's have inadequate accessibility for cleaning equipment	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority
GPT's cleaning requirements do not suit Local Authority maintenance vehicle limitations	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority
Adequate clearances to other infrastructure cannot be achieved.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority
Batters on stormwater basins are steeper than allowable standards.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority
Conventional risks exist.				◉	○		Local Authority
Risks to safety associated with maintaining earthworks, retaining walls & sea walls							
Retaining walls impede ease of access to services.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority or Asset Owner
Constructed batters are steeper than allowable standard.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority or Asset Owner
Possible remnant contaminated soils or unexploded ordinances.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Local Authority or Land Owner
Conventional risks exist.				◉	○		Local Authority or Asset Owner
General							
Pressurised or flammable services not within standard corridor.	◉	○	TBC with relevant Authority.	◉	○	Injury to persons	Service Authorities
Conventional risks exist.				◉	○		Service Authorities

Risk Management Report

Demolition - Civil

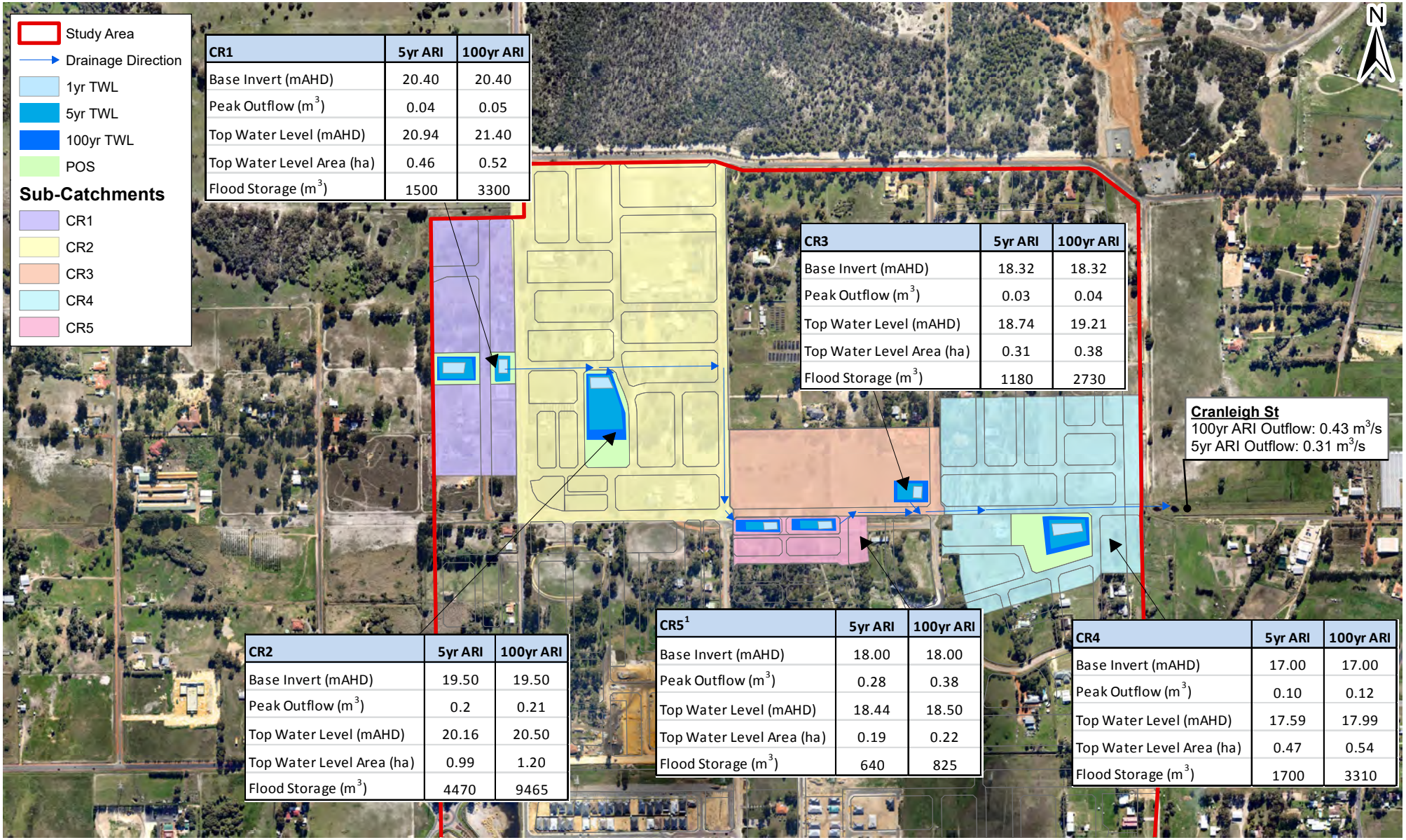
Scope of Risk Assessment			Date			Attending (Name and Position)	
Dayton Primary School			04-May-21			Project Engineer Darren Pesich	
		PRE-DESIGN RISK RATING			POST-DESIGN RISK RATING		
	HAZARD IDENTIFIED	MAYBE UNCONVENTIONAL	UNCONVENTIONAL	DESIGN MITIGATION	CONVENTIONAL	UNCONVENTIONAL	RESIDUAL RISK (do not include specific mitigation strategies unless you are an expert in managing this sort of hazard)	RESPONSIBILITY
	***** Enter job specific if applicable******							
	Hazard 1	◉	○		◉	○		

Risk Management Report

Residual Risk Report

Scope of Risk Assessment	Date	Attending (Name and Position)	
Dayton Primary School	04-May-21	Darren Pesich, Project Engineer	
HAZARD IDENTIFIED	POST-DESIGN RISK RATING RISK RATING/ UNCONVENTIONAL	RESIDUAL RISK	RESPONSIBILITY

Appendix B Local Water Management Strategy – Figure 14



CR1	5yr ARI	100yr ARI
Base Invert (mAHD)	20.40	20.40
Peak Outflow (m^3)	0.04	0.05
Top Water Level (mAHD)	20.94	21.40
Top Water Level Area (ha)	0.46	0.52
Flood Storage (m^3)	1500	3300

CR3	5yr ARI	100yr ARI
Base Invert (mAHD)	18.32	18.32
Peak Outflow (m^3)	0.03	0.04
Top Water Level (mAHD)	18.74	19.21
Top Water Level Area (ha)	0.31	0.38
Flood Storage (m^3)	1180	2730

CR2	5yr ARI	100yr ARI
Base Invert (mAHD)	19.50	19.50
Peak Outflow (m^3)	0.2	0.21
Top Water Level (mAHD)	20.16	20.50
Top Water Level Area (ha)	0.99	1.20
Flood Storage (m^3)	4470	9465

CR5[1]	5yr ARI	100yr ARI
Base Invert (mAHD)	18.00	18.00
Peak Outflow (m^3)	0.28	0.38
Top Water Level (mAHD)	18.44	18.50
Top Water Level Area (ha)	0.19	0.22
Flood Storage (m^3)	640	825

CR4	5yr ARI	100yr ARI
Base Invert (mAHD)	17.00	17.00
Peak Outflow (m^3)	0.10	0.12
Top Water Level (mAHD)	17.59	17.99
Top Water Level Area (ha)	0.47	0.54
Flood Storage (m^3)	1700	3310

Note: 1- CR5 shows combined stroage. POS and drainage locations are indicative only and subject to approval of the Local Structure plan, subdivision design and UWMP

Job No. J5132
Scale: 1:10,000

0 200 400 600 800 Metres

St Leonards Estate Pty Ltd
West Swan East: LWMS

Figure 14: Proposed Stormwater Management: Cranleigh St Catchment

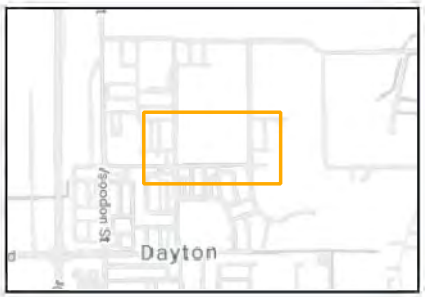
Appendix C Existing Site and Services Information

Existing Conditions - Aerial Contours

Existing Aerial Contours

Client: Christou
Project: Dayton Primary School
Project No.: 301250182
Data Sources: WA Department of Primary Industries and Regional Development (DPIRD-072)
Basemap Service Credits: SLIP Locate
Map displayed in EPSG:28350
Author: Malone, Daniel (Perth), Stantec (2021-04-22)

Stantec

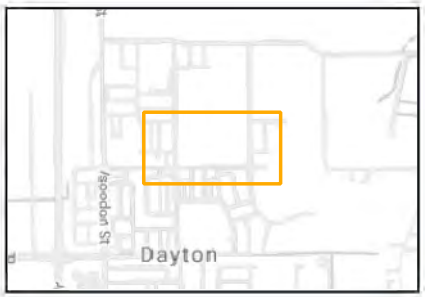


Existing Conditions - Groundwater

Existing Groundwater Conditions (Mininum & Maximum)

Client: Christou
Project: Dayton Primary School
Project No.: 301250182
Data Sources: Department of Water - Perth Groundwater Map
Basemap Service Credits: SLIP Locate
Map displayed in EPSG:28350
Author: Malone, Daniel (Perth), Stantec (2021-04-22)

Stantec

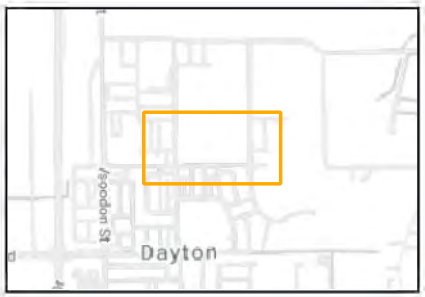


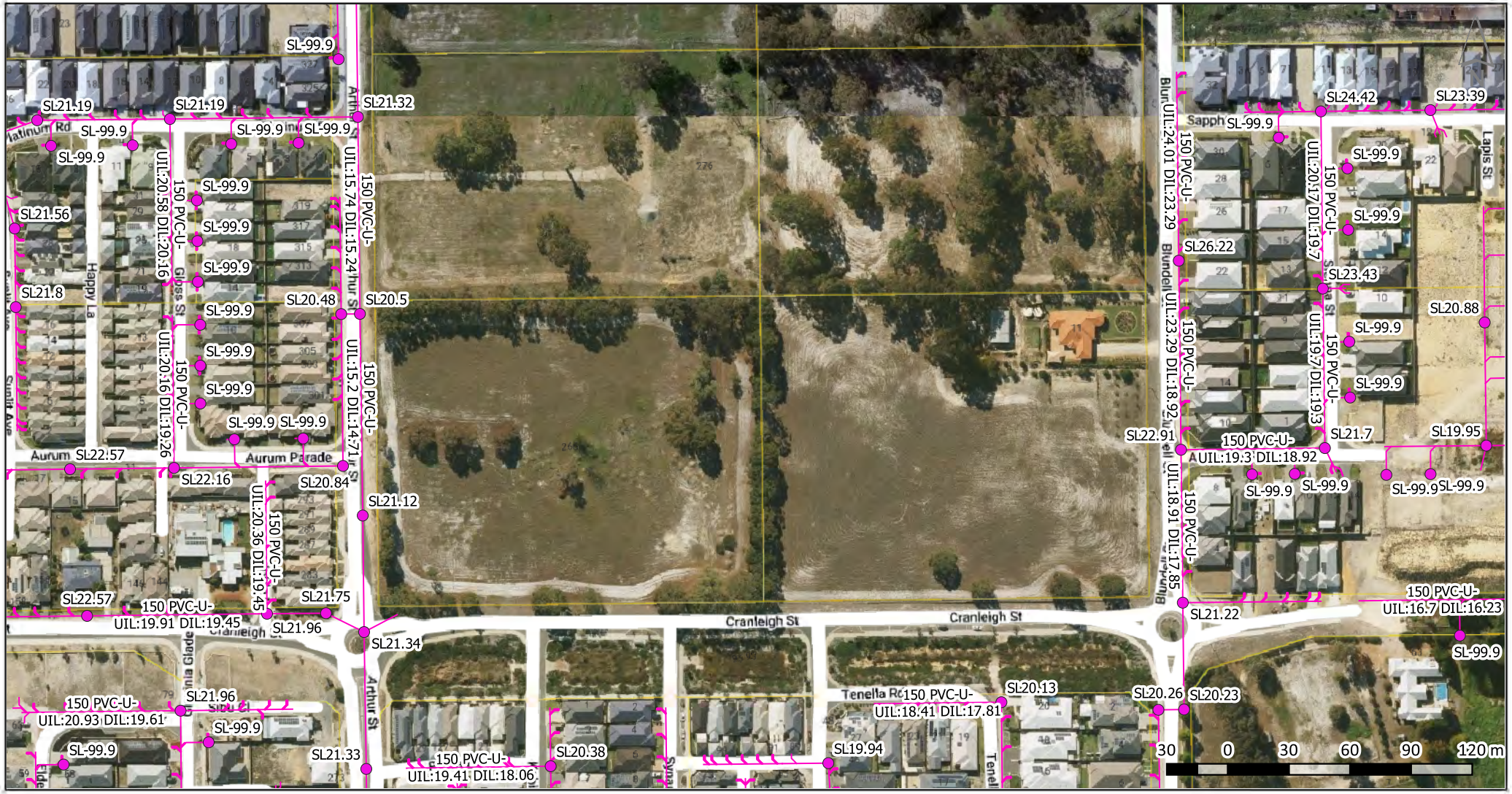
Existing Conditions - Acid Sulfate Soil Risk

Existing ASS Risk

Client: Christou
Project: Dayton Primary School
Project No.: 301250182
Data Sources: WA Department of Environment (DWER-049)
Basemap Service Credits: SLIP Locate
Map displayed in EPSG:28350
Author: Malone, Daniel (Perth), Stantec (2021-04-22)

Stantec



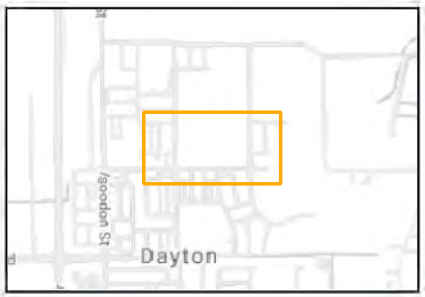


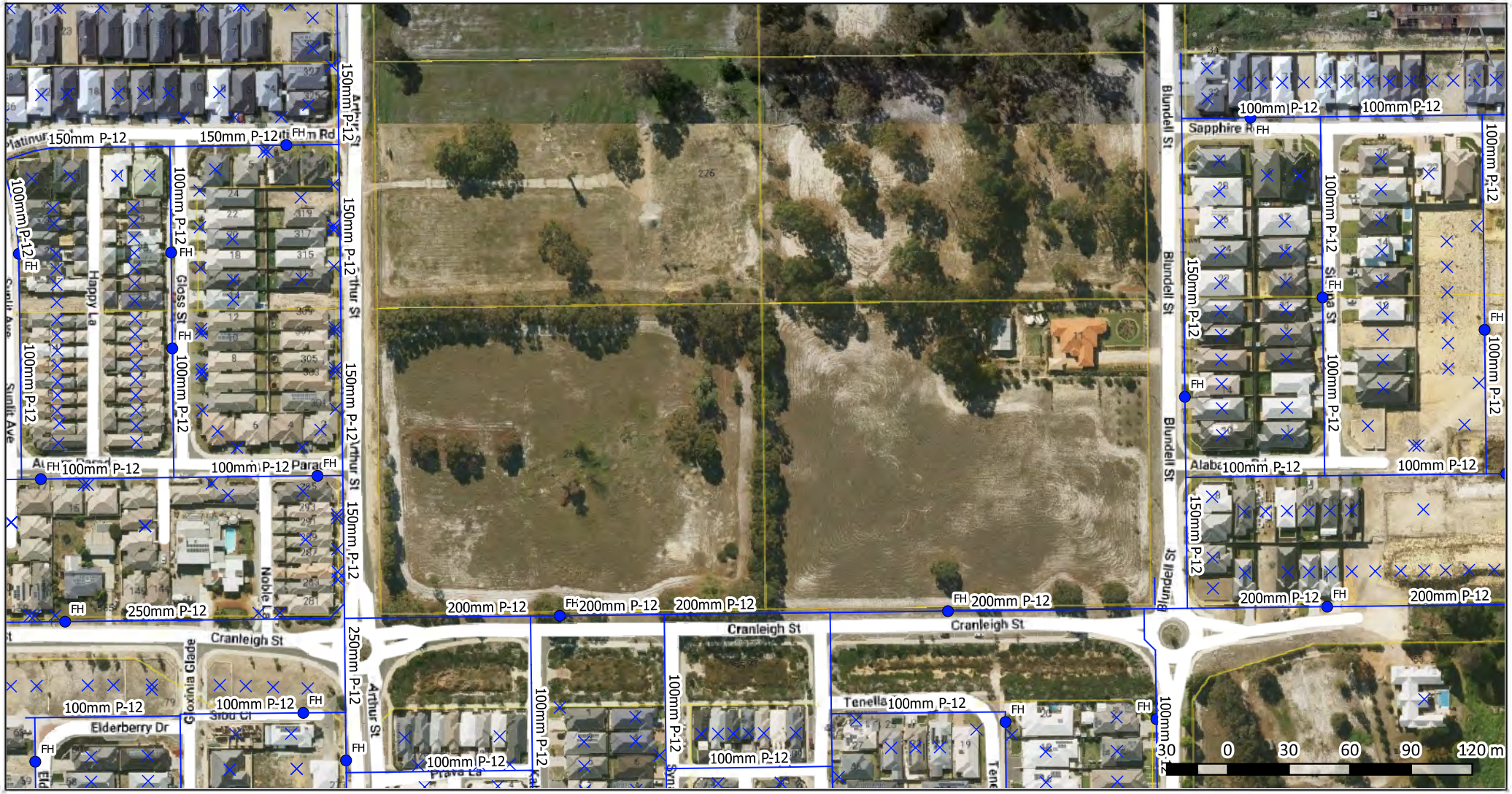
Existing Services - Sewer

Existing Sewer Infrastructure

Client: Christou
Project: Dayton Primary School
Project No.: 301250182
Data Sources: Water Corp Planned Assets (WCORP-026, WCORP-068, WCORP-069, WCORP-084)
Basemap Service Credits: SLIP Locate
Map displayed in EPSG:28350
Author: Malone, Daniel (Perth), Stantec (2021-04-22)

Stantec



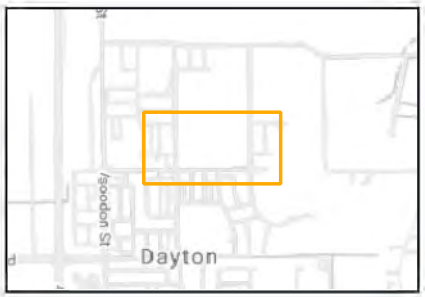


Existing Services - Water

Existing Water Infrastructure

Client: Christou
Project: Dayton Primary School
Project No.: 301250182
Data Sources: Water Corp Planned Assets (WCORP-010, WCORP-013)
Basemap Service Credits: SLIP Locate
Map displayed in EPSG:28350
Author: Malone, Daniel (Perth), Stantec (2021-04-22)

Stantec



GIS SYMBOLS SHEET

EXISTING GAS NETWORK

- High Pressure
- Polyethylene High Pressure
- City High Pressure
- Medium Pressure
- Albany Medium Pressure
- Medium Low Pressure
- Low Pressure
- Not Gassed
- Service
- High Pressure Service

ASSOCIATED INFRASTRUCTURE

- Associated Asset

PROPOSED GAS NETWORK

- Proposed Main

ABANDONED GAS NETWORK

- Abandoned Gas Main
- Abandoned Gas Main Sold
- Abandoned Valve
- Abandoned Fitting

DUCTS AND SLEEVES

- Duct
- Horizontal Boring
- Sleeve
- Road Crossing
- Concrete Slab

TOPOGRAPHY

- ATCO Easement
- Fence
- Building
- Kerb
- Water Boundary
- Contour Line
- Elevation Point

FEATURE LINES

- Miscellaneous Line
- Reference Line
- Gas Indicator Line
- Gas Pit
- DOC 1.2m — Arrow Pointer with Text

VALVES

- High Pressure
- High Pressure Service
- Main
- Service
- Isolation

GATE STATIONS

- Gate Station
- Pressure Reducing Station
- L.P.G. Tank

REGULATOR SETS

- Distribution Regulator
- Boundary Regulator

TELEMETRY MONITORING DEVICE

- Non Billing Meter
- Pressure Monitoring Device

DELIVERY POINTS

- Service Point
- Meter
- Interval Meter
- Meter Set

FEATURE POINTS

- SC — Side Elevation
- Obstacle
- See Details
- NC — Not Connected
- SV — Gas Service
- Sign
- OLS — Offline Service
- Linked Reference Document
- PLS — Pre-Laid Service
- PLSS — Pre-Laid Service Stairs
- PLST — Pre-Laid Service Tee
- BL — Asset ends on Building / Property Line
- CoD — Asset ends on Direction Peg

PROTECTION DEVICES

- T — Test Point
- PM — Potential Monitoring
- Odorant Test Point
- E — Earthing
- Bond Wire
- Bond Junction
- R — Rectifier
- IJ — Insulation Joint
- A — Anode
- GB — Ground Bed
- EM — Earth with Mitigation
- FS — Foreign Structure Monitoring
- IJM — Insulation Joint with Mitigation

FITTINGS

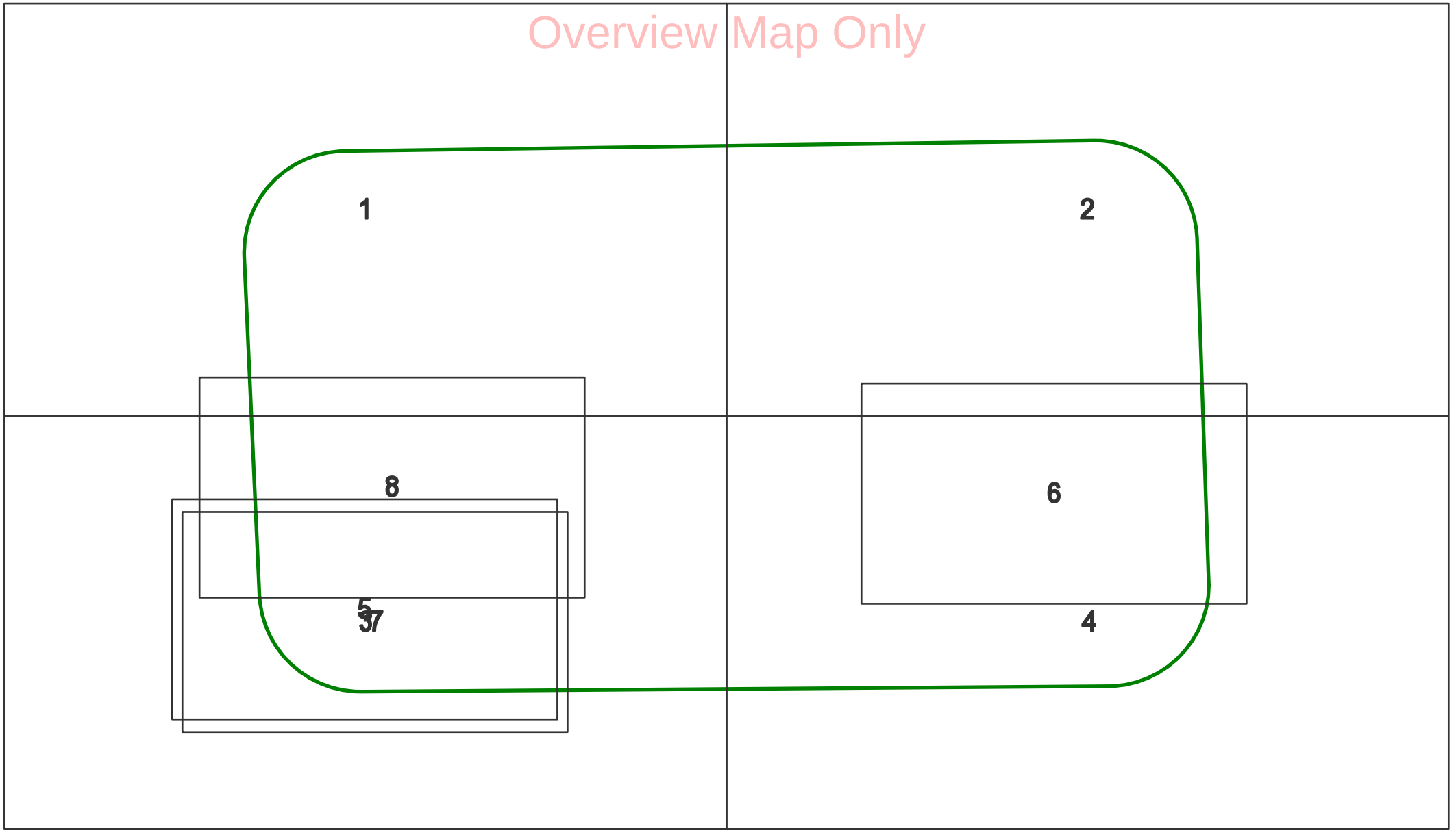
- Syphon
- Coupling
- Expansion Joint
- Main Cross
- Reducer
- Stopple
- Flange
- Change Node
- Thredolet
- Tapping Band
- Bend
- Elbow
- Monolithic Joint
- End Cap
- Tee
- Transition
- Three-Way Tee
- Short Stop
- Weldolet
- Socket
- Spherical Tee
- Tapping Tee
- Barrier
- Squeeze Off

FEATURE POLYGONS

- Hard Digging
- Proving Gas Location
- Pressure Upgrade
- Licence Area
- Not Gassed
- Suburb
- Local Government Authority

WARNING - HIGH PRESSURE PIPELINE IN THE VICINITY.

No works within 15 metres of this asset are permitted without prior approval from ATCO Gas Australia PH 1300 926 755



Sequence No: 107569171 | Map Tile: | Scale: 1:3075

Job No: 21251545 | Date:12/03/2021 | Location: Cranleigh Street, Dayton 6055

N W E S

ATCO

Please read all **warnings**, conditions and information on the attached "Underground Asset Details" information sheet. This plan is issued subject to that information and those conditions and **warnings** (including, but not limited to, the "NO HOT WORKS" warning). Plans are current for only **30 days** from date of request, indicative only and not warranted to be accurate. It is your responsibility to carefully locate underground assets and follow safe work practises and procedures (eg pot-holing). ATCO Gas Australia will seek compensation for damage caused to assets.

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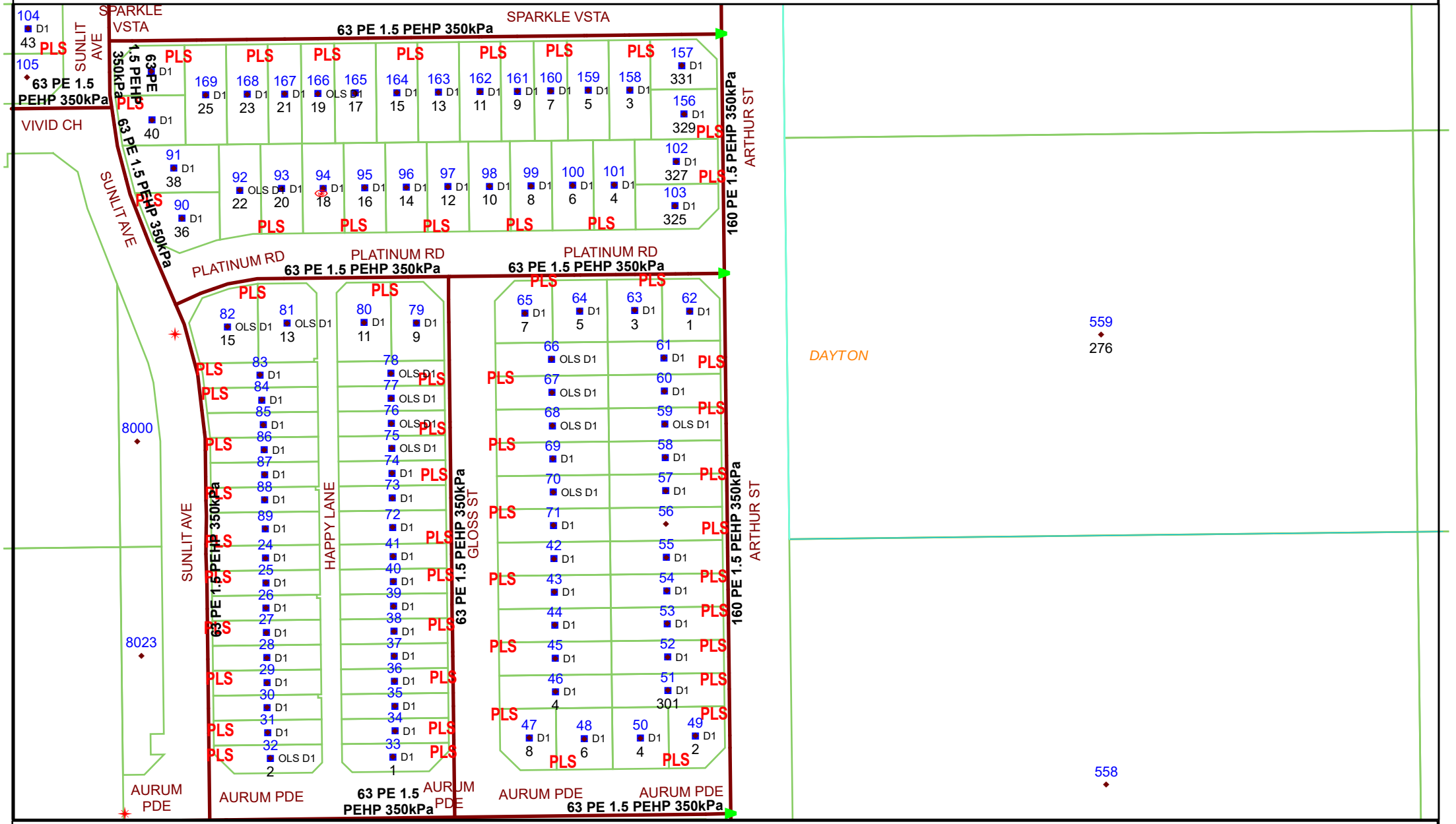

Sequence No: 107569171 Map Tile: 1 Scale: 1:1500

Job No: 21251545 Date:12/03/2021 Location: Cranleigh Street, Dayton 6055

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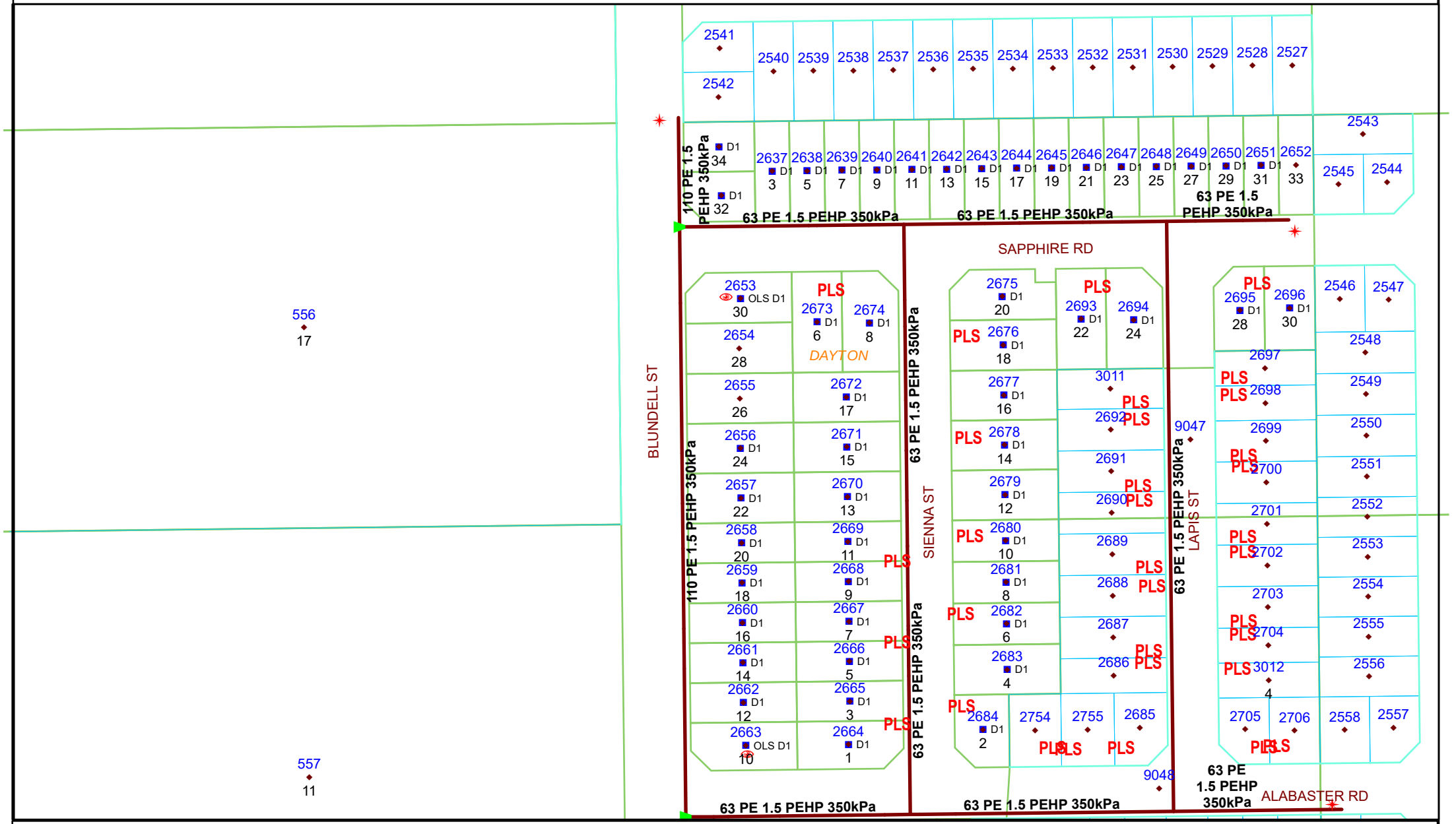

Sequence No: 107569171 Map Tile: 2 Scale: 1:1500

Job No: 21251545 Date:12/03/2021 Location: Cranleigh Street, Dayton 6055

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WARNING - HIGH PRESSURE PIPELINE IN THE VICINITY.

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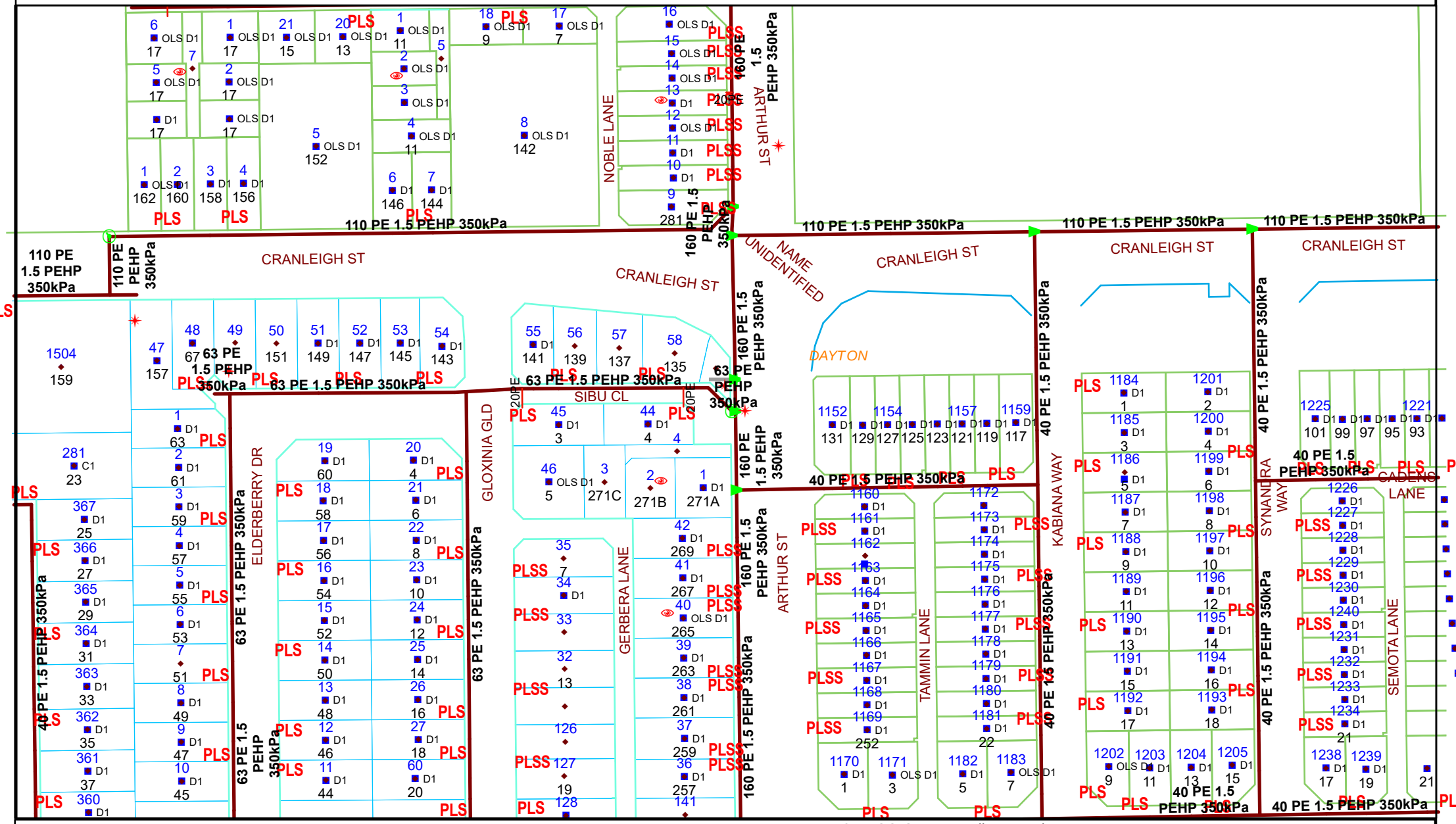

Sequence No: 107569171 Map Tile: 3 Scale: 1:1500

Job No: 21251545 Date:12/03/2021 Location: Cranleigh Street, Dayton 6055

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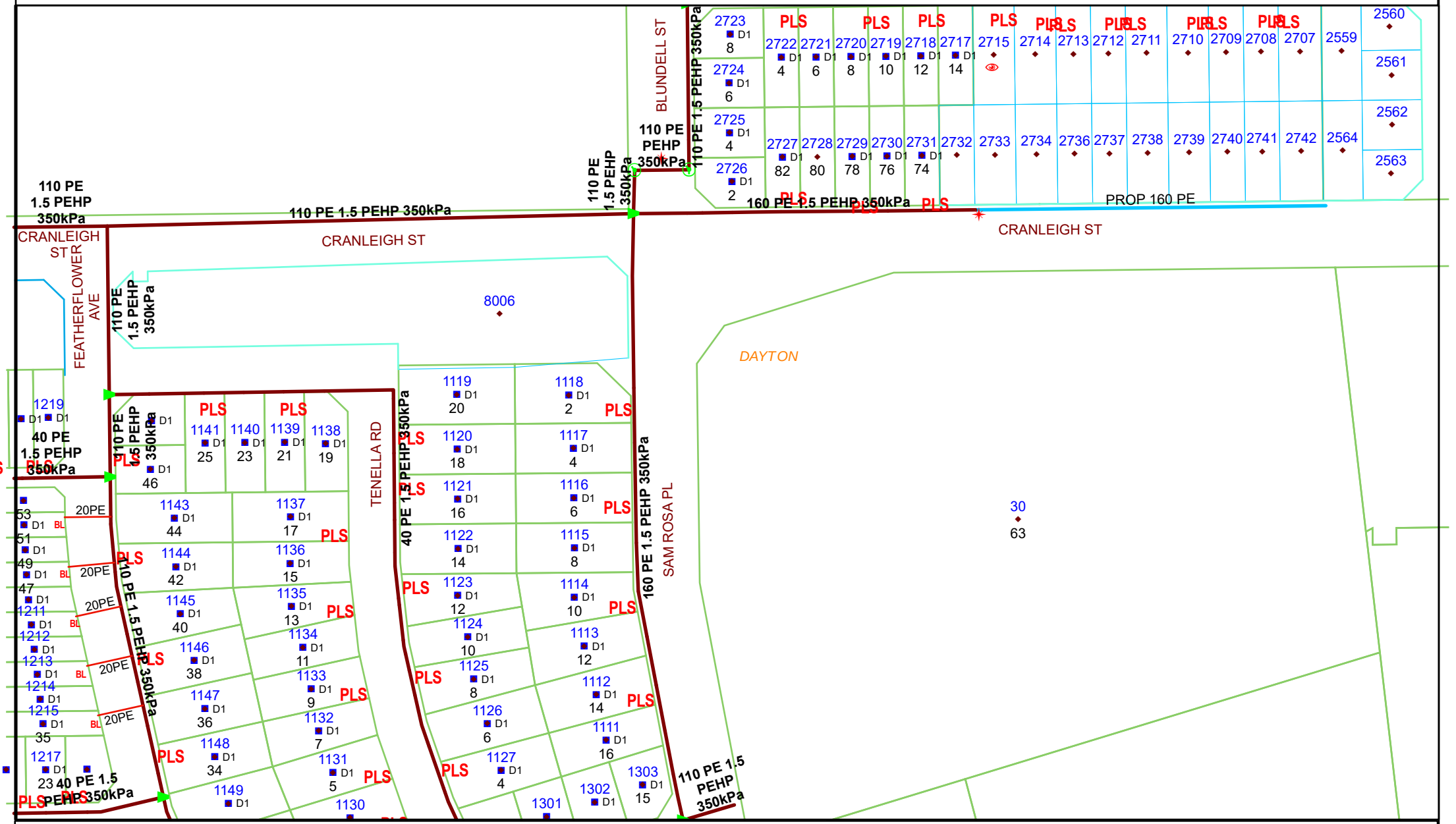

Sequence No: 107569171 Map Tile: 4 Scale: 1:1500

Job No: 21251545 Date:12/03/2021 Location: Cranleigh Street, Dayton 6055

Please read all **warnings**, conditions and information on the attached "Underground Asset Details" information sheet. This plan is issued subject to that information and those conditions and **warnings** (including, but not limited to, the "NO HOT WORKS" warning). Plans are current for only **30 days** from date of request, indicative only and not warranted to be accurate. It is your responsibility to carefully locate underground assets and follow safe work practises and procedures (eg pot-holing). ATCO Gas Australia will seek compensation for damage caused to assets.

WARNING - HIGH PRESSURE PIPELINE IN THE VICINITY.

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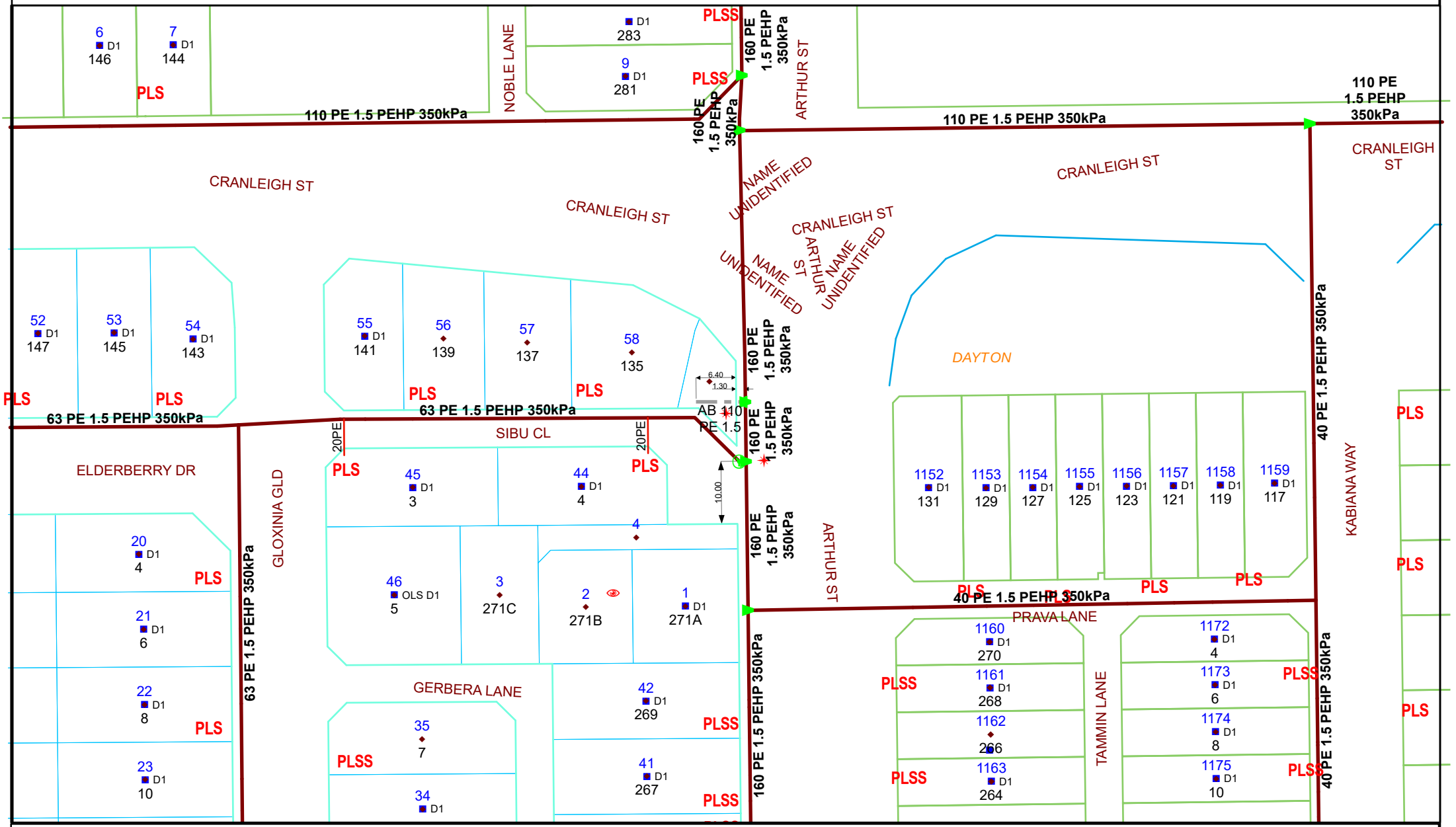

Sequence No: 107569171 | Map Tile: 5 | Scale: 1:800

Job No: 21251545 | Date: 12/03/2021 | Location: Cranleigh Street, Dayton 6055

N W E S

ATCO

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WARNING - HIGH PRESSURE PIPELINE IN THE VICINITY.

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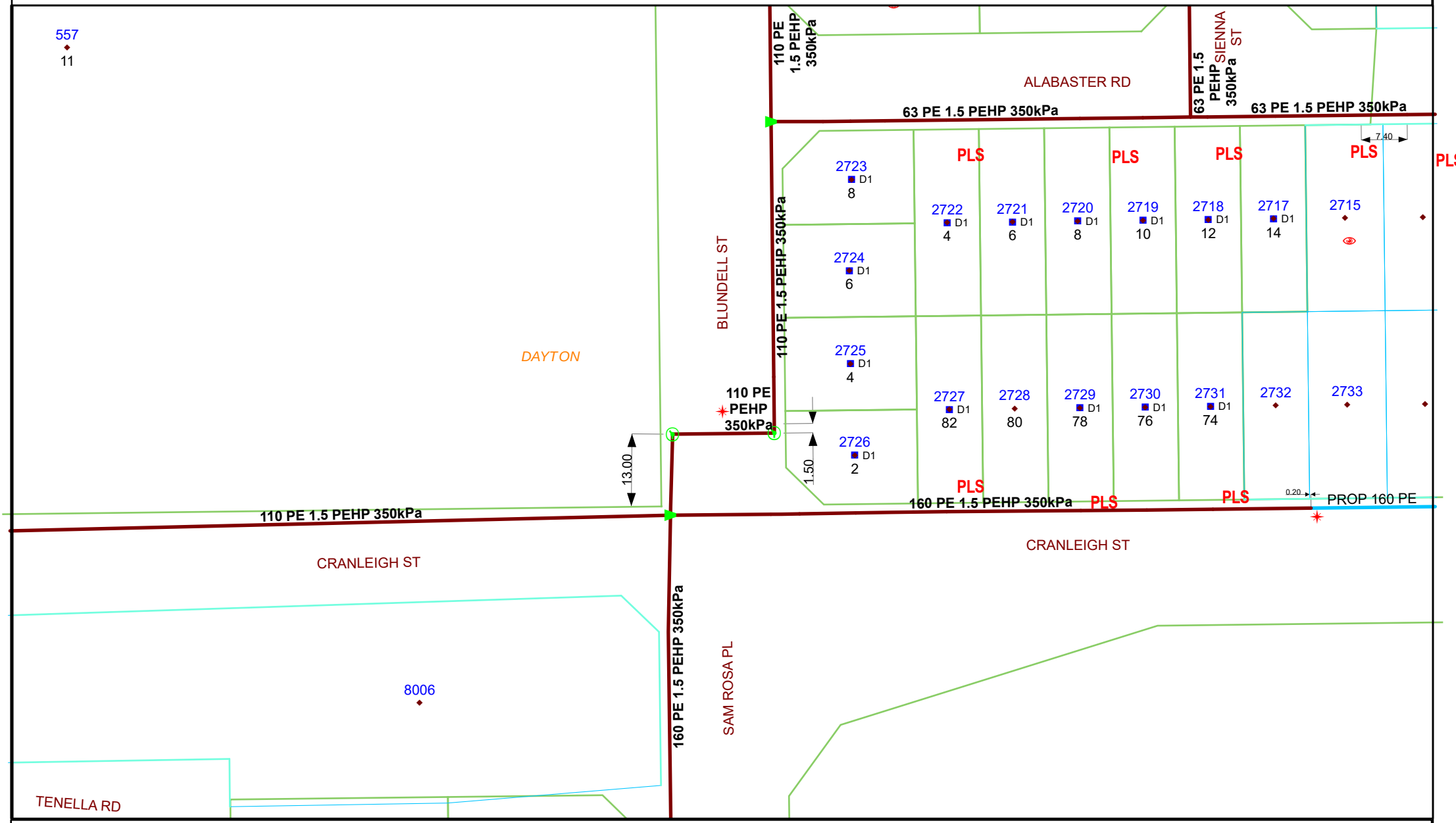

Sequence No: 107569171 Map Tile: 6 Scale: 1:800

Job No: 21251545 Date:12/03/2021 Location: Cranleigh Street, Dayton 6055

N W E S

ATCO

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WARNING - HIGH PRESSURE PIPELINE IN THE VICINITY.

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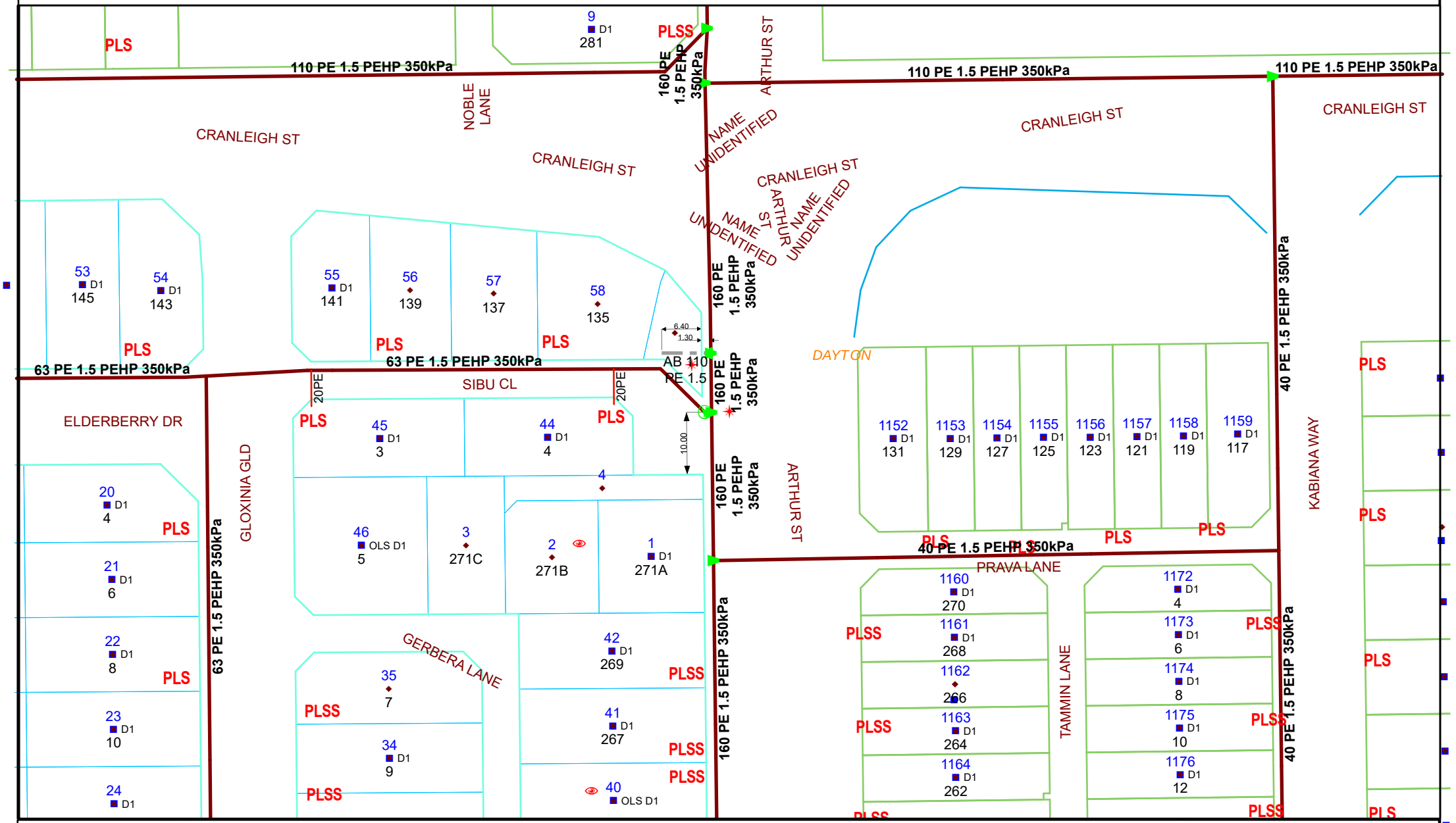


Sequence No: 107569171 Map Tile: 7 Scale: 1:800

Job No: 21251545 Date:12/03/2021 Location: Cranleigh Street, Dayton 6055

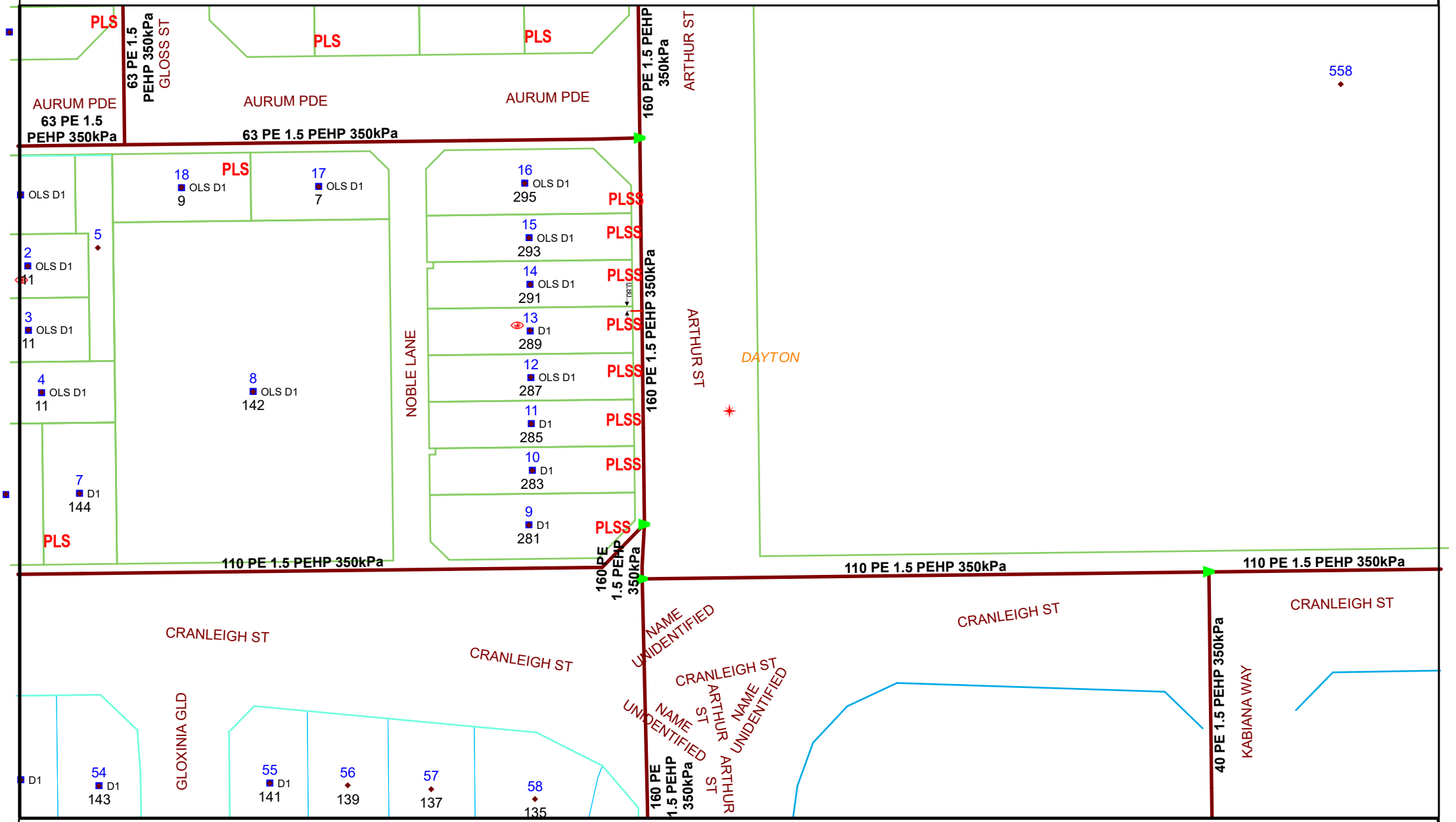
N W E S

ATCO

Please read all **warnings**, conditions and information on the attached "Underground Asset Details" information sheet. This plan is issued subject to that information and those conditions and **warnings** (including, but not limited to, the "NO HOT WORKS" warning). Plans are current for only **30 days** from date of request, indicative only and not warranted to be accurate. It is your responsibility to carefully locate underground assets and follow safe work practises and procedures (eg pot-holing). ATCO Gas Australia will seek compensation for damage caused to assets.

WARNING - HIGH PRESSURE PIPELINE IN THE VICINITY.

No works within 15 metres of this asset are permitted without prior approval from ATCO Gas Australia PH 1300 926 755



Sequence No: 107569171 Map Tile: 8 Scale: 1:800

Job No: 21251545 Date:12/03/2021 Location: Cranleigh Street, Dayton 6055

Please read all **warnings**, conditions and information on the attached "Underground Asset Details" information sheet. This plan is issued subject to that information and those conditions and **warnings** (including, but not limited to, the "NO HOT WORKS" warning). Plans are current for only **30 days** from date of request, indicative only and not warranted to be accurate. It is your responsibility to carefully locate underground assets and follow safe work practises and procedures (eg pot-holing). ATCO Gas Australia will seek compensation for damage caused to assets.

Western Power
363 Wellington Street
Perth WA 6000
T: 13 10 87 F: (08) 9326 6079
www.westernpower.com.au
Electricity Networks Corporation ABN 18 540 492 861

To: Mr Daniel Malone
Company: Stantec
Phone Details: 0423276568
Email Address: daniel.malone2@stantec.com

Sequence Number: 107569167
Job Number: 21251545
Dig Site Location: Cranleigh Street
Dayton
WA, 6055

DIAL BEFORE YOU DIG 1100 INFORMATION SHEET

This information relates to both underground and overhead network assets and is valid for 30 days from date of issue - 12/03/2021 5:28 PM

- **The *Energy Operators (Powers) Act 1979* makes it an offence to damage Western Power's network.**
- **The *Occupational Safety and Health Regulations 1996* establish restrictions for working safely around the Western Power network.**
- **Western Power *Easements* and *Network Policy and Standards* establish restrictions for development around the Western Power network.**

It is the duty of care of persons planning to work or develop around Western Power's network to comply with the requirements of these statutory obligations and any other legislation, standard or guidance relevant.

Western Power's network assets are classified below:

Network Asset	Classification
Transmission line	66kV, 132kV, 220kV and/or 330kV
Distribution line	6.6kV, 11kV, 22kV and/or 33kV
	240V/415V (insulated / uninsulated)
Communication cable and other cables	communications, pilot cables, fibre optics

A danger zone, Western Power easement and restriction zone represents an area of high risk when working and developing around the Western Power network. Danger zones apply only to work around the network, whilst easement and restriction zone areas apply only to development and land use.

It is a requirement to work and develop outside of these areas so as far as is reasonably practicable. If you propose to work and/or develop within these areas, refer to the Western Power website for available information, services and lead times at http://www.westernpower.com.au/safety-working-near-electricity.html or by contacting Western Power's **Customer Service Centre** on **13 10 87.**

IN THE EVENT OF DAMAGE TO A WESTERN POWER ASSET CALL WESTERN POWER FAULTS AND EMERGENCIES ON 13 13 51

GENERAL INFORMATION

- In the event that you discover a cable NOT shown on your map or you wish to clarify the construction status of assets in Design Areas, contact Western Power on 1300 769 345 (7:00 to 16:30 weekdays).
- Western Power underground **communications pipes** are also known as Perth Fibre Network: These pipes are typically 3 – 4.2m from property boundary but may vary.
- The typical alignment for underground assets is 0 - 0.6m and 2.4 – 3m from the property boundary.
- It is mandatory for the customer/excavator/contractor to physically locate all services before excavating.
- Never assume depth and alignment of cables.
- Check Utility Providers Code of Practice for Western Australia requirements for work in road and rail reserves at this Main Roads Western Australia site: https://www.mainroads.wa.gov.au/BuildingRoads/StandardsTechnical/RoadandTrafficEngineering/RoadsideItems/GuidelinesforRoadsideServices/Pages/Utility_Providers_Code_of_Practice_for_Western_Australia.aspx
- Please note the following lead times apply for Western Power to provide advice in working safely around the network:
    - **Transmission** – at least **30** business days
    - **Distribution –** at least **20** business days
    - **Communication and other cables –** at least **30** business days
- Work within Danger Zones is prohibited under the *Occupational Safety and Health Regulations 1996*, unless exemptions apply. Danger Zone areas are defined under *Regulation 3.64*.
- Development within easement and restriction zone areas is required to comply with restrictions under Western Power's standard easement conditions. These conditions are established under the relevant easement on Certificate of Title, or if an easement does not exist, they are established under Western Power Network Policy and Standards. You can request standard easement conditions from Western Power or access them from the Western Power website.

MAP LEGEND INFORMATION

Proposed Construction Assets* means that overhead/underground assets may possibly be found in the Design Area* shaded on the plan.

Design Area* means field-works are possibly in progress or just completed and the plans supplied may differ from the current state in the ground or overhead.

UG Crossing* means that there could be multiple underground ducts at that location.

NOT depicted on Western Power Dial Before You Dig Plans are:

- Cables within a private property, for example, from pillar (green dome) to your electric meter. A cable-locating company will have to be contacted for on-site locations in your private property.
- Private cables belonging to government authorities, for example, Main Roads, Transperth, etc.
- Private streetlight cables belonging to local government, private estates etc.

STATE UNDERGROUND POWER PROGRAMME (SUPP)
IN PROGRESS OR COMPLETED

Retrospective large scale undergrounding of power and/or communications assets has been identified in the vicinity of your enquiry.

Please refer to the attached plan(s), for instructions or additional information.

- **Large Scale Undergrounding in Progress**
  There may be uncommissioned underground assets installed. Attached plan does not depict all Western Power underground activity.
- **Attention!**
  Not all underground assets shown, for more information contact Western Power on 1300 769 345 (7:00 to 16:30 weekdays).
- **Large Scale Undergrounding Completed**
  Default Alignments are used: - 0 to 0.6m & 2.7m but may vary.
  Some cables can range up to 7.0 m from the property boundaries caution is advised.

DISCLAIMER

The provisions of this Disclaimer cannot and do not purport to limit or otherwise exclude the application of, or any warranties, rights, powers or remedies under, any Commonwealth or Western Australian legislation that does not permit or otherwise makes void any such exclusion or limitation provisions, including but not limited to, section 18 of the Competition and Consumer Act 2010 (Cth)

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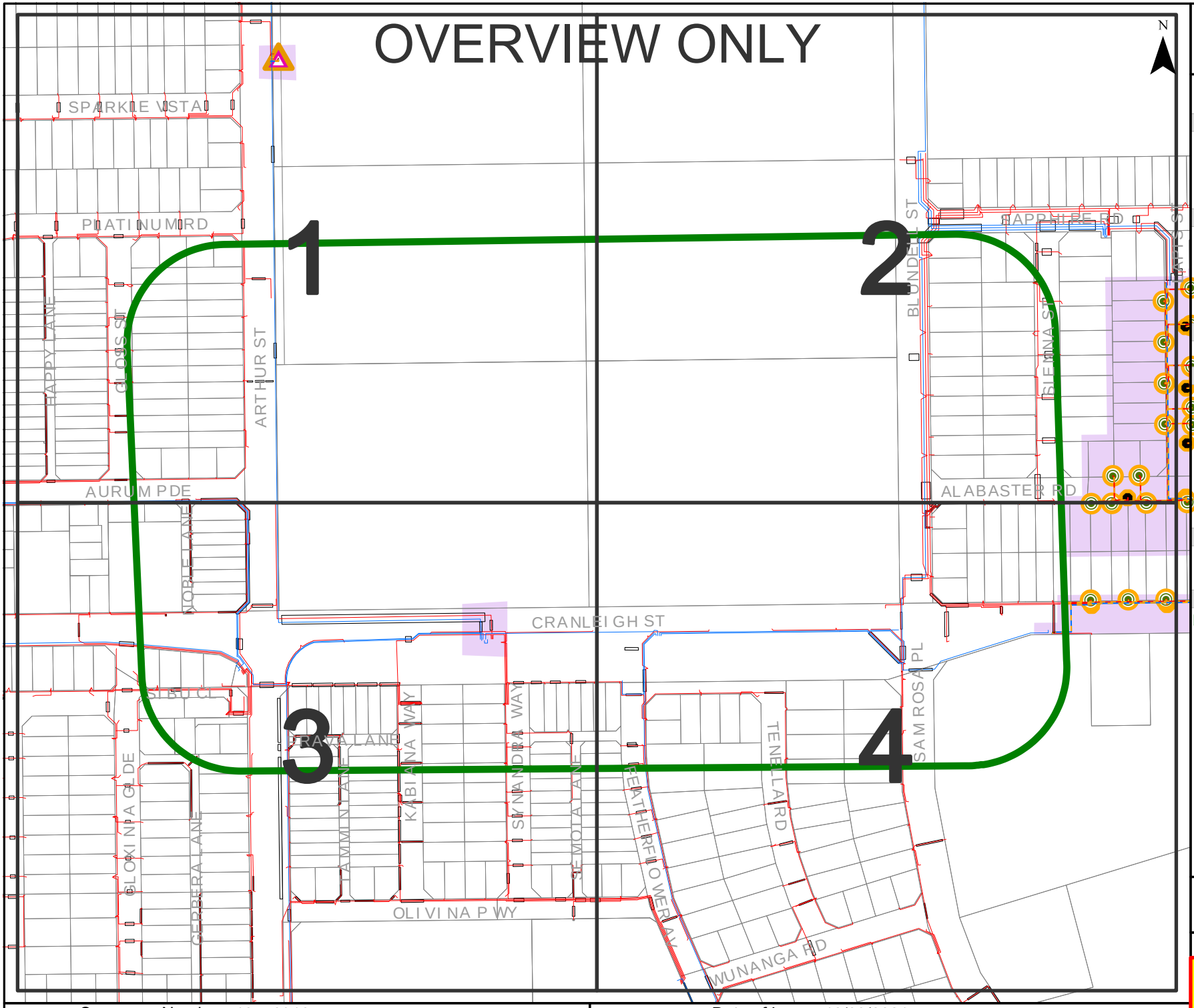
3. are under no obligation to correct, update or revise, the Information.



westernpower

UNDERGROUND LEGEND

Structures

- Pillar
- Metal Pole
- Transformer Site
- UG Crossing *
- Ring Main Unit
- LV Distribution Frame

Distribution Cables

- High Voltage Cable (1kV - 33kV)
- Low Voltage Cable (< 1kV)
- Street Light Circuit (< 1kV)
- Street Light Pilot (< 1kV)
- Earth Wire

Cable Pole Terminations

- HV Termination
- LV Termination

Proposed Construction Assets

- Design Area *
- High Voltage Underground Cable
- Low Voltage Underground Cable
- Metal Pole
- Pillar
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- HV Termination
- LV Termination

State Underground Power Project

- CURRENT Work Area *
- COMPLETED Area *

Feature

- Area of Interest

*** Please refer to coversheet**

Privately owned cables NOT SHOWN (including house services)

This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.

Telephone Support: 1300 769 345
Mon to Fri - 08:00 to 16:30

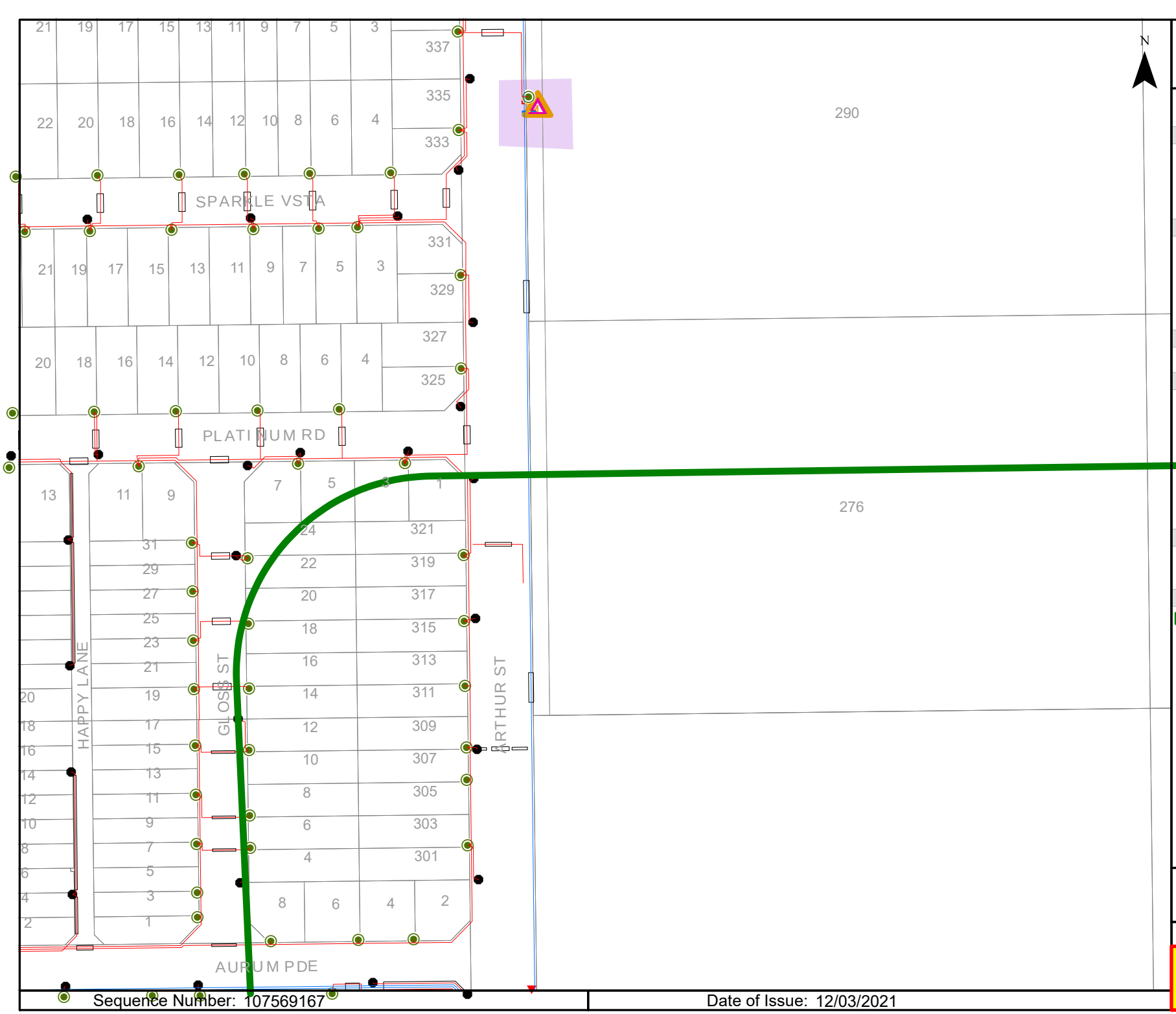
Information valid for 30 days from date of issue

A4	Scale : 1:3075

WARNING! Look out for overhead power lines

Sequence Number: 107569167

Date of Issue: 12/03/2021



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UNDERGROUND LEGEND

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A4 | Scale : 1:1500

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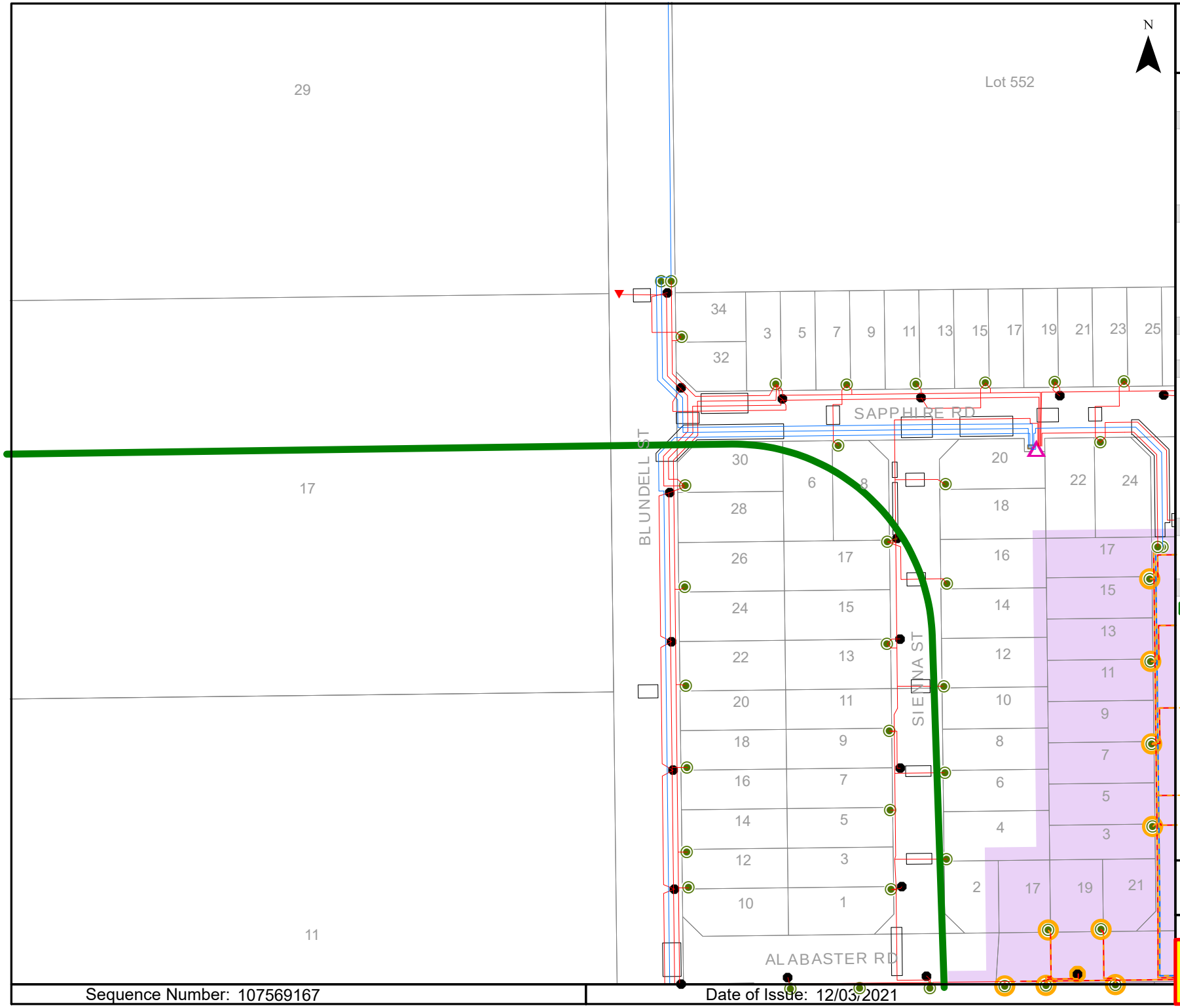

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UNDERGROUND LEGEND

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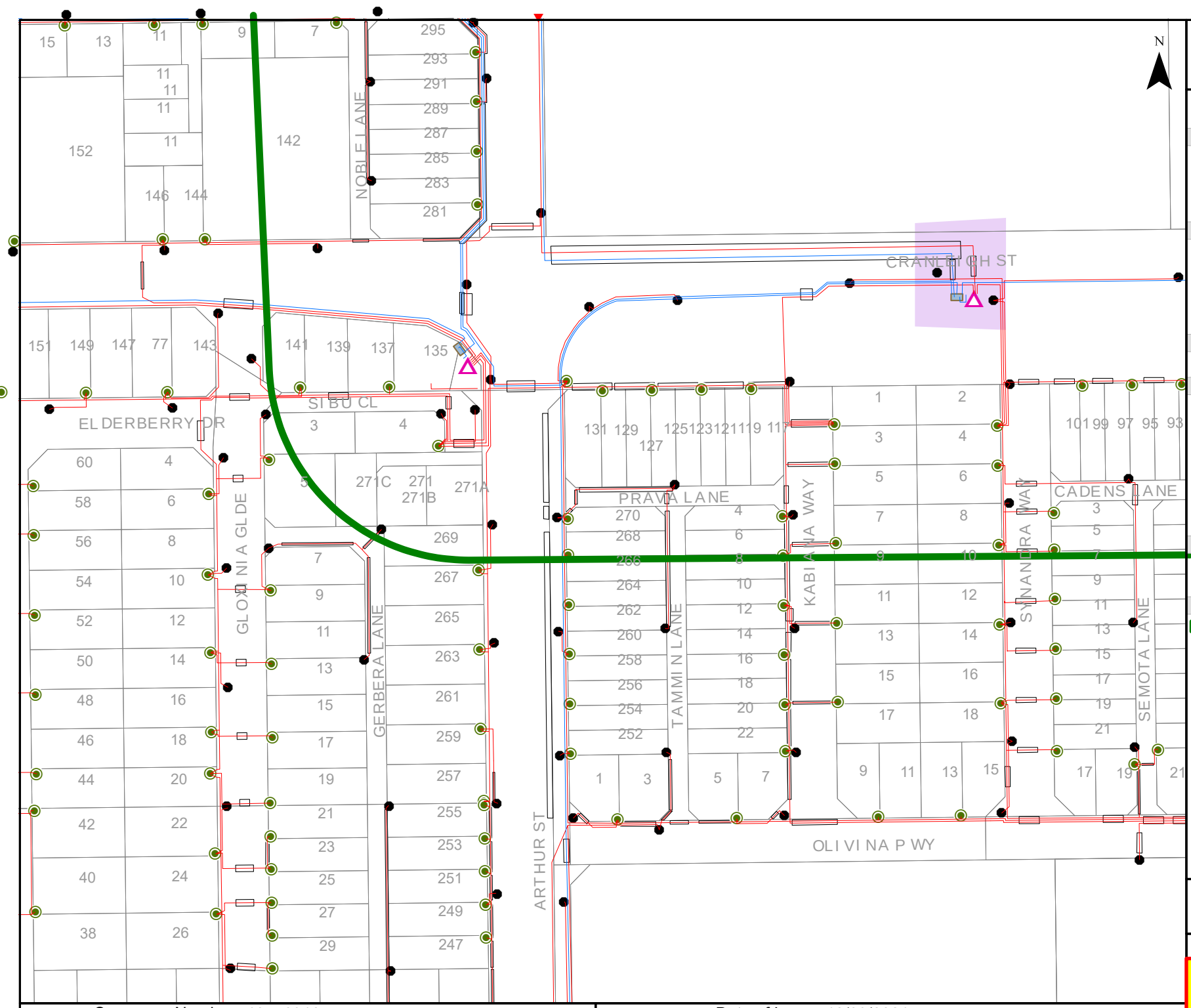

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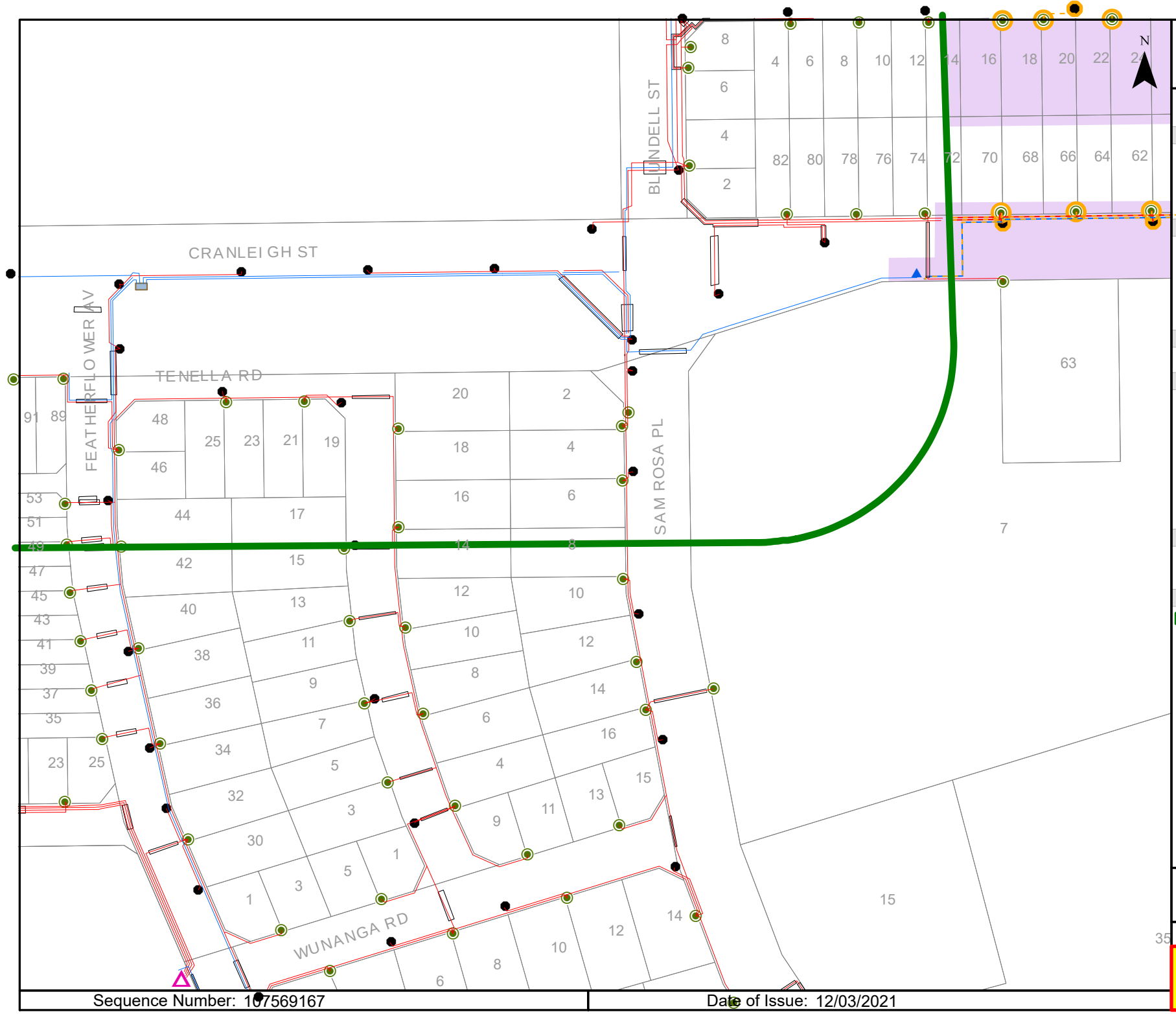

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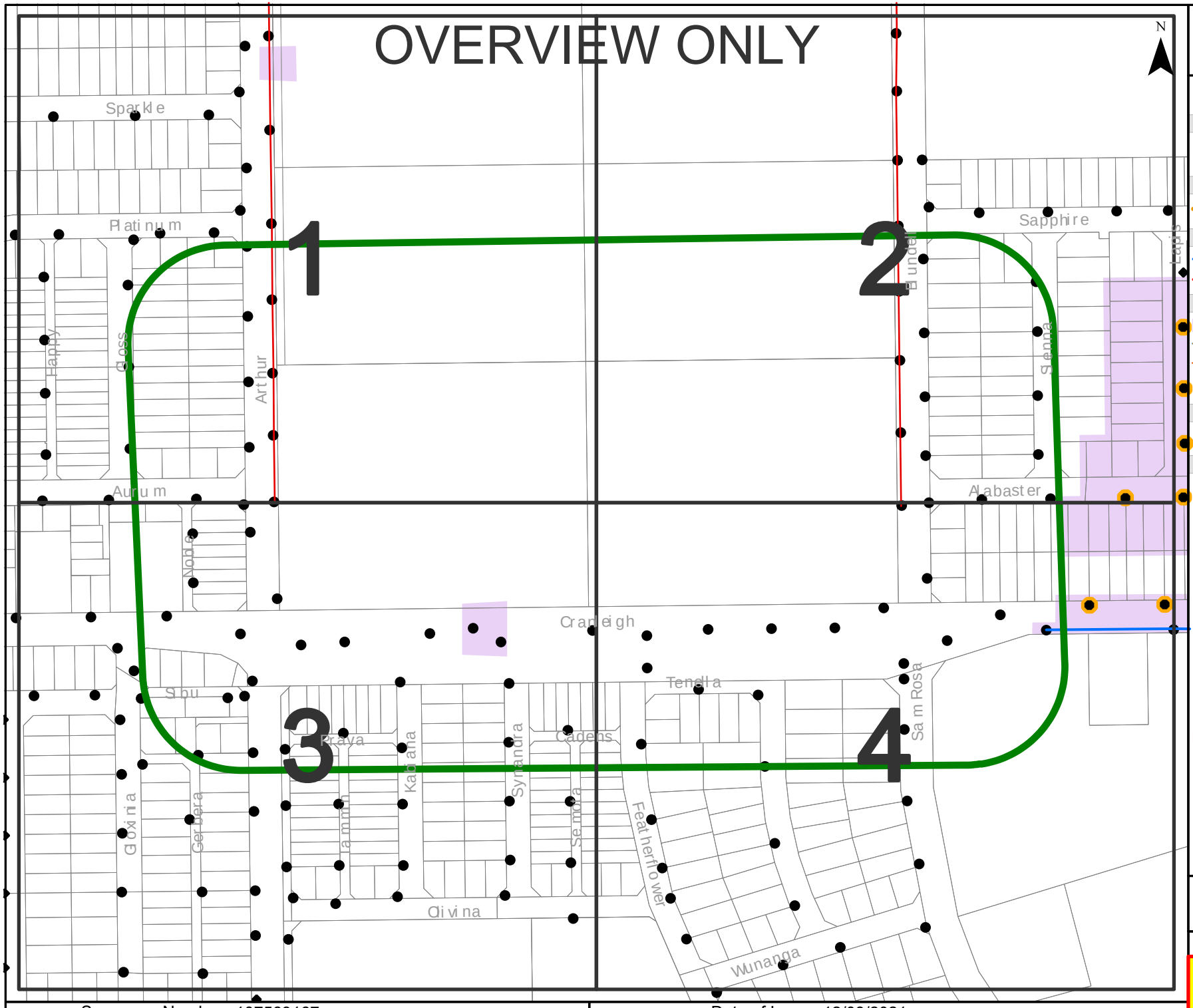

OVERHEAD LEGEND

Structures

- Power Pole
- Transmission Poles

Transmission Overhead Powerline

- Transmission (33kV - 330kV)

Distribution Overhead Powerline

- High Voltage (1kV - 33kV)
- Low Voltage (< 1kV)

Proposed Construction Assets

- Design Area *
- High Voltage Overhead Powerline
- Low Voltage Overhead Powerline
- Power Pole

Communications Assets

- Overhead Pilot Cable

Feature

- Area of Interest

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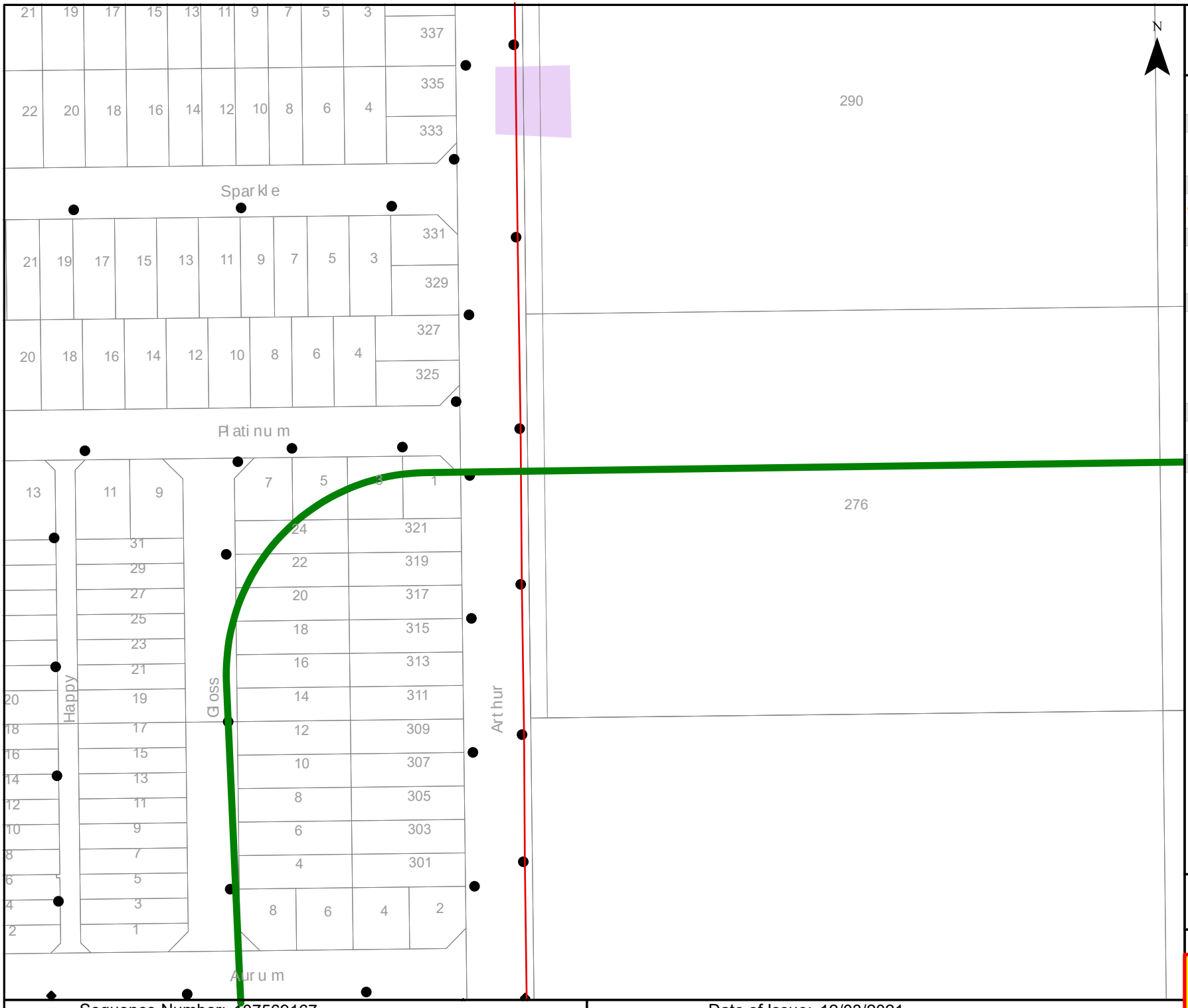

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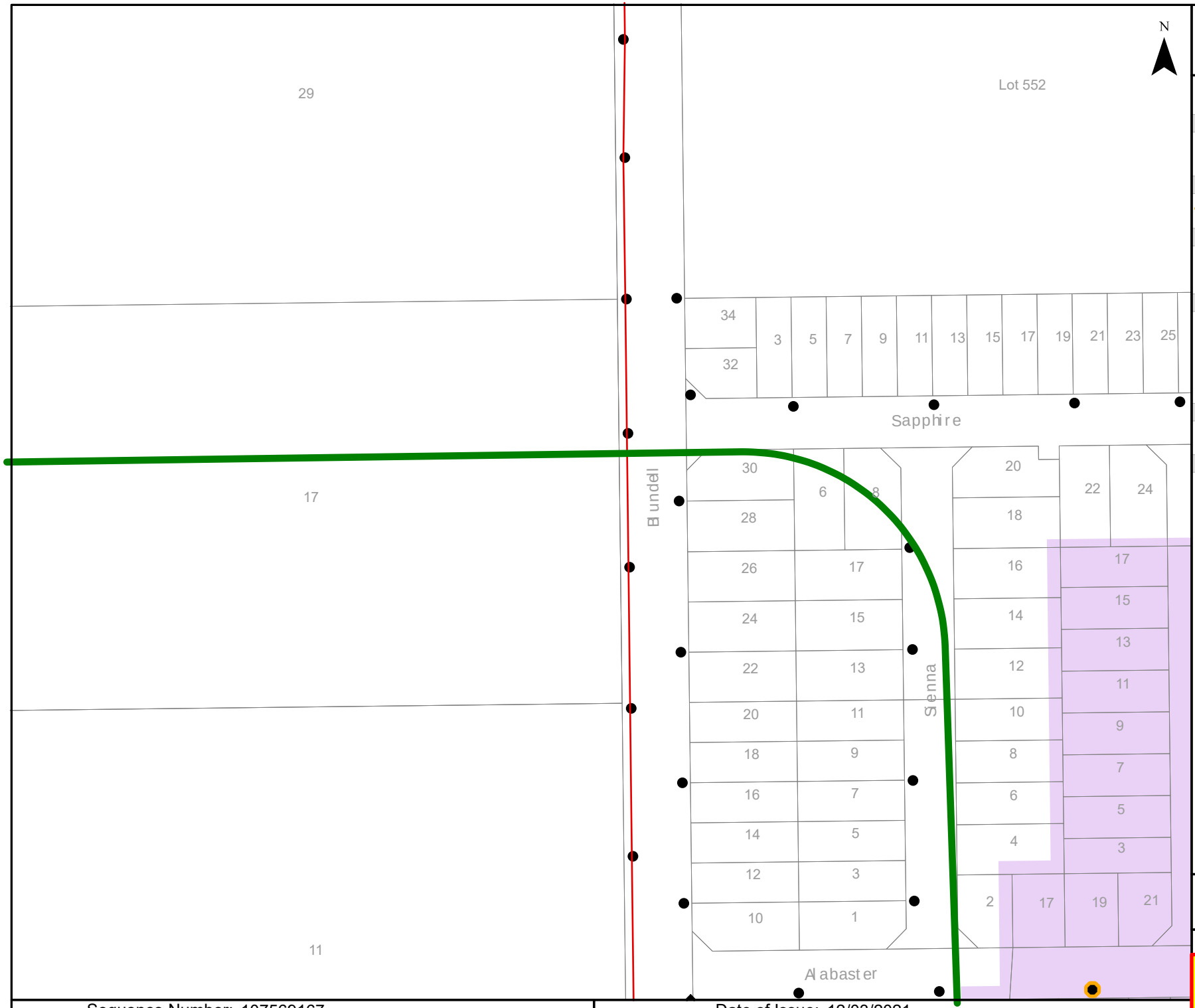

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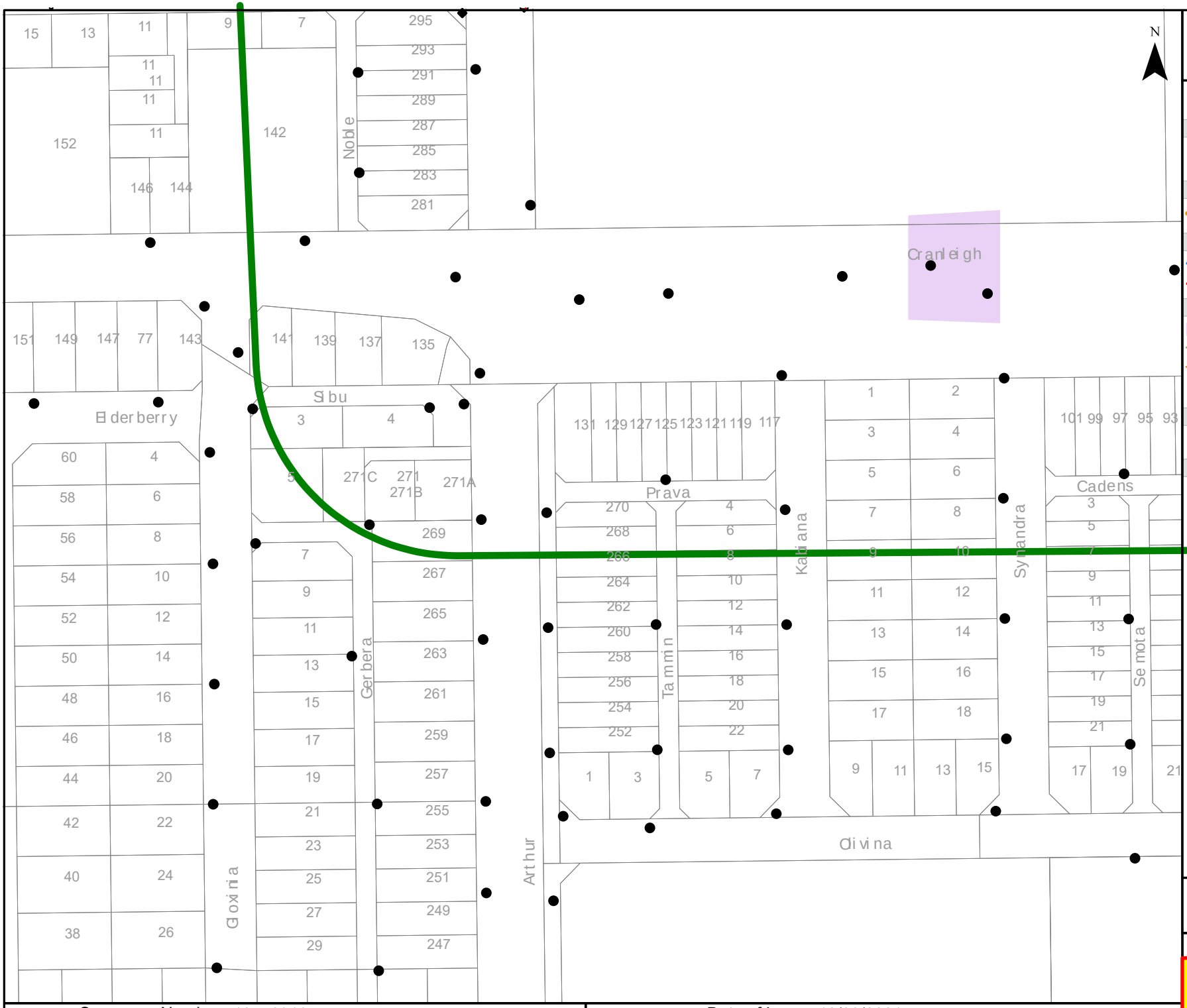

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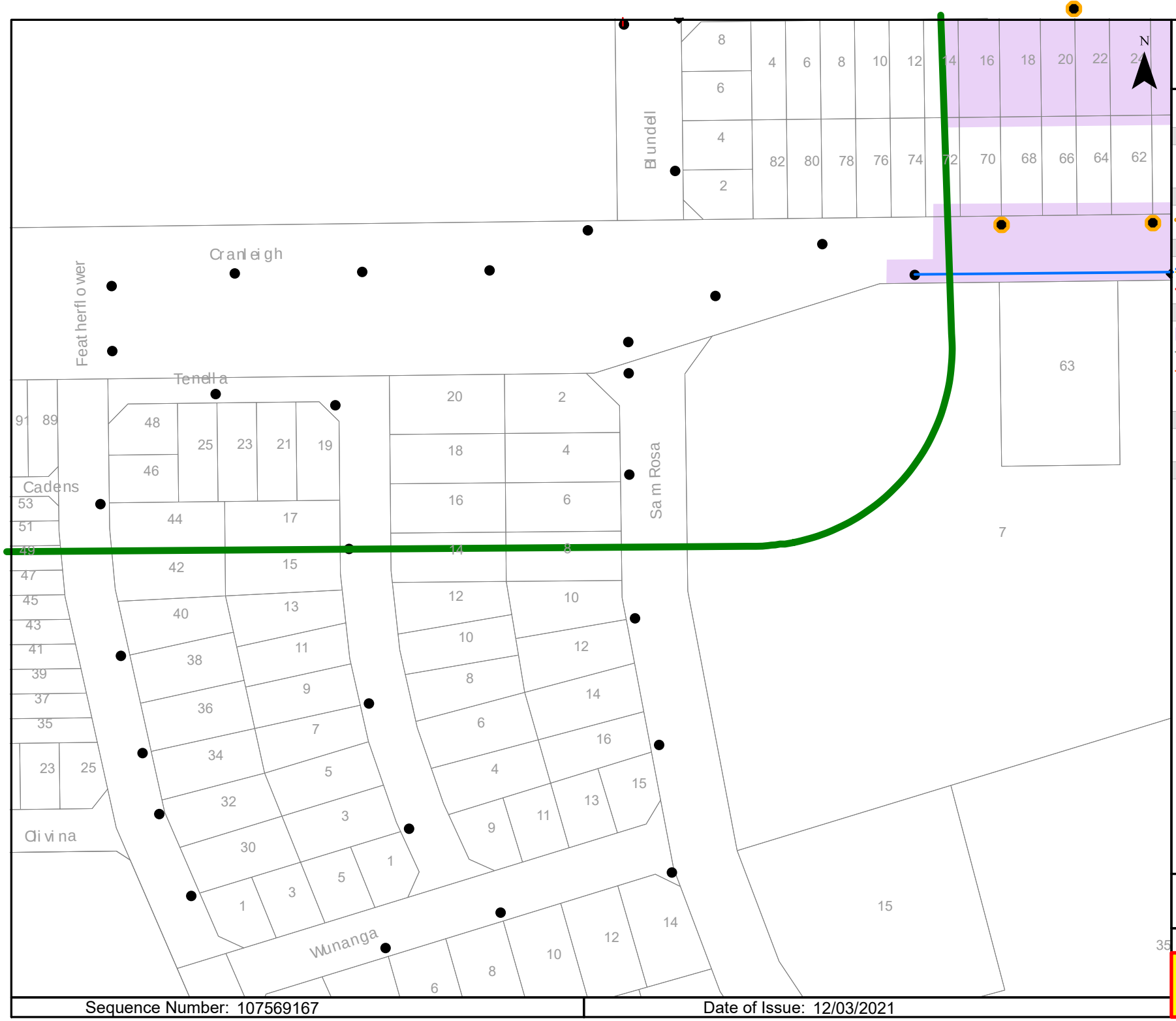

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WARNING! Look out for overhead power lines

Sequence Number: 107569167

Date of Issue: 12/03/2021

To: Mr Daniel Malone
Phone: 0423276268
Fax: Not Supplied
Email: daniel.malone2@stantec.com

Dial before you dig Job #:	21251545
Sequence #	107569174
Issue Date:	12/03/2021
Location:	Cranleigh Street , Dayton , WA , 6055

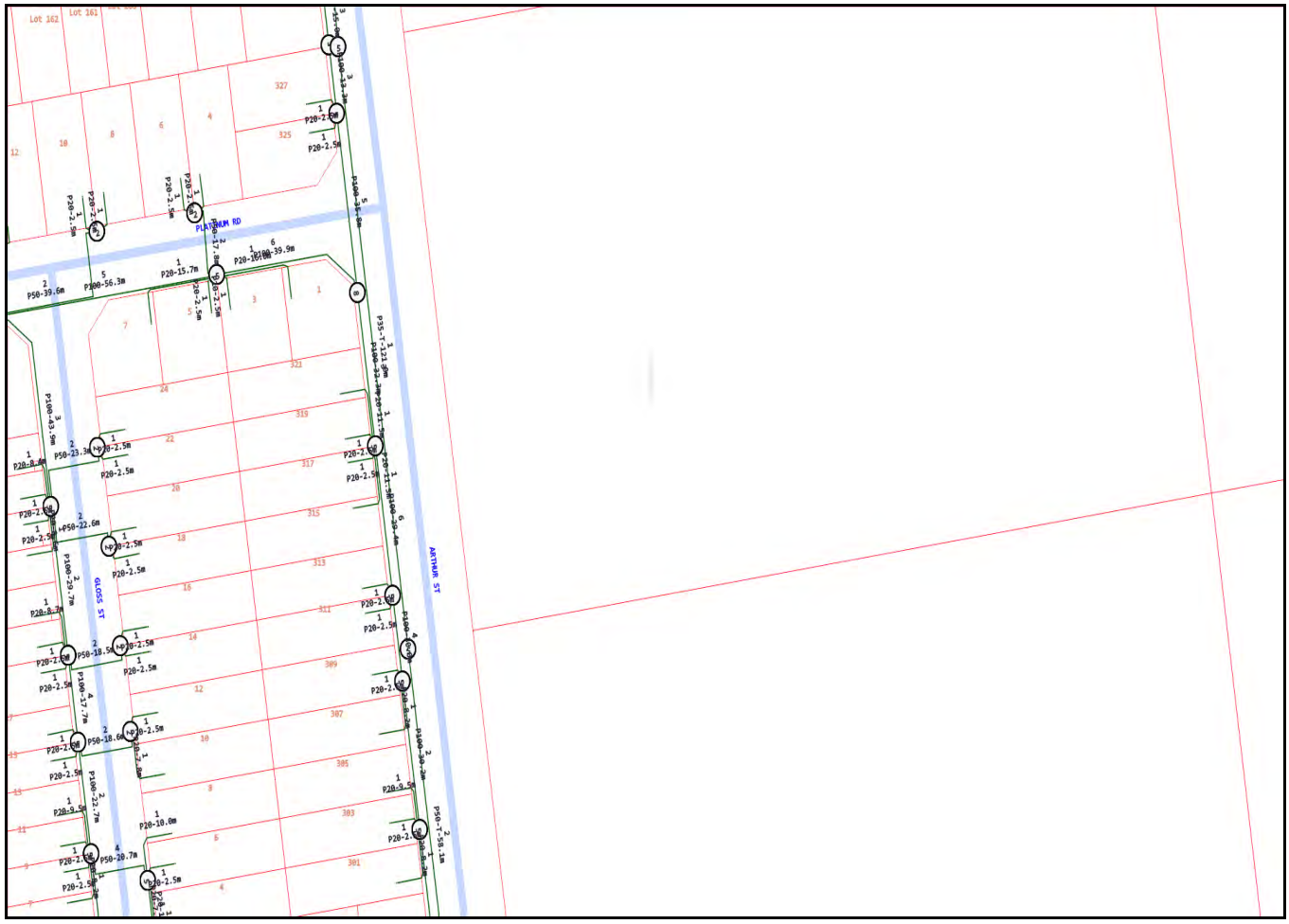
Indicative Plans

1	3
2	4

LEGEND

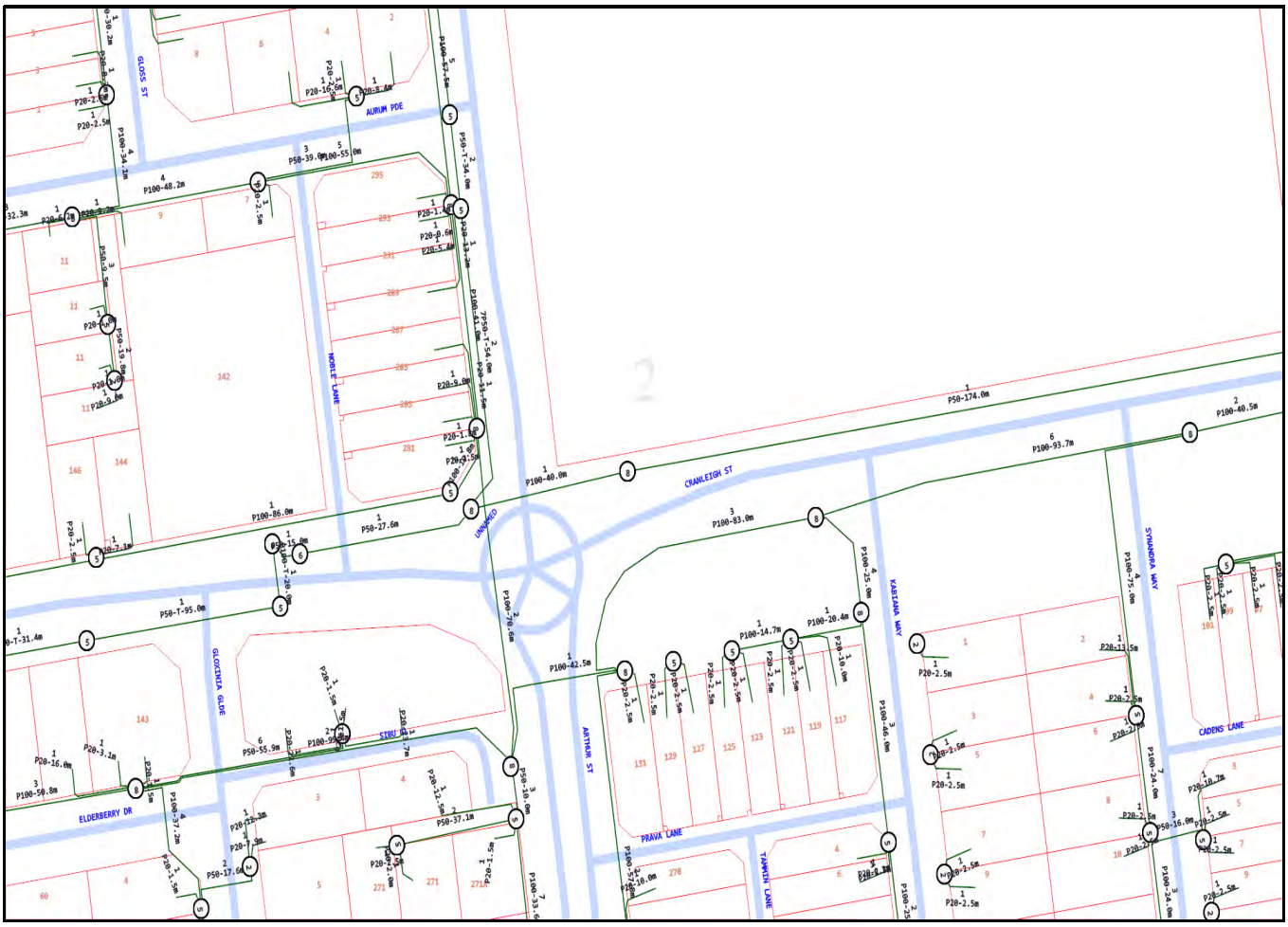
11	Parcel and the location
5	Pit with size "5"
2E	Power Pit with size "2E". Valid PIT Size: e.g. 2E, 5E, 6E, 8E, 9E, E, null.
	Manhole
	Pillar
2 PO – T- 25.0m P40 – 20.0m 5 9	Cable count of trench is 2. One "Other size" PVC conduit (PO) owned by Telstra (-T-), between pits of sizes, "5" and "9" are 25.0m apart. One 40mm PVC conduit (P40) owned by NBN, between pits of sizes, "5" and "9" are 20.0m apart.
2 10.0m 5 9	2 Direct buried cables between pits of sizes ,"5" and "9" are 10.0m apart.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Copper/RF/Fibre) cables.
5 9	Trench containing only DESIGNED/PLANNED (Copper/RF/Fibre/Power) cables.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Power) cables.
BROADWAY ST	Road and the street name "Broadway ST"
Scale	0 20 40 60 Meters 1:2000 1 cm equals 20 m

Email dbyd@nbnco.com.au Web www.nbn.com.au



Level 13, 100 Mount Street, North Sydney NSW 2060

Email dbyd@nbnco.com.au Web www.nbn.com.au



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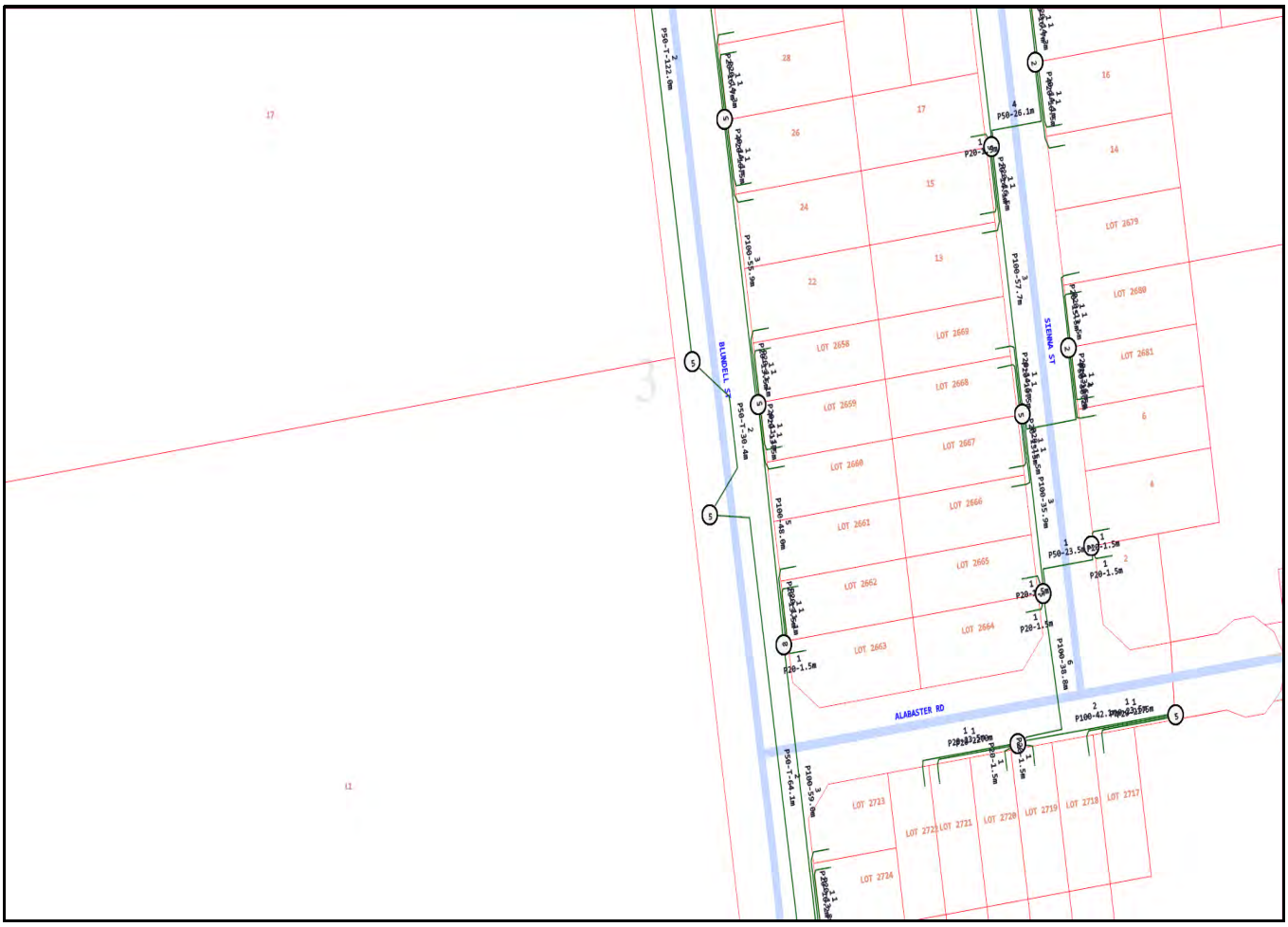

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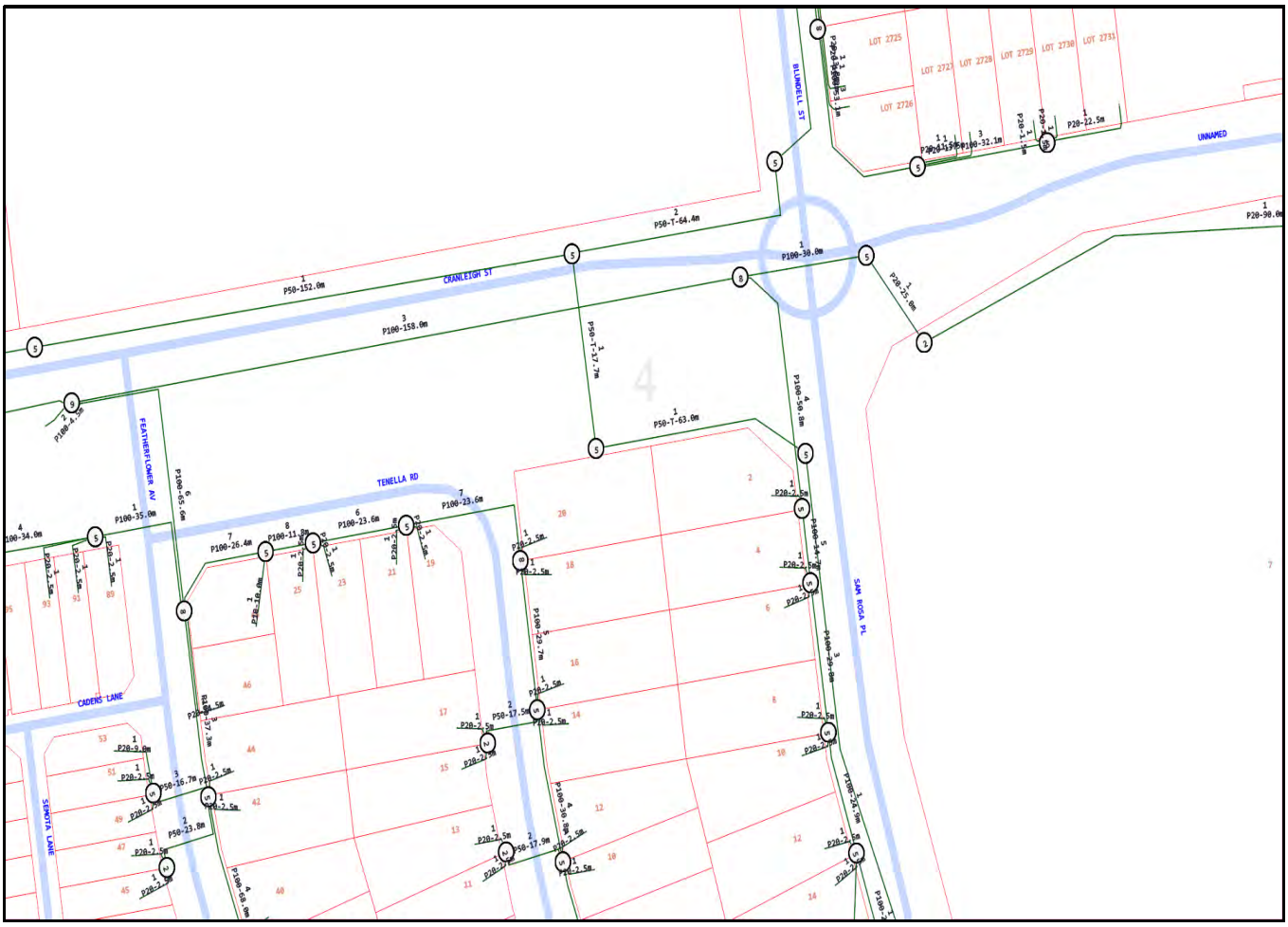


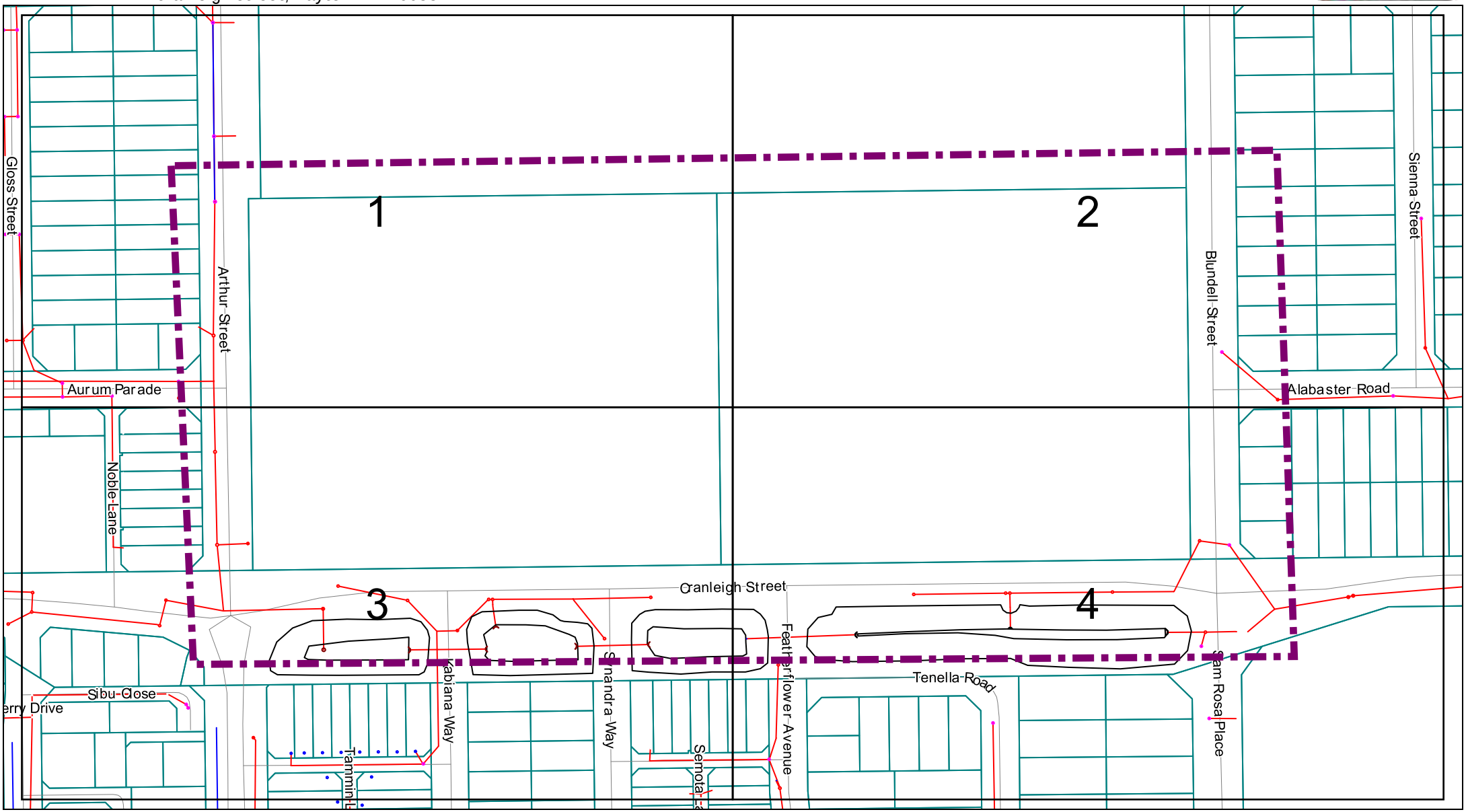
Emergency Contacts

You must immediately report any damage to the **nbn™** network that you are/become aware of. Notification may be by telephone - 1800 626 329.

Email dbyd@nbnco.com.au Web www.nbn.com.au

City of Swan – Assets Impacted

Location Address: Cranleigh Street, Dayton WA 6055



Sequence Number: 107569168 **Scale:** 1:2050 Overview

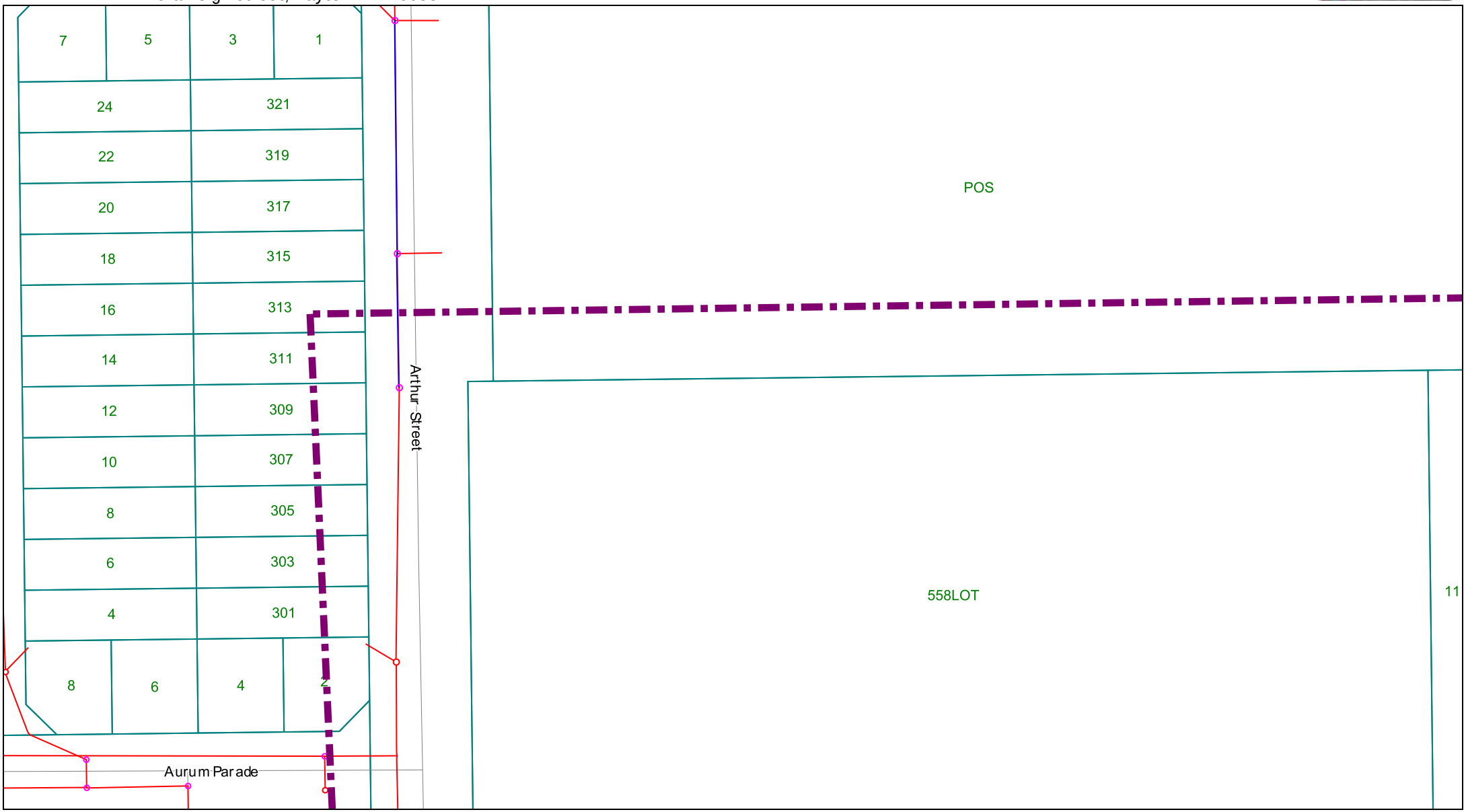
Job Number: 21251545 **Date Generated:** 12/03/2021

Legend

Pipe
Subsoil Pipe
Fibre Optic Pipe
Fibre Optic Pit
Gully
Reticulation
Special Projects
Manhole/Junction Pit
Side Entry Pit
Combined Side Entry Pit
Bubble Up Pit
Gross Pollutant Trap
Table Drain
Headwall
Water Corporation Drain

City of Swan – Assets Impacted

Location Address: Cranleigh Street, Dayton WA 6055



Sequence Number: 107569168 **Scale:** 1:1000 Tile: 1

Job Number: 21251545 **Date Generated:** 12/03/2021

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DBYD Response Plan Assets Impacted v4.0 (30/09/2015)

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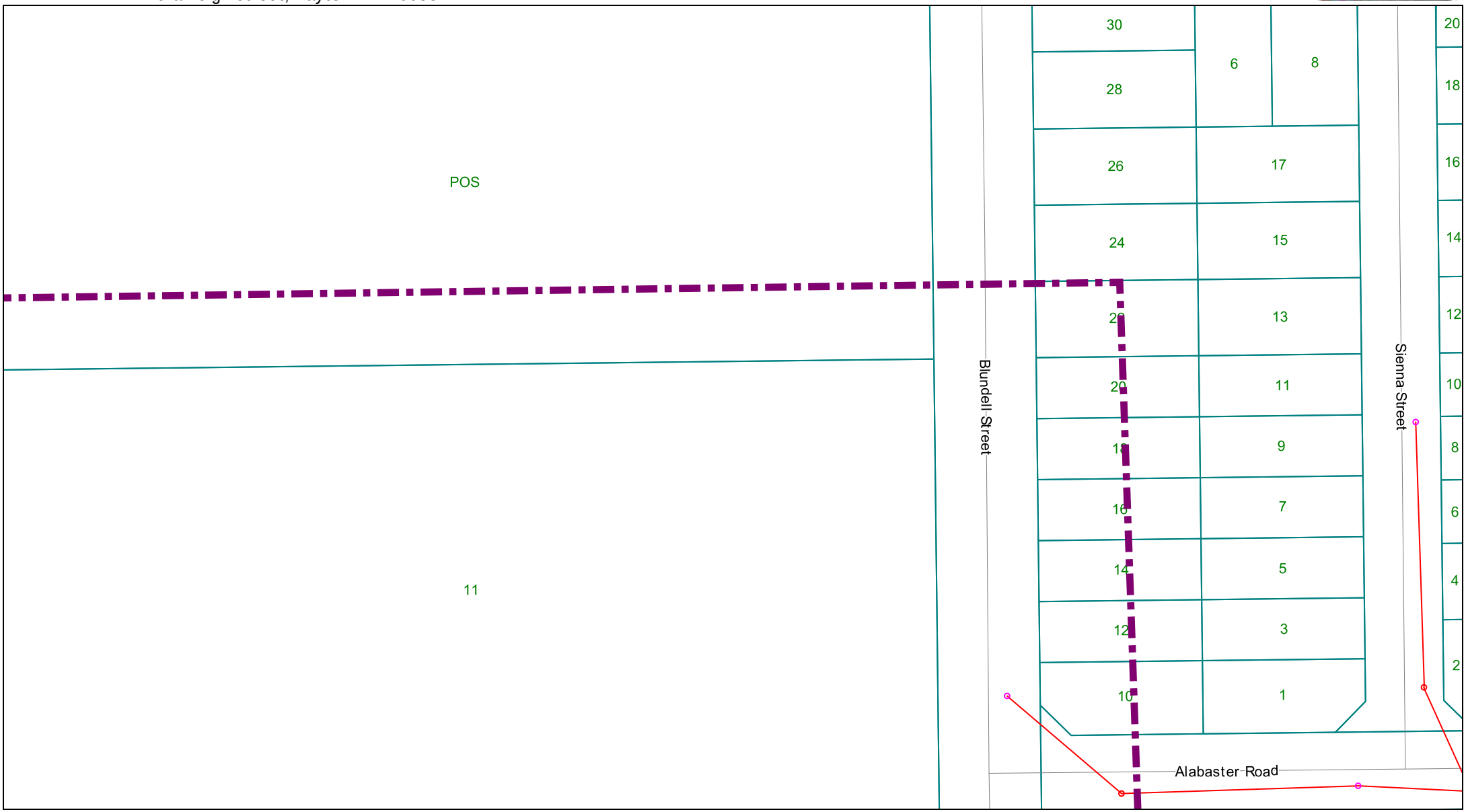
City of Swan – Assets Impacted

Location Address: Cranleigh Street, Dayton WA 6055



Sequence Number: 107569168 **Scale:** 1:1000 Tile: 2

Job Number: 21251545 **Date Generated:** 12/03/2021

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City of Swan – Assets Impacted

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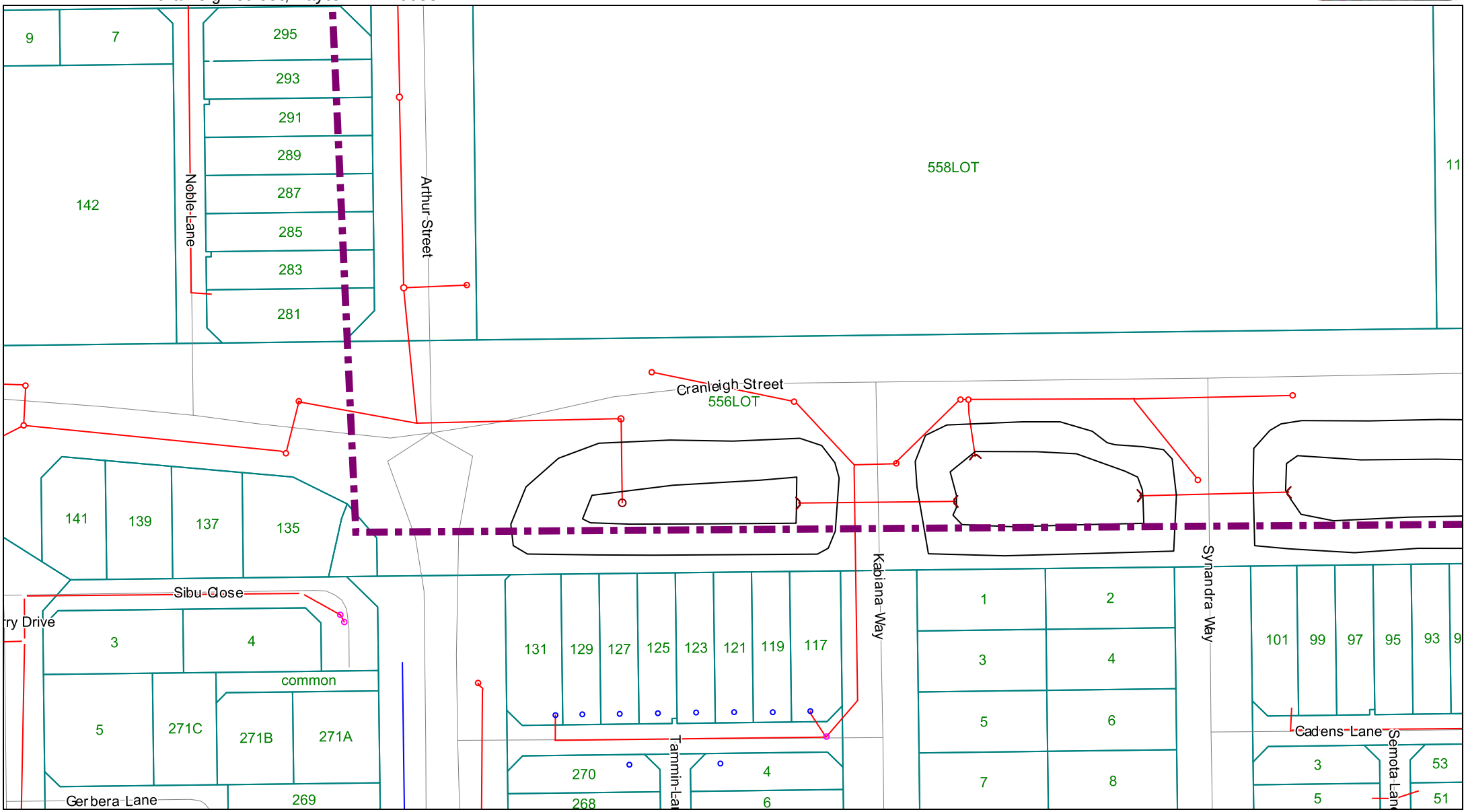

Sequence Number: 107569168 **Scale:** 1:1000 Tile: 3

Job Number: 21251545 **Date Generated:** 12/03/2021

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- Special Projects
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- Side Entry Pit
- Combined Side Entry Pit
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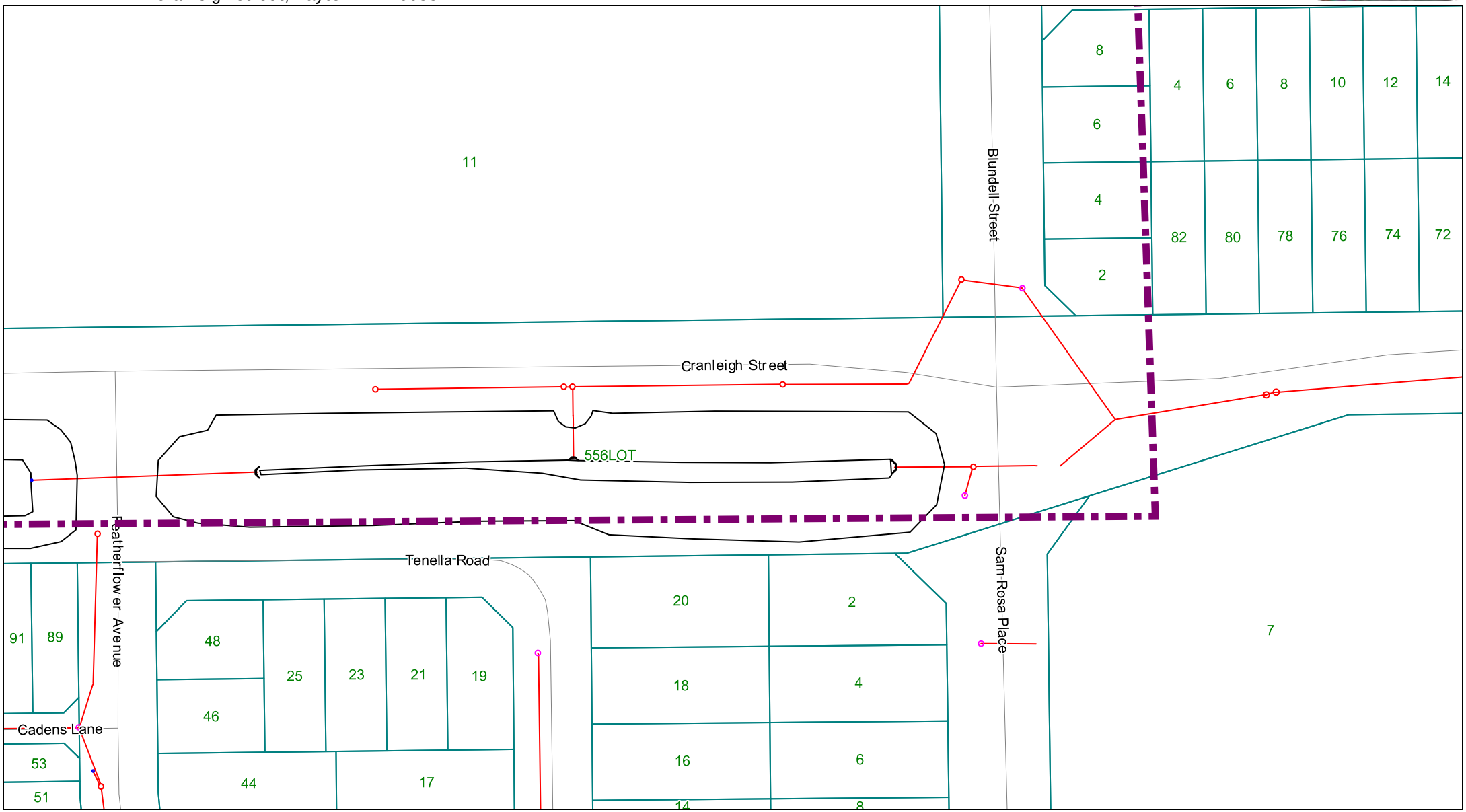
City of Swan – Assets Impacted

Location Address: Cranleigh Street, Dayton WA 6055



Sequence Number: 107569168 **Scale:** 1:1000 Tile: 4

Job Number: 21251545 **Date Generated:** 12/03/2021

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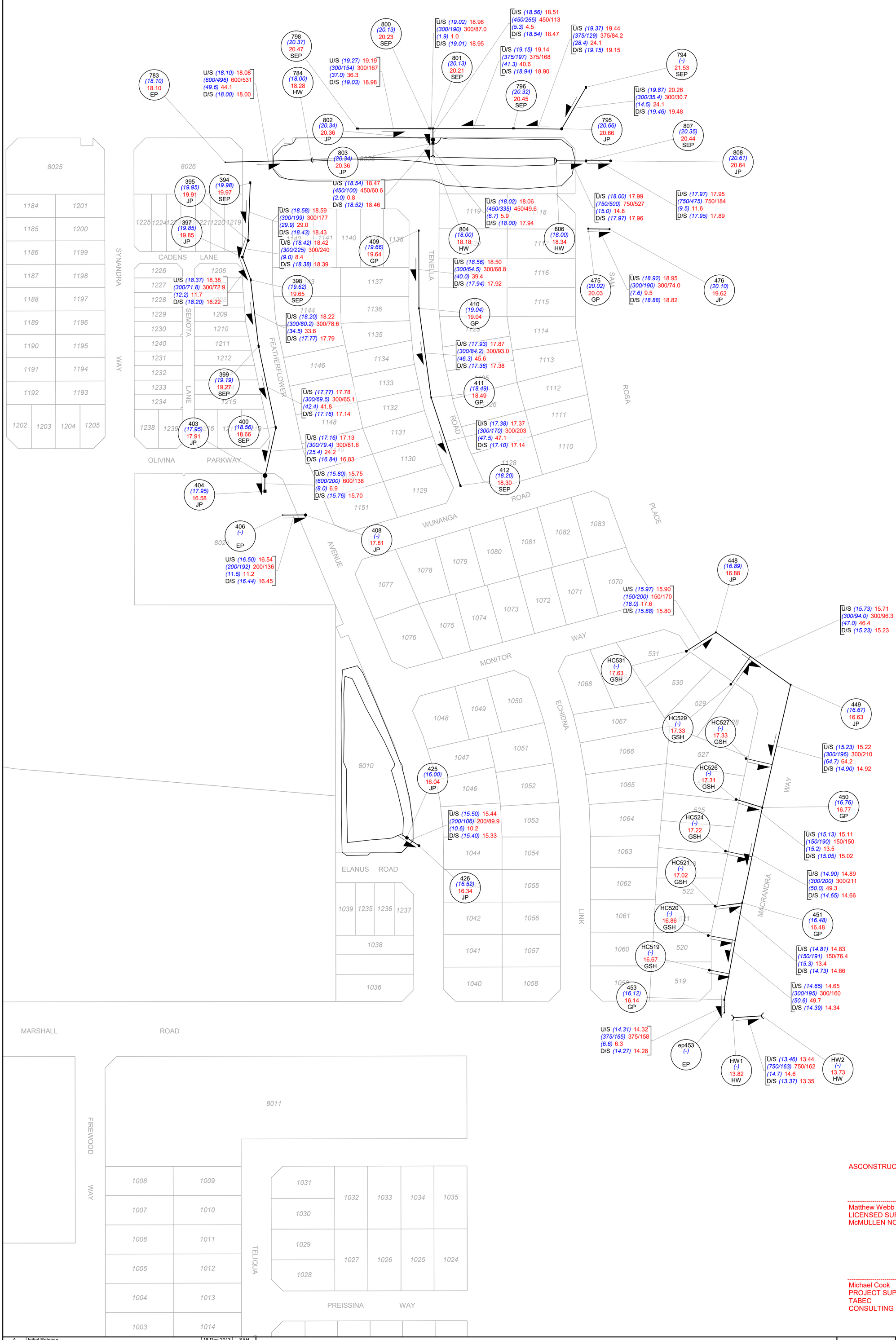

ASCONSTRUCTED

Matthew Webb
LICENSED SURVEYOR
McMULLEN NOLAN GROUP

DATE

Michael Cook
PROJECT SUPERINTENDENT
TABEC
CONSULTING ENGINEERS

DATE

Rev	Description	Date	By
A	Initial Release	18 Dec 2013	SAH

CITY OF SWAN
ST LEONARDS ESTATE, DAYTON STAGE 1L
DRAINAGE AS-CONSTRUCTED

LEGEND:
Design - (300/62.29)
Ascon - 300/61.92

MNG Ref:
93980AS-305A

N

Scale 1:1000
10 0 40
All distances are in metres

NAU, 20 Dec 2013, 10:35:43 AM

BLEND PAVEMENT TO EXISTING OVER 20.0m

EXTENSION OF ARTHUR ST UPGRADE BY OTHERS

LIMIT OF ROADWORKS CH 1881.0

FUTURE 2.3m D.U.P.

BY OTHERS U/S 17.33 750 /287 31.67 D/S 17.22

EXISTING BOUNDARY

ULTIMATE BOUNDARY

DRAINAGE PITS CSEG749, MH752, SEP754, OS1 AND CONNECTING DN750 PIPEWORK HAVE BEEN DESIGNED BY PRITCHARD FRANCIS ENGINEERS AND ARE TO BE CONSTRUCTED AS PER THEIR DRG No. '14-083 C5.02' & '14-083 C6.03'.

TRUNCATION IN LOT 565 WILL NOT BE PROVIDED AS PART OF THESE WORKS

TRUNCATION IN LOT 558 WILL NOT BE PROVIDED AS PART OF THESE WORKS

REMOVE TEMPORARY INTERSECTION PAVEMENT

INTERFACE WITH LOT 558 PART OF STAGE 1M WORKS

CRANLEIGH

ST

ARTHUR

WAY

PRAVA

SURPLUS EXISTING PAVEMENT TO BE REMOVED

EXISTING TELSTRA TO REMAIN

CAP PIPE

MATCHLINE (Drg 301)

MATCHLINE (Drg 300)

PLAN
1:500

REFER DRG No. 2223-1N-302 FOR NOTES & LEGEND

DIAL BEFORE YOU DIG www.1100.com.au

WAPC: 146365

SCALE 1:500 A1

No.	DATE	DRAWN	APPROVED	AMENDMENT	No.	DATE	DRAWN	APPROVED	AMENDMENT
2	10.07.14	RDE	xMC	ARTHUR ST ROUNDABOUT AMENDED.					
1	25.02.14	RDE	xMC	ARTHUR ST DRAINAGE AMENDED.					
0	03.12.13	RDE	MC	ISSUED FOR CONSTRUCTION.					
B	18.09.13	RDE	MC	ISSUED FOR APPROVAL.	4	26.08.14	AI	CCB	DRAINAGE LEVELS TO 'SEP 740' AMENDED
A	27.08.13	RDE	MC	ISSUED FOR COMMENTS.	3	18.08.14	AI	MC	ROUNDABOUT DRAINAGE BY OTHERS AMENDED.

CLIENT PROGRESS DEVELOPMENTS — ST LEONARDS

DESIGNED	CHECKED	APPROVED
RDE	MC	*M.COOK
DRAWN	CHECKED	DATE
RDE	MC	03.12.13

TABEC Civil Engineering Consultants
TABEC Pty Ltd ACN 090 796 204
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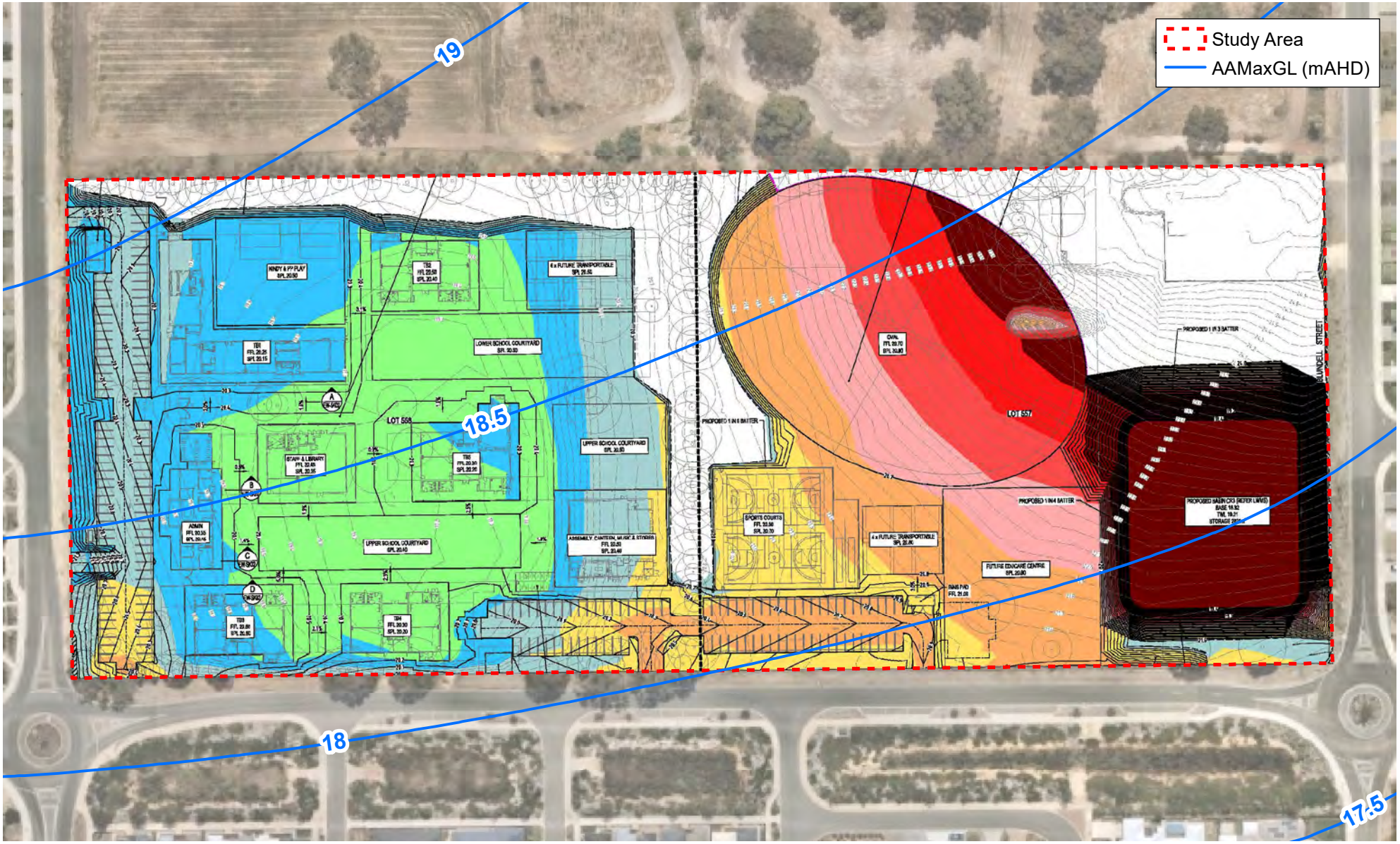
PROJECT ST LEONARDS ESTATE, DAYTON - STAGE 1N

TITLE ROADWORKS & DRAINAGE PLAN Sheet 2

DRAWING NUMBER 2223-1N-301 ISSUE 4

T:\Projects\2223\Design\CAD\Stage 1N\2223-1N-300-302.dwg 26/08/14 12:23:54 oldson

Appendix D Average Annual Maximum Groundwater Levels (AAMGLs)



Data Source:

Coordinate System: GDA 94, Zone 50

Job No. J7050
Scale: 1:1,605 @A4

0 20 40 60 80 Metres

N

Stantec
Dayton Primary School: Water Management Plan
Figure 1: Pre-Development AAMaxGL

Appendix E Preliminary Civil Plans

Design with
community in mind

Ground Floor
226 Adelaide Terrace
Perth WA 6000
Tel +61 +61 8 6222 7000

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Douglas Partners
Geotechnics | Environment | Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed Dayton Primary School
11 Blundell Street, Dayton, WA

Prepared for
Stantec Australia Pty Ltd

Project 201389.00
March 2021

Douglas Partners
Geotechnics | Environment | Groundwater

Document History

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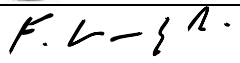
Revision 0	1	0	Gary Sollitt, Stantec Australia Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		12 March 2021
Reviewer		12 March 2021

bsi. ISO 9001 Quality Management
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Table of Contents

Report on Geotechnical Investigation
Proposed Dayton Primary School
11 Blundell Street, Dayton, WA

1. Introduction

This report presents the results of a geotechnical investigation undertaken for the proposed Dayton Primary School at 11 Blundell Street, Dayton, WA. The investigation was commissioned in an email dated 10 February 2021 by Gary Sollitt of Stantec Australia Pty Ltd and was undertaken in accordance with Douglas Partners' proposal P201389 dated 8 February 2021.

It is understood that the proposed development will include the construction of a several buildings, car parking areas, cricket nets, courts and an oval. it is understood that the abovementioned buildings are likely to vary between 1 and 2 storeys in height.

The purpose of the investigation was to assess the subsurface conditions beneath the site and thus provide comments on:

- Subsurface conditions, including areas of foundation risk, topsoil thickness, areas of uncontrolled fill, compressible layers or any other problematic ground conditions, if encountered, and make suggestions in terms of recommended strategies to address any identified risks;
- Site classification in accordance with AS 2870-2011 and measures that could be adopted to improve this classification, if required;
- Recommendations in terms of site preparation, including the possible re-use of existing materials as controlled fill, specification for any imported fill and the removal/treatment of any unsuitable materials encountered;
- Recommendations on suitable foundation systems and provision of geotechnical parameters for foundation design including allowable bearing pressures for pad and strip footings founded at 0.5 m and 1 m below finished floor levels;
- Estimated short and long-term settlements associated with the recommended founding systems, including potential differential settlements across the proposed structure;
- Recommendations in relation to the founding of slabs on ground and external pavements, including indicative external pavement CBR;
- A flexible pavement thickness design for the proposed internal roads and car parking areas based on the City of Swan standards and the geotechnical findings, and requirement for sub-soil drainage;
- Geotechnical parameters for retaining wall design calculations;
- A suitable design permeability rate across the site for the purposes of stormwater disposal design and comments on the suitability of soakwells and drainage basins for the purposes of stormwater disposal;
- The groundwater level beneath the site at the time of the investigation, if encountered, and evaluate whether dewatering is likely to be required during construction; and

- The presence of acid sulfate soils based on a review of desktop information and limited sampling and analysis.

The investigation included the excavation of 19 test pits together with Perth sand penetrometer (PSP) testing adjacent to the test pits, two in-situ infiltration tests and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the issues listed above.

2. Site Description

The site is bound by Arthur Street to the west, Cranleigh Street to the south, Blundell Street to the east and by vacant land to the north. At the time of the investigation, the site comprised vacant land, with a building and associated shed and tank at the north eastern corner (see Photo 1 below). Group of trees are shown along the northern, western and southern site boundaries, central portion and within the western half of the site.

Photo 1: View of the site from test location 18 looking northeast.

Based on a survey plan provided by the client, the western half of the site is generally flat at RL 22 m. The eastern half of the site generally slopes from RL 22 m along its western end to RL 27 m at the north eastern corner.

The published Perth 1:50,000 Environmental Geology sheet indicates that the site is underlain by Bassendean sand within its eastern half and some parts of the western half, and thin Bassendean sand over cohesive materials of the Guildford Formation elsewhere.

Published acid sulfate risk mapping indicates that the site is mapped as “moderate to low risk of acid sulfate soils occurring within 3 m of natural soil surface” at the site.

3. Field Work Methods

Field work was carried out on 15 and 16 February 2021 and comprised the excavation of 19 test pits, together with Perth sand penetrometer (PSP) testing adjacent to each test pit and two in-situ infiltration tests.

The test pits (test locations 1 to 19) were excavated to depths of between 1.5 m and 3 m using an 8 tonne excavator equipped with a 450 mm wide bucket, and were logged in general accordance with AS1726-2017 by an experienced geotechnical engineer from Douglas Partners. Test pit termination prior to the target depth due to collapse of the test pit walls below groundwater or on well cemented layers, was generally experienced, except at test locations 6, 13, 14 and 17 to 19. Soil samples were recovered from selected locations for subsequent laboratory testing.

The PSP tests were carried out adjacent to the test pits in accordance with AS 1289.6.3.3 to assess the in situ density of the subgrade soils.

Two in-situ infiltration tests (test locations 6 and 17) were carried out using the falling head method at depths of 1.8 m and 1.2 m below existing ground level, respectively. The location, depth of testing and results are discussed in Section 4.3.

Soil samples for acid sulfate soil analysis were recovered from 0.5 m intervals from test locations 1, 3, 5, 8, 11 and 15. Soil samples were placed into snap lock bags which were hand-pressed to expel excess air and labelled with a unique sample identification number. Samples were subsequently placed in a chilled insulated container for transport to Douglas Partners’ offices where they were frozen prior to dispatch to the laboratory.

Test locations were determined using GPS coordinates and site features, and are marked on Drawing 1 in Appendix B. Surface elevations at each test location were estimated from a survey plan provided by the client, and are quoted relative to Australian Height Datum (AHD).

4. Field Work Results

4.1 Ground Conditions

Detailed logs of the ground conditions and results of the field testing are presented in Appendix C, together with notes defining descriptive terms and classification methods in Appendix A.

The ground conditions generally comprised sand (mostly Bassendean Sand and some minor sand possibly from the Guildford Formation) overlain by a thin layer of topsoil. Cemented layers ('coffee rock') between 0.1 m and more than 1.25 m in thickness were recorded within the Bassendean Sand material within the western third of the site area. Clayey materials of the Guildford Formation were recorded underlying the Bassendean sand within the testing depth at three test locations (6, 8 and 9), from depths of between 1.8 m and 2.1 m below existing ground levels.

A summary of the encountered ground conditions is given below.

- **SANDY TOPSOIL (SAND SP-SM) –** 100 mm to 200 mm thick, fine to medium grained sand, dark grey-brown, with silt, trace gravel and rootlets, at all test locations with the exception of test locations 1 and 6.
- **Unit 1: SANDY FILL (SAND SP-SM) –** fine to medium grained sand, grey-brown, with silt, trace gravel and rootlets, encountered at test locations 1 and 6 to depths of 0.25 m and 0.8 m, respectively. Building materials and large pieces of concrete slabs were recorded within the fill.

  The sandy fill was loose becoming medium dense from 0.3 m depth (refer to Table 1 next page for thicknesses and levels of loose zones).

- **Unit 2: SAND SP-SM –** fine to medium grained sand, grey and yellow -brown, with some fines, encountered at all test locations, to depths of between 1.8 m and a maximum test termination depth of 2.9 m below existing surface levels.

  Weakly cemented to well cemented Silty SAND SM layers (coffee rock) approximately varying between 0.1 m and more than 1.25 m in thickness, were recorded within the Unit 2 material within the western third of the site area.

  The Unit 2 sand was generally medium dense to dense. However, a shallow surficial loose layer varying between 0.3 m and 0.9 m in thickness, was recorded at test locations 2, 3, 8 to 12 and 18. The only exceptions were test locations 14 to 17 and 19 (within proposed oval, courts and car parking areas) where increased thicknesses of loose sand (between 1.3 m and 2.4 m) were recorded. Refer to Table 1 next page for thicknesses and levels of loose zones.

- **Unit 3: Clayey SAND SC and SAND SP-SC (Guildford Formation)**: generally medium dense, fine to medium grained sand, low plasticity clay, grey mottled blue, encountered underlying the Unit 2 sand at test locations 6, 8 and 9, to a maximum test termination depth of 3 m.

Table 1: Summary of Depth of Loose Zones and Approximate Relative Levels

Test Location	Surface Level (m AHD) [1]	Loose Zones		
		Depth to Base (m)	Level (m AHD)	
		To	From	To
2	22.0	0.45	22.0	21.55
3		0.3	22.0	21.7
6		0.3	22.0	21.7
8		0.45	22.0	21.55
9		0.3	22.0	21.7
10		0.6	22.0	21.4
11		0.45	22.0	21.55
12		0.45	22.0	21.55
14	22.9	1.25	22.9	21.65
15	22.5	1.3	22.5	21.2
16	22.3	1.6	22.3	20.7
17	22.8	1.5	22.8	21.3
18	23.7	0.9	23.7	22.8
19	23.5	2.4	23.5	21.1

Note: [1] Surface level estimated from a survey plan provided by the client.

4.2 Groundwater

Groundwater was observed within the majority of the test pit locations excavated within the western half of the site, during the field work undertaken on 15 and 16 February 2021, as summarised in Table 2 next page. The test pits were immediately backfilled following sampling, which precluded any longer-term monitoring of groundwater levels.

Table 2: Summary of Groundwater Observations

Test Location	Surface Level (m AHD)[1]	Groundwater Depth (m)	Approximate Groundwater Level (m AHD)
1	22.0	2.05	19.95
2		2.00	20.00
3		2.40	19.60
4		2.40[2]	19.60[2]
5		2.80	19.20
6		2.10[2]	19.90[2]
8		1.95[2]	20.05[2]
9		1.75[2]	20.25[2]
12		1.90[2]	20.10[2]

Notes: [1] Surface level estimated from a survey plan provided by the client.
[2] Groundwater seepage.

It should be noted that groundwater levels are potentially affected by various factors such as climatic conditions and land usage, and will therefore vary with time.

4.3 Results of Infiltration Testing

Two in-situ infiltration tests were carried out in the vicinity of test locations 6 and 17 using the falling head method, at depths of 1.8 m and 1.2 m below existing ground level, respectively. Field permeability values were estimated using a method based on Hvorslev (1951) and Ritzema (1994). Permeability can also be estimated from particle size distribution test results from samples taken from the same depths at infiltration test locations, using the Hazen's formula. The Hazen's formula provides an indication of the permeability for clean sand with rounded particle shape in loose conditions, and therefore its applicability to the site conditions should be considered with caution. Table 3 below summarises the permeability results.

Table 3: Summary of Permeability Analysis

Test Location	Depth (m)	Measured Permeability[1]		Derived Permeability[2]		In situ Conditions of Tested Material
		(m/s)	(m/day)	(m/s)	(m/day)	
6	1.8	1.6×10^{-5}	1	2.3×10^{-4}	19	Unit 2: SAND SP, trace silt, medium dense
17	1.2	9.0×10^{-5}	8	9×10^{-4}	>25	Unit 2: SAND SP, trace silt, loose

Notes: [1]: In situ permeability (Hvorslev).
[2]: Hazen's formula (assumes sand in loose condition, with rounded sand particles).

5. Geotechnical Laboratory Testing

5.1 Geotechnical

A geotechnical laboratory testing programme was carried out on selected soil samples by a NATA registered laboratory, and comprised the determination of:

- For soil identification and permeability assessment:
  - the particle size distributions of five samples;
  - the Atterberg limits and linear shrinkage of two samples;
  - Organic content of five topsoil samples; and
  - pH and sulfate on three soils samples.
- For assessment of pavement design parameters:
  - The soaked California bearing ratio (CBR) on one sample;
  - The modified maximum dry density (MMDD) on one sample; and
  - The optimum moisture content on one sample.

Detailed test report sheets are given in Appendix D and the results are summarised in Table 4 below and Tables 5 and 6 next page.

Table 4: Results of Laboratory Testing for Soil Identification

Test Location	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	D_{10}	D_{60}	LL (%)	PL (%)	PI (%)	LS (%)	OC (%)	Material
2	0.1	-	-	-	-	-	-	-	-	-	2.1	TOPSOIL/SAND SP-SM
4	0.1	-	-	-	-	-	-	-	-	-	4.4	
6	1.8	5	95	0	0.15	0.42	-	-	-	-	-	Unit 2: SAND SP, trace silt
	2.0	19	81	0	-	0.36	21	13	8	1.5	-	Unit 3: Clayey SAND SC
7	0.1	-	-	-	-	-	-	-	-	-	3.0	TOPSOIL/SAND SP-SM
9	2.0	20	80	0	-	0.34	22	13	9	2.5	-	Unit 3: Clayey SAND SC
11	0.1	-	-	-	-	-	-	-	-	-	4.7	TOPSOIL/SAND SP-SM
15	0.1	-	-	-	-	-	-	-	-	-	1.3	
16	0.5	3	97	0	0.20	0.50	-	-	-	-	-	Unit 2: SAND SP, trace silt
17	1.2	2	98	0	0.30	0.55	-	-	-	-	-	

Notes Fines are particles smaller than 75 µm.
Sand is particles larger than 75 µm and smaller than 2.36 mm.
Gravel is particles larger than 2.36 mm and smaller than 63 mm.
A D_{10} of 0.15 mm means that 10% of the sample particles are less than 0.15 mm.
A D_{60} of 0.42 mm means that 60% of the sample particles are less than 0.42 mm.
LL – Liquid Limit PL – Plastic limit PI – Plasticity index LS – Linear shrinkage
OC – Organic content
- Not tested.

Table 5: Results of Compaction and CBR Testing

Test Location	Depth (m)	Modified Max. Dry Density (t/m³)	Optimum Moisture Content (%)	CBR (%)	Swell (%)	Material
16	0.5	1.72	15.5	12[1]	0	Unit 2: SAND SP, trace silt

Note [1] Sample compacted at 95% of modified maximum dry density.
CBR: California bearing ratio.

Table 6: Results of Laboratory Testing for Soil Aggressivity

Test Location	Depth (m)	Soil Description	Soil Condition[1]	Exposure Classification			
				Concrete		Steel	
				pH	SO4 (mg/kg)	pH	Cl (mg/kg)
2	1.0	Unit 2: SAND SP	B	6.0	<10	6.0	<10
6	2.0	Unit 3: Clayey SAND SC		6.9	49	6.9	53
9	2.0	Unit 3: Clayey SAND SC		6.2	31	6.2	47

Notes: [1]: Soil Type based on guideline presented in AS 2159-2009 and summarise below:
Soil Type A – High permeability soils (e.g. sands and gravels) which are in groundwater.
Soil Type B – Low permeability soils (e.g. silts and clays) or all soils above groundwater.
Scale of aggressivity based on threshold values given in AS 2159-2019

Non-aggressive	Mild	Moderate	Severe	Very Severe

5.2 Acid Sulfate Soil

Acid sulfate soil screening tests were undertaken on all soil samples retrieved from test locations 1, 3, 5, 8, 11 and 15.

Acid sulfate soil screening tests were undertaken on selected soil samples by the MPL Laboratories Pty Ltd (MPL). The screening tests comprised measurement of pH of the soil in water (pH_F) and the pH of the soil after oxidation with a 30% solution of hydrogen peroxide (pH_{FOX}). The results of these tests provide an indication of the presence of actual and potential acid sulfate soils and should be considered as qualitative only.

The screening test results were assessed for the possible presence of actual acid sulfate soil (AASS) or potential acid sulfate soil (PASS) on the basis of the following guidance indicators specified in the DWER (June 2015), namely:

- $pH_F < 4$ strongly indicates oxidation has occurred in the past and that AASS are likely to be present; and
- $pH_{FOX} < 3$ plus a pH_{FOX} reading at least one pH unit below the corresponding pH_F, plus a strong reaction with peroxide, strongly indicates the presence of PASS.

Following the review of the screening test results, selected soil samples were submitted to MPL Laboratories to undergo the Chromium suite of testing. This laboratory test quantifies the existing acidity and potential acidity derived from sulfide oxidation which is reported as a net acidity. Soil samples were selected for laboratory analysis with due consideration of the following:

- Screening results, with particular focus on the lowest reported pH_F or pH_{FOX} within a soil stratum;
- Reported reaction strength; and
- Visual properties of the soils encountered.

If the net acidity, calculated from the results of the titratable actual acidity (TAA) and the chromium reducible sulfur (S_{CR}) is greater than the appropriate action criterion for the amount of disturbance, it is considered that acid sulfate soils are present and excavations within this material would require specific management. In this regard, the most conservative action criterion of 0.03% S has been adopted for the assessment.

With reference to summary of acid sulfate soil results presented in Table F-1, Appendix F, the following comments are made:

- The results for pH_F are not indicative of actual acid sulfate soils conditions at the sampling locations;
- The results for pH_{FOX} are not indicative of potential acid sulfate soils conditions at the sampling locations; and
- The calculated net acidity is below the adopted action criterion of 0.03% S for all samples submitted for analysis.

6. Proposed Development

It is understood that the proposed development will include the construction of:

1. Within Lot 558
    - o a staff and library building;
    - o five teaching blocks;
    - o an assembly building (with canteen and music room); and
    - o new car parking areas off Arthur and Cranleigh Streets.

    It is understood that the above listed buildings are likely to vary between 1 and 2 storeys in height.
2. Within Lot 557
    - o new cricket nets and sports courts; and
    - o a new oval.

7. Comments

7.1 Site Classification

The site with the exception of the proposed oval, is classified as 'Class A' in accordance with AS2870, following suitable site preparation as described in Section 7.2.

The area beneath the proposed oval is classified as 'Class P', because some loose natural sand of Unit 2 will possibly remain at depth following the site preparation suggested in Section 7.2 for the proposed oval. However, an amendment of the site classification of this area to 'Class A', if required, would be possible following some relatively minor but specific site preparation that is not warranted for a sport oval and is therefore not discussed in this report. A suitable site preparation would likely be specific to the proposed development or buildings in this area.

It is noted that AS 2870 applies to single houses, townhouses and the like classified as Class 1 and 10a under the Building Code of Australia. It also applies to light industrial and commercial buildings if they are similar in size, loading and superstructure flexibility to those designs included in AS 2870.

7.2 Site Preparation

It is recommended that all site works be undertaken under the supervision of an experienced geotechnical engineer.

Prior to buildings, cricket nets, courts and pavements construction, all topsoil and vegetation should be stripped from building, cricket nets and court envelopes and pavement areas and stockpiled for possible re-use, if applicable as described in Section 7.6. Topsoil was recorded to be approximately between 100 mm to 200 mm thick at the majority of the test locations. Any areas of deeper organic materials encountered during topsoil and vegetation stripping should be removed. The sandy fill of Unit 1 encountered at test location 6 to 0.8 m depth, is considered to be an unsuitable material because it includes large concrete slab pieces, and should also be excavated and chased up from the proposed building envelope, treated and re-used as described in Section 7.7.

Possible tree roots remaining from any clearing operations should be completely removed, and the excavations backfilled with material of similar geotechnical properties to the surrounding ground, and compacted to achieve a dry density ratio of not less than 95% relative to modified compaction.

It is recommended that following stripping, the natural subgrade be assessed by a geotechnical engineer to determine whether previous natural topsoil, vegetation, roots or unsuitable fill remain at subgrade level. Any such materials will require removal and the excavations backfilled with material of similar geotechnical properties to the surrounding ground.

Based on the findings of the investigation, the ground beneath the site is likely to generally include:

- shallow loose soils recorded at various locations during the ground investigation to depths up to 0.6 m below existing ground levels within the western half of the site increasing in thickness within the eastern half of the proposed development area, to depths of:

  - up to 1.6 m below existing ground levels within the proposed pavement, cricket nets and courts footprints; and
  - up to 2.4 m below existing ground levels within the proposed oval footprint; overlying

- medium dense to dense soils of Units 2 and 3 to a maximum test termination depth of 3 m below existing surface level, including weakly cemented to well cemented Silty SAND SM layers (coffee rock), approximately varying between 0.1 m and more than 1.25 m in thickness.

The density and strength of the abovementioned loose materials require some improvement, prior to construction of the proposed buildings, pavements, cricket nets and courts. Given the relatively shallow depth of the loose materials with the exception of the proposed oval footprint, and considering the nature of the proposed pavements, cricket nets and courts, it is considered that a compaction strategy using a heavy roller, complemented with hand compaction of all building footing excavations, as detailed below, should be suitable to densify the loose soils for the proposed buildings, pavements, cricket nets and courts.

Beneath the proposed oval footprint, surface proof-compaction using a heavy roller as discussed above in this section, is anticipated to be suitable without any further requirements. However, some loose to medium dense sand is anticipated to remain at depth within some portions of the proposed oval footprint, following the abovementioned proof-compaction.

Prior to excavation for foundations and pavements construction, it is recommended that the exposed subgrade beneath the proposed building, cricket nets and court envelopes, oval and pavement areas be proof compacted using a heavy (say 16 tonne) vibrating smooth drum roller. Any areas that show signs of excessive deformation during compaction should be continually compacted until deformation ceases or, alternatively, the poor quality material could be excavated and replaced with suitable structural fill compacted to achieve a dry density ratio of not less than 95% relative to modified compaction.

Following excavation for footings, it is recommended that the base of every footing excavations be inspected by an experienced geotechnical engineer to ensure that suitable foundation soils occurs. The base of all footing excavations should be compacted using hand held compaction equipment such as a vertical rammer or vibrating plate compactor.

Compaction control in sand could be carried out using a Perth sand penetrometer (PSP) test in accordance with test method AS 1289.6.3.3. The sand subgrade should be compacted to achieve a minimum blow count of 8 blows per 300 mm rod penetration to a depth of not less than 1 m below founding level. It should be noted that this compaction level has not been directly correlated to a dry density of 95% relative to modified compaction. Lower blow counts than the above level may be acceptable provided that a correlation between Perth sand penetrometer (PSP) test and dry density ratio has been established by a NATA accredited laboratory and following review by a geotechnical engineer.

7.3 Excavation Conditions and Groundwater

Based on the ground conditions described in Section 4.1, excavations associated with footings construction, are anticipated to be undertaken through sandy fill and natural sand and should be readily achieved using standard earthmoving equipment (i.e. 8 tonne excavator).

However, for deeper excavations (say more than 1 m below existing levels), and given the slow excavation rates and refusal experienced on well cemented Silty SAND SM layers (coffee rock) using a 8 tonne backhoe during the investigation, the use of a powerful excavator (i.e. 20 tonne or heavier) together with provisions for ripping tynes and hydraulic hammer attachments, is recommended.

As described in Section 4.2, groundwater was recorded between 1.7 m and 2.8 m from the ground surface within the majority of the test pits within the western half of the site, during the investigation undertaken when groundwater was likely near its low seasonal level. Therefore, groundwater is not anticipated to impact proposed excavations to a depth of about 1 m below existing ground levels provided earthworks are undertaken prior to the onset of winter rains. If earthworks are proposed in winter, it is recommended that groundwater level be assessed prior to the earthworks to assess the likelihood of encountering groundwater within proposed excavation depths. For excavations in sand below groundwater, dewatering (say using well points) to a depth of approximately 1 m below the base of the excavation would be required. The impact of the encountered coffee rock on the installation of well points would need to be considered and might require pre-drilling. The well points will be used to minimise the risk of sand running into excavations and might need to be completed with sumps if the base of the excavation is within cohesive materials of the Guildford Formation.

7.4 Design Parameters for Earth Retaining Systems

During construction, it is recommended that batter slopes not steeper than 1.5H:1V (horizontal : vertical) be adopted for temporary excavations not deeper than 3 m in sandy materials. For deeper excavations, it is recommended that the slope be stepped so that an average slope angle of not steeper than 2H:1V is achieved.

It is also emphasised that the abovementioned batter angle is not applicable if water emanates from the excavation slopes (see comments in Section 7.3 above with regards to groundwater and dewatering requirements). In such conditions, there is potential for instability no matter how flat the batter angle, and as such consideration could be given to the use of dewatering and/or retaining structures.

If loads are applied at the top of the batter (for example, excavated soil or equipment), or if there is any groundwater influence, then a site specific assessment of stability should be undertaken.

Parameters for the design of temporary and permanent retaining structures are suggested in Table 7 below. In addition to the soil pressure, retaining wall design should also allow for external loads such as buildings, live loads and hydrostatic pressure, if any.

Table 7: Suggested Soil Parameters for Retaining Wall Design

Soil Type	Drained Angle of Friction Φ' (degrees)	Undrained Shear Strength C_u (kPa)	Soil Unit Weight above Water γ (kN/m³)	Coefficient of Active Earth Pressure K_a	Coefficient of Earth Pressure at Rest K_0	Coefficient of Passive Earth Pressure K_p[1]
Soils from Units 2 and 3 and Imported Fill (Medium Dense and Denser)	32	0	18	0.31	0.47	3.2

Note: [1] Ultimate values that require a reduction factor not greater than 0.5 to limit lateral movements.

7.5 Re-use of Topsoil

Sandy topsoil was recorded over thicknesses of between 100 mm and 200 mm at the majority of the test locations.

Results of the laboratory testing indicate that the majority of the topsoil material is not suitable for re-use as structural fill in its current condition, owing to high organic contents (ie up to 5% as summarised in Table 4 in Section 5). However, such materials can be considered for re-use as fill, provided that:

- The bulk of the large organic particles are removed from the material by passing it through a screen with minimum aperture size of 25 mm, or by initially stripping off the bulk of the vegetation and root mass using a grader to limit the quantity of organic material within the underlying topsoil. Consideration can also be given to stockpile the stripped topsoil for at least a year to allow for some break down of biodegradable material; and
- It is blended at a suitable ratio with non-organic sand (or other granular structural fill). A suitable blending ratio of 3:1 (clean sand : topsoil) is tentatively suggested based on the result of laboratory testing, but this blending ratio should be refined following assessment of the material resulting from the screening operations. Results of the assessment will indicate any opportunities to favourably adjust the blending ratio (ie increasing the organic sand fill fraction and decreasing the clean sand fraction) based on the performance of the screening operations.

  The contractor should develop a suitable method for the appropriate blending of the topsoil and non-organic sand on site. It is suggested that small scale blending could be undertaken by turning the two materials using an excavator or loader bucket a sufficient number of times to form a homogenous blended material. On a large scale, the use of a scraper to pick up, blend and place the material is suggested. Alternatively, suitable blending should be achievable by placement of a layer of non-organic sand over the existing topsoil, followed by raking through the two material types with dozer or grader tynes and blades. Owing to the encountered thickness of topsoil (up to 200 mm), in-situ mixing could be undertaken in stages in order to achieve the targeted mixing ratio of 3:1 (clean sand : topsoil), for instance by placing 200 mm of non-organic sand above the existing topsoil, mixing, then placing another layer of non-organic sand and mixing again, and repeating the process until the targeted mixing ratio is met.

The suitability of the screened material should also be regularly assessed by a geotechnical engineer (including the determination of organic content, particle size gradings and modified maximum dry density) for approval prior to use as fill, which may also result in optimising the blending ratio.

Blended fill materials typically have a reduced permeability in comparison with clean sand, and therefore verification of the permeability of the blended material is suggested, prior to use. Any material considered unsuitable for use as fill by the geotechnical engineer should be removed from the site, or used in non-structural areas.

7.6 Re-use of Excavated Materials and Imported Fill

The sand and gravel fraction of the Unit 1 fill materials, if excavated, and in particular the fill encountered at test location 6 could possibly be re-used to form a structural fill material, from a geotechnical perspective, following screening to remove foreign materials and particles greater than 150 mm in size.

The granular soils of Unit 2 should also be suitable for re-use as structural fill, provided they are free from organic matter and particles greater than 150 mm in size.

Soil from Unit 3 would also be considered to form a suitable structural fill, however, with a significantly lower permeability and lower pavement bearing capacity than the aforementioned soils from Units 1 and 2. Therefore, if re-use of Unit 3 is further considered, it is recommended that it is re-used in the deeper parts of proposed fill (say 1 m below any pavements and at least 0.5 m below the base of any soakwells).

Imported fill, if required, is recommended to comprises free draining cohesionless sand with less than 5% by weight of particles passing a 0.075 mm sieve. The material should be free from organic matter.

It is recommended that granular soils of Unit 1 following treatment, if required, Units 2 and 3 and imported sand fill, if required, be placed in loose lift thickness within 2% of its optimum moisture content with each layer compacted to achieve a dry density ratio of not less than 95% relative to modified compaction.

Compaction control of sand could be carried out using a Perth Sand Penetrometer in accordance with test method AS 1289.6.3.3, as described in Section 7.2.

It is recommended that verification of the compaction works be undertaken by an experienced geotechnical engineer.

7.7 Foundation Design

Shallow foundation systems comprising slab, pad and strip footings should be suitable to support typical one and two storey buildings. Footings of buildings covered by AS 2870-2011 should be designed to satisfy the requirements of this standard for a site classification ('Class A'), provided that site preparation is carried out as detailed in Section 7.2.

It should be noted that AS 2870-2011 is applicable to residential structures and "other forms of construction including some light industrial, commercial and institutional buildings if they are similar to houses in size, loading and superstructure flexibility".

For structures not covered by AS 2870-2011, shallow pad footings, strip footings and slabs founded at a depth of at least 0.5 m into medium dense or denser granular materials of Unit 2, are considered suitable to support the proposed structures. The design of such foundation systems can be based on

the maximum allowable bearing pressures and associated settlements summarised in Table 8 next page.

The allowable bearing pressures in Table 8 below are suggested provided that site preparation is carried out as outlined in Section 7.2.

Table 8: Estimated Settlement of Square Pad and Strip Footings

Footing Size (m)		Founding Depth Below Existing Site Levels (m)	Allowable Bearing Pressure (kPa)	Estimated Total Settlement (mm)
			Granular Soil (eg soils of Units 2 and 3 following compaction)	
Pad	1.5	0.5	230	15 - 20
	2.0			20 - 25
Strip	0.5		215	10 - 15
	1.0			15 - 20
Pad	1.5	1	245	
	2.0		250[1]	25
Strip	0.5		160	5 - 10
	1.0		190	15 - 20

Note: The allowable bearing pressure values in this table consider the adverse impact of the relatively shallow groundwater and clayey sand materials encountered beneath the site.
[1] Recommended allowable bearing pressure to limit settlements to 25 mm.

Long-term total and differential settlements are likely to be less than half of the total settlement.

Settlement in granular soils occurs over a short period of time with the majority of settlement occurring during construction.

7.8 Pavement Design Parameters and Design

The shallow soils across the proposed pavement areas generally comprise sand fill and natural sand.

A laboratory test result detailed in Section 5 indicate a CBR value of 12% for a soaked sample of the sand material of Unit 2

Based on the abovementioned CBR result, observations made in the field and Douglas Partners' experience with similar materials, a subgrade CBR design value of 12% is suggested for the design of pavements on the sand subgrade materials. The abovementioned CBR value is suggested, provided that the subgrade is compacted achieve a dry density ratio of not less than 95% relative to modified compaction and suitably drained.

A modulus of subgrade reaction of 55 kPa/mm is recommended for the sand subgrade for rigid pavement design, based on the abovementioned CBR value of 12%. It should be noted that this value only applies to wheel loads, as modulus of subgrade reaction is a function of the size of the loaded area.

Therefore, a site specific assessment should be undertaken if moduli of subgrade reaction are required for larger loaded areas (eg design of pads).

In the event the subgrade comprises treated topsoil, treated materials or imported sand fill, the pavement should be designed using an appropriate CBR of the material. This value should be assessed once the material is known.

It is recommended that subgrade be inspected by a suitably experienced geotechnical engineer prior to placement of the pavement layers to identify unsuitable subgrade materials.

For the proposed internal roads, the following minimum pavement structure is indicated in the City of Swan drawing STD 200-2s dated July 2017, assuming a traffic loading no greater than 1.0 x 10^5 ESAs (access street):

- 10 mm aggregate asphalt wearing course: 30 mm thick;
- 14 mm aggregate asphalt intermediate course: 40 mm thick;
- Prime or primerseal; and
- Sub-base (crushed limestone): 200 mm thick.

The suitability of the above listed pavement thickness was assessed using the computer program CIRCLY. The pavement model used in the CIRCLY analysis includes a design asphalt layers (10 mm aggregate wearing course and 14 mm aggregate intermediate course) with vertical moduli of 1,400 MPa and 1,500 MPa, respectively. The above wearing course and intermediate course layers vertical moduli were based on the typical asphalt moduli (3,500 MPa and 3,700 MPa, respectively) provided in Table 6.14 of Austroads Part 2: Pavement Structural Design (2017), and following adjustments for in service air voids, temperature and vehicle speed. A design speed of 40 km/h was assumed and was used in the asphalt modulus adjustment.

A vertical modulus of 250 MPa was adopted for the sub-base quality layer, as per 'typical value' included in Austroads Part 2: Pavement Structural Design (2017), Table 6.3. A vertical modulus of 120 MPa was adopted for the subgrade using a CBR value of 12%.

Results of the pavement analysis indicate unsuitable thickness for a traffic loading of 1.0 x 10^5 ESAs, such as assumed for the proposed internal roads, due to an early fatigue of the asphalt intermediate course layer. The following is therefore recommended:

- Increase the intermediate course layer to 50 mm instead of the 40 mm listed above; or
- Replace the crushed limestone sub-base material with a crushed rock base (CRB) quality material. A vertical modulus of 500 MPa was adopted for the crushed rock base (CRB) quality material in the CIRCLY analysis, as per 'typical value' included in Austroads Part 2: Pavement Structural Design (2017), Table 6.3.

Alternatively, the following pavement profile is also considered suitable by Douglas Partners to support traffic loadings of up to 1.0 x 10^5 ESAs:

- 10 mm aggregate asphalt wearing course: 30 mm thick;
- Prime or primerseal; and
- Basecourse (crushed rock base, CRB): 200 mm thick.

The CIRCLY results are presented in Appendix E.

For the proposed car parking areas and based on Douglas Partners experience, a reduction in the abovementioned basecourse (crushed rock base, CRB) thickness to 150 mm is suggested.

It is recommended that the wearing course asphalt layer comprise a 10 mm dense graded asphalt manufactured with a Class 170 binder and the intermediate course asphalt layer comprise a 14 mm dense graded asphalt manufactured with a Class 170 binder, complying with MRWA Specification 511.

The crushed rock base (CRB) quality material should consist of a DGB20 base (crushed rock) complying with the requirements of Table 242.3 of the City of Swan Specification 242, Flexible Pavements and Main Roads Specification 501. The CRB should be compacted to achieve a dry density ratio of not less than 98% relative to modified compaction, and be dried back to a moisture content of less than 60% of OMC, prior to application of the prime.

The sub-base should consist of a GLS40 sub-base (crushed limestone) complying with the requirements of Table 242.4 of the City of Swan Specification 242, Flexible Pavements and Main Roads Specification 501. The sub-base should compacted to achieve a dry density ratio of not less than 95% relative to modified compaction as per Clause 242.20 of the City of Swan Specification 242, Flexible Pavements. It is recommended that the sub-base be dried back to 85% or less.

7.9 Soil Permeability

The shallow ground conditions beneath the site generally comprise medium dense to dense natural sand, including moderately to well cemented Silty SAND SM layers, overlying clayey sand at particular locations within the western half of the site. On site infiltration systems using soakwells is considered suitable in the encountered sand. Underlying 'coffee rock' layers and clayey soils from the Guildford Formation classified 'SC' or 'SP-SC' in the logs in Appendix C should be considered impervious for drainage design.

The results of the infiltration testing summarised in Section 4.3 indicates permeability values of between 1.6 x 10^{-5} m/s (1 m/day) and 9 x 10^{-4} m/s (>25 m/day) for the shallow natural sand, in its in-situ condition.

To allow for possible variations in soil fines content and densification of the sand during site formation and construction, a preliminary design permeability for the sand of approximately 1 x 10^{-5} m/s (approximately 0.8 m/day) is suggested.

Owing to the relatively low permeability of the 'coffee rock' and clayey soils from the Guildford Formation, a clearance of approximately 0.5 m between the base of soakwells and Unit 3 materials is recommended.

The infiltration capability commonly reduces over time due to silt build up at the base of soakwells and therefore the soakwells must be cleaned and maintained on a regular basis. Soakwells should be positioned at a distance from all buildings, retaining walls and boundaries by not less than 2 m.

7.10 Acid Sulfate Soils

Based on the results of limited soil sampling and analysis, acid sulfate soils are not present to depths of up to 2 m at the sampling locations. In this regard, management of acid sulfate soils does not appear to be warranted, provided excavations for construction do not exceed 2 m depth and dewatering is not required.

Further detailed investigation for acid sulfate soils would be required for the following:

- Excavations of greater than 2 m depth; and / or
- Dewatering is proposed to be undertaken; and / or
- To address a development condition requiring investigation and management of acid sulfate soils.

8. References

1. AS 2870 (2011). *Residential Slabs and Footings.* Standards Australia.
2. AS 1289 (2000). *Methods of Testing Soils for Engineering Purposes.* Standards Australia.
3. AS 1289.6.3.3 (1999). *Soil Strength and Consolidation Tests-Determination of the Penetration Resistance of a Soil – Perth Sand Penetrometer Test.* Standards Australia.
4. AS 1726 (2017). *Geotechnical Site Investigation.* Standards Australia.
5. AS 3798 (2007). *Guidelines on Earthworks for Commercial and Residential Developments.* Standards Australia.
6. AS 2159 (2009). *Piling – Design and Installation.* Standards Australia.
7. City of Swan (2001). *Specification 242, Flexible Pavements.*
8. Main Roads WA (2012). *Specification 501 Pavements.*

9. Limitations

Douglas Partners has prepared this report for the proposed Dayton Primary School at 11 Blundell Street in Dayton, WA in accordance with Douglas Partners' proposal dated 8 February 2021 and acceptance received from Mr Gary Sollitt Stantec Australia Pty Ltd in an email dated 10 February 2021. The work was carried out under Douglas Partners' Conditions of Engagement. This report is provided for the

exclusive use of Stantec Australia Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas Partners, does so entirely at its own risk and without recourse to Douglas Partners for any loss or damage. In preparing this report Douglas Partners has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas Partners' field testing has been completed.

Douglas Partners' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas Partners in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas Partners cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas Partners. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of Douglas Partners. Douglas Partners may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to Douglas Partners. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) — Non-cohesive and free-running.
- Moist (M) — Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) — Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w <PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w >PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈LL' (i.e. near the liquid limit).
- 'Wet' or 'w >LL' (i.e. wet of the liquid limit).

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

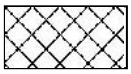
Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete

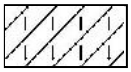

Filling

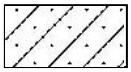
Soils


Topsoil

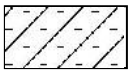

Peat


Clay

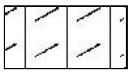

Silty clay

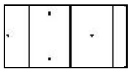

Sandy clay

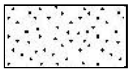

Gravelly clay


Shaly clay

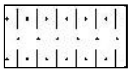

Silt


Clayey silt


Sandy silt

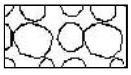

Sand

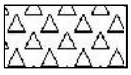

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

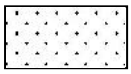

Talus

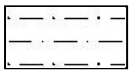
Sedimentary Rocks

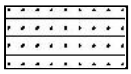

Boulder conglomerate

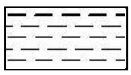

Conglomerate


Conglomeratic sandstone

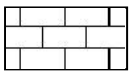

Sandstone


Siltstone

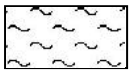

Laminite

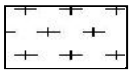

Mudstone, claystone, shale

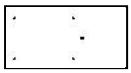

Coal


Limestone

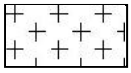
Metamorphic Rocks

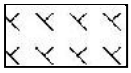

Slate, phyllite, schist


Gneiss

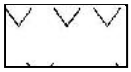

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Sampling Methods

Douglas Partners

Sampling

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

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

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Appendix B

Drawings

Douglas Partners Geotechnics | Environment | Groundwater	**Tests Location Plan** **Proposed Dayton Primary School** **11 Blundell Street, Dayton, WA**	PROJECT: 201389.00 Drawing No: 1 REV: 0
	CLIENT: Stantec Australia Pty Ltd	DATE: 23/2/2021

Appendix C

Results of Field Work

TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402888
NORTHING: 6475714

PIT No: 1
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.25	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel (building materials) and rootlets, dry to moist.							
		SAND SP: fine to medium grained, grey, trace silt, moist, medium dense. Bassendean Sand.		D E	0.5				
21	1	- becoming dense from 0.75 m depth.		E	1.0				1
	1.3	CEMENTED Silty SAND SM (COFFEE ROCK): moderately cemented, dark brown, moist to wet.		E	1.5				
				D	1.8				
20	2	- becoming well cemented from 1.9 m depth.		E	2.0			▼	2
	2.1	Pit discontinued at 2.1m (Hard digging)							

RIG: 8 tonne backhoe with 450 mm bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater observed at 2.05 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402900
NORTHING: 6475677

PIT No: 2
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.17	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.		D	0.1				
		SAND SP: fine to medium grained, light grey, trace silt and rootlets to 0.4 m depth, moist, loose. Bassendean Sand.							
		- becoming medium dense to dense from 0.45 m depth.							
21	1			D	1.0				1
	1.25	CEMENTED Silty SAND SM (COFFEE ROCK): moderately cemented, dark brown, moist to wet.							
		- becoming weakly cemented, brown and with silt (SP-SM) from 1.6 m depth.							
20	2	- becoming grey and wet from 2.0 m depth.						▼	2
				D	2.3				
	2.5	Pit discontinued at 2.5m (Collapsing conditions)							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 8 tonne backhoe with 450 mm bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater observed at 2.0 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402949
NORTHING: 6475686

PIT No: 3
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.15	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand.		E	0.5				
		- becoming medium dense from 0.3 m depth.							
21	1			E	1.0				1
	1.2								
	1.3	CEMENTED Silty SAND SM (COFFEE ROCK): moderately cemented, dark brown, moist to wet.							
		SAND SP-SM: fine to medium grained, light grey, with silt, moist to wet. Probably Bassendean Sand.		E	1.5				
20	2	2.0		E	2.0				2
		SAND SP-SC: fine to medium grained, light grey, with clay, moist to wet. Probably Guildford Formation.							
		- becoming wet from 2.1 m depth.						▼	
		- trace clay (SP) from 2.4 m depth.		E	2.5				
	2.7	Pit discontinued at 2.7m (Collapsing conditions)							

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater observed at 2.4 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402985
NORTHING: 6475712

PIT No: 4
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.1	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.		D	0.1				
		SAND SP: fine to medium grained, light grey, trace silt, moist, medium dense to dense. Bassendean Sand.							
21	1			D	1.0				1
	1.5	CEMENTED Silty SAND SM (COFFEE ROCK): very well cemented, dark brown, mottled brown, dry to moist.							
20	2	- becoming moderately cemented, brown, mottled dark brown from 1.8 m depth.							2
		- becoming weakly cemented, light grey-brown, with silt (SP-SM) from 2.1 m depth.						▽	
	2.75	Pit discontinued at 2.75m (Collapsing conditions)							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater seepage observed at 2.4 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 403028
NORTHING: 6475707

PIT No: 5
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.1	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, medium dense to dense. Bassendean Sand.		E	0.5				
21	1			E	1.0				1
				E	1.5				
20	2 2.0	CEMENTED Silty SAND SM (COFFEE ROCK): moderately to well cemented, dark brown, moist to wet.		E	2.0				2
		- becoming brown, with silt (SP-SM) from 2.3 m depth.		E	2.5				
		- becoming wet from 2.7 m depth.						▼	
	2.9	Pit discontinued at 2.9m (Target)							

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater observed at 2.8 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

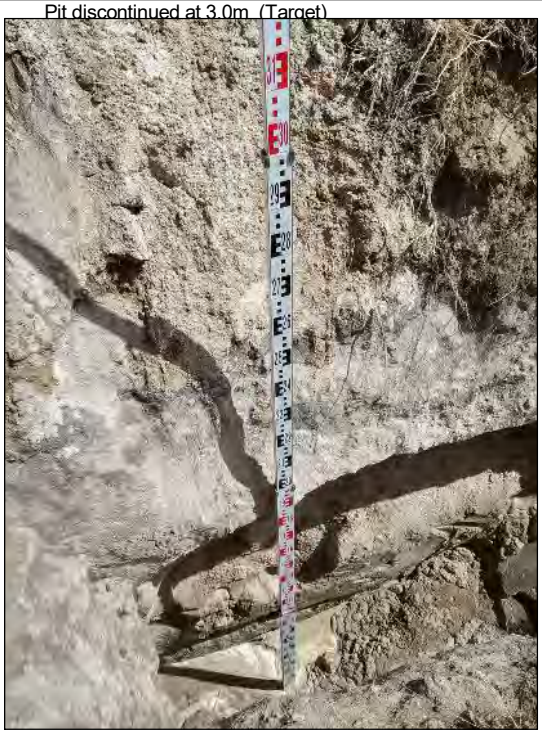
TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402997
NORTHING: 6475662

PIT No: 6
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.8	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt and large concrete slab pieces, dry to moist, loose. - becoming medium dense from 0.3 m depth.							
21	1.9	SAND SP: fine to medium grained, light grey, trace silt, moist, medium dense. Bassendean Sand.							
20	3.0	Clayey SAND SC: fine to medium grained, grey, mottled blue, low plasticity, medium dense, moist. Guildford Formation.		D	2.0		pp = 100-150	▽	
		- becoming grey-brown from 2.5 m depth.		D	2.5				
		Pit discontinued at 3.0m (Target)							



RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater seepage observed at 2.1 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 403037
NORTHING: 6475619

PIT No: 7
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.15	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, dry to moist.		D	0.1				
		SAND SP: fine to medium grained, light grey, trace silt, moist, medium dense to dense. Bassendean Sand.							
21	1	- trace rootlets (15 mm in diameter) at 1.1 m depth.							
20	2								
	2.9	Pit discontinued at 2.9m (Target)							

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402980
NORTHING: 6475596

PIT No: 8
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.1	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace rootlets, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand.							
		- becoming mediun dense from 0.45 m depth.		E	0.5				
21	1			E	1.0				1
				E	1.5				
		- becoming moist to wet from 1.8 m depth.						▽	
20	2			E	2.0				2
	2.1	Clayey SAND SC: fine to medium grained, grey-brown, mottled orange-brown, low plasticity, wet. Guildford Formation.							
				E	2.5				
	2.8	Pit discontinued at 2.8m (Collapsing conditions)							

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater seepage observed at 1.95 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402956
NORTHING: 6475640

PIT No: 9
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.2	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand. - becoming medium dense from 0.3 m depth.							
21	1								1
	1.5	CEMENTED Silty SAND SM (COFFEE ROCK): moderately cemented, brown, mottled dark brown, moist to wet.							
	1.8	- becoming weakly cemented from 1.6 m depth.							
20	2	Clayey SAND SC: fine to medium grained, grey mottled blue, low plasticity, wet, medium dense. Guildford Formation.		D	2.0		pp = 100	▽	2
	2.5	Pit discontinued at 2.5m (Collapsing conditions)							

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater seepage observed at 1.75 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402938
NORTHING: 6475596

PIT No: 10
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.15	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand.							
		- becoming medium dense from 0.6 m depth.		D	0.7				
21	1								1
	1.8	CEMENTED Silty SAND SM (COFFEE ROCK): well cemented, dark brown, moist to wet.							
20	2 2.0	Pit discontinued at 2.0m (Collapsing conditions and hard digging)							2

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402886
NORTHING: 6475620

PIT No: 11
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.17	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.		D	0.1				
		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand.		E	0.5				
		- becoming medium dense to dense from 0.45 m depth.							
21	1			E	1.0				1
				E	1.5				
20	2			E	2.0				2
	2.4	CEMENTED Silty SAND SM (COFFEE ROCK): well cemented, dark brown, mottled brown, moist to wet.							
	2.6	Pit discontinued at 2.6m (Hard digging)							

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22 AHD
EASTING: 402937
NORTHING: 6475595

PIT No: 12
PROJECT No: 201389.00
DATE: 15/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.2	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand. - becoming medium dense to dense from 0.45 m depth.							
21	1								1
	1.5	CEMENTED Silty SAND SM (COFFEE ROCK): moderately to well cemented, dark brown, moist to wet. - becoming brown, with silt (SP-SM) from 1.75 m depth. Possibly Guildford Formation.						▽	
20	2								2
	2.6	Pit discontinued at 2.6m (Collapsing conditions)							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: Groundwater seepage observed at 1.9 m depth.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 24.4 AHD
EASTING: 403133
NORTHING: 6475713

PIT No: 13
PROJECT No: 201389.00
DATE: 16/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
24	0.16	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, medium dense. Bassendean Sand.							
		- becoming yellow-brown from 0.7 m depth. Possibly Guildford Formation.							
23	1	- trace rootlets (10 mm - 20 mm in diameter) at 1.0 m depth.		D	1.0				1
		- trace rootlets (10 mm - 20 mm in diameter) at 1.2 m depth.							
22	2 2.0	Pit discontinued at 2.0m (Target)							2

Dynamic Penetrometer Test (blows per 150mm): 5 10 15 20

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22.9 AHD
EASTING: 403077
NORTHING: 6475717

PIT No: 14
PROJECT No: 201389.00
DATE: 16/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.18	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
	1	SAND SP: fine to medium grained, light grey, trace silt and trace rootlets to 0.9 m depth, moist, loose. Bassendean Sand.							1
21		- becoming yellow-brown, medium dense from 1.25 m depth. Possibly Guildford Formation.							
	2 2.0	Pit discontinued at 2.0m (Target)							2
20									

Dynamic Penetrometer Test (blows per 150mm): 5 10 15 20

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22.5 AHD
EASTING: 403088
NORTHING: 6475641

PIT No: 15
PROJECT No: 201389.00
DATE: 16/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.18	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.		D	0.1				
22		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand.		E	0.5				
	1	- becoming yellow-brown from 0.65 m depth. Possibly Guildford Formation.		E	1.0				1
21		- becoming medium dense from 1.3 m depth.		E	1.5				
	2			E	2.0				2
20				E	2.5				
	2.9	Pit discontinued at 2.9m (Collapsing conditions)		E	2.9				

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22.3 AHD
EASTING: 403088
NORTHING: 6475600

PIT No: 16
PROJECT No: 201389.00
DATE: 16/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.15	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand.		B	0.5				
21	1	- becoming yellow-brown from 1.5 m depth. Possibly Guildford Formation.							
		- becoming medium dense from 1.6 m depth.							
20	2								
	2.5	Pit discontinued at 2.5m (Collapsing conditions)							

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 22.8 AHD
EASTING: 403158
NORTHING: 6475596

PIT No: 17
PROJECT No: 201389.00
DATE: 16/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.19	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt and rootlets to 0.6 m depth, moist, loose. Bassendean Sand.		D	0.5				
	1								1
21	1.5	- becoming yellow-brown from 1.4 m depth. Possibly Guildford Formation. - becoming medium dense from 1.5 m depth.							
		Pit discontinued at 1.5m (Target)							
	2								
20									

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 23.7 AHD
EASTING: 403148
NORTHING: 6475639

PIT No: 18
PROJECT No: 201389.00
DATE: 16/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23	0.18	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace rootlets, dry to moist.		D	0.1				
		SAND SP: fine to medium grained, light grey, trace silt and rootlets, moist, loose. Bassendean Sand.							
	1	- becoming moist from 0.7 m depth.							
		- becoming medium dense from 0.9 m depth.							
22		- becoming yellow-brown from 1.3 m depth. Possibly Guildford Formation.							
	2	2.0 Pit discontinued at 2.0m (Target)							
21									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Stantec Australia Pty Ltd
PROJECT: Proposed Dayton Primary School
LOCATION: 11 Blundell Street Dayton

SURFACE LEVEL: 23.5 AHD
EASTING: 403109
NORTHING: 6475681

PIT No: 19
PROJECT No: 201389.00
DATE: 16/2/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23	0.16	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, dry to moist.							
		SAND SP: fine to medium grained, light grey, trace silt, moist, loose. Bassendean Sand.							
	1	- becoming loose to medium dense from 0.9 m depth.							1
22		- becoming yellow-brown from 1.1 m depth. Possibly Guildford Formation.		D	1.5				
	2	- becoming medium dense from 2.4 m depth.							2
	2.0	Pit discontinued at 2.0m (Target)							
21									

Dynamic Penetrometer Test (blows per 150mm) scale: 5, 10, 15, 20

RIG: 8 tonne backhoe with 450 mm toothed bucket

LOGGED: PD

SURVEY DATUM: MGA94 Zone 50 J

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Surface level interpolated based on a survey plan provided by the client.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

Appendix D

Geotechnical Laboratory Test Results

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

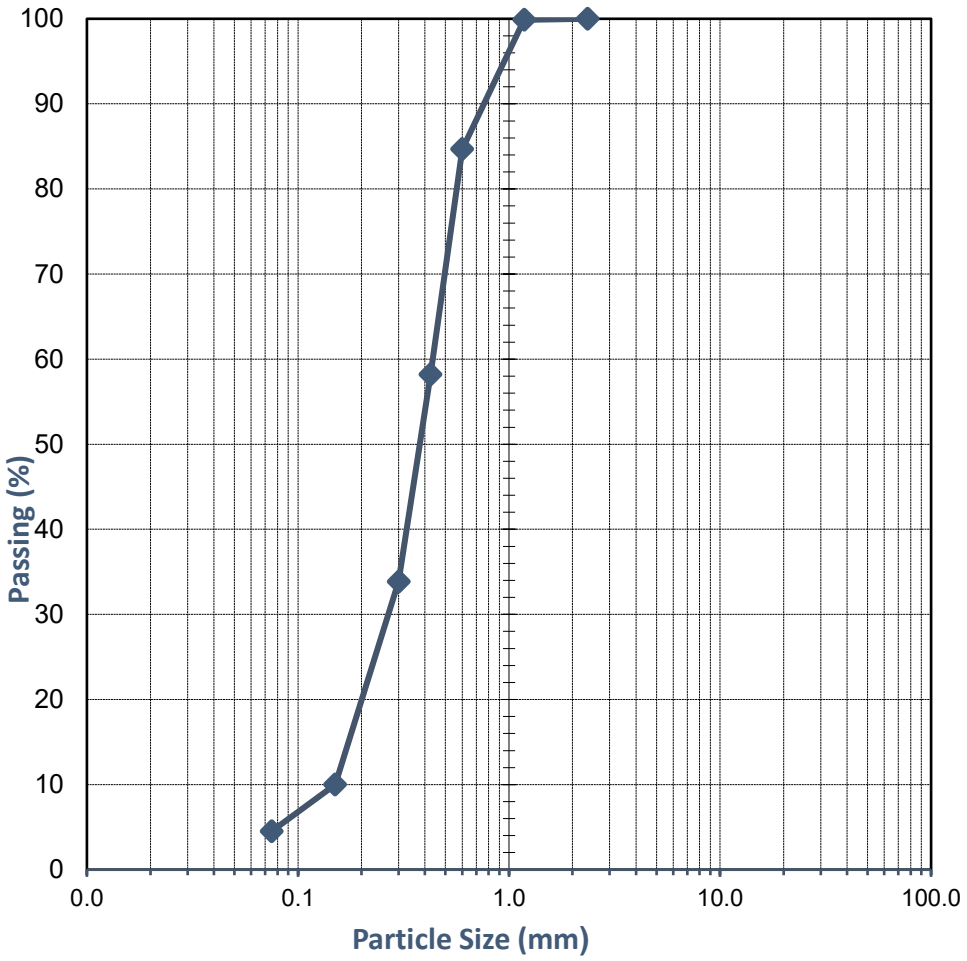
TEST REPORT - AS 1289.3.6.1

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3206_1_PSD
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3206
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24/02/2021
Sample Identification:	6, 1.8m	*Date Tested:*	2/03/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	85
0.425	58
0.300	34
0.150	10
0.075	5



Comments:

Approved Signatory:

Name: Matt van Herk

Date: 03/March/2021

NATA

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

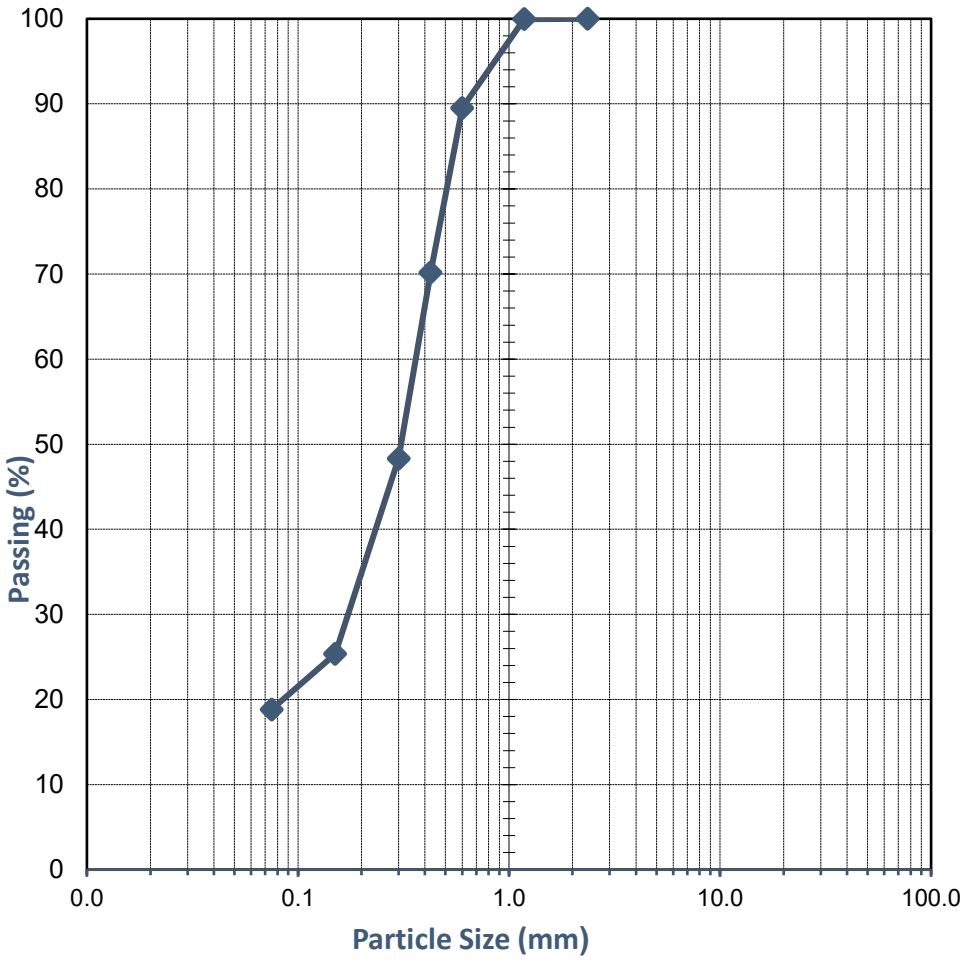
TEST REPORT - AS 1289.3.6.1

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3207_1_PSD
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3207
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24/02/2021
Sample Identification:	6, 2.0m	*Date Tested:*	2/03/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	90
0.425	70
0.300	48
0.150	25
0.075	19



Comments:

Approved Signatory:

Name: Matt van Herk

Date: 03/March/2021

NATA

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

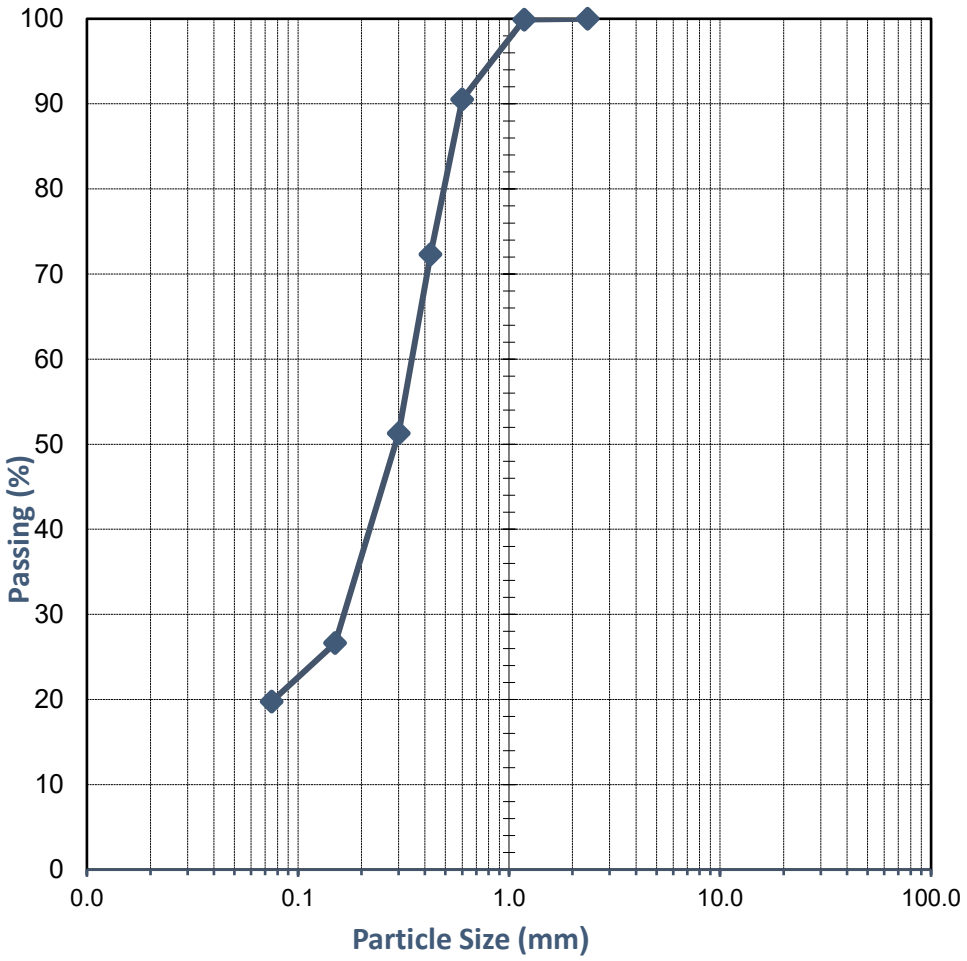
TEST REPORT - AS 1289.3.6.1

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3209_1_PSD
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3209
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24/02/2021
Sample Identification:	9, 2.0m	*Date Tested:*	2/03/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	91
0.425	72
0.300	51
0.150	27
0.075	20



Comments:

Approved Signatory:

Name: Matt van Herk

Date: 03/March/2021

NATA

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

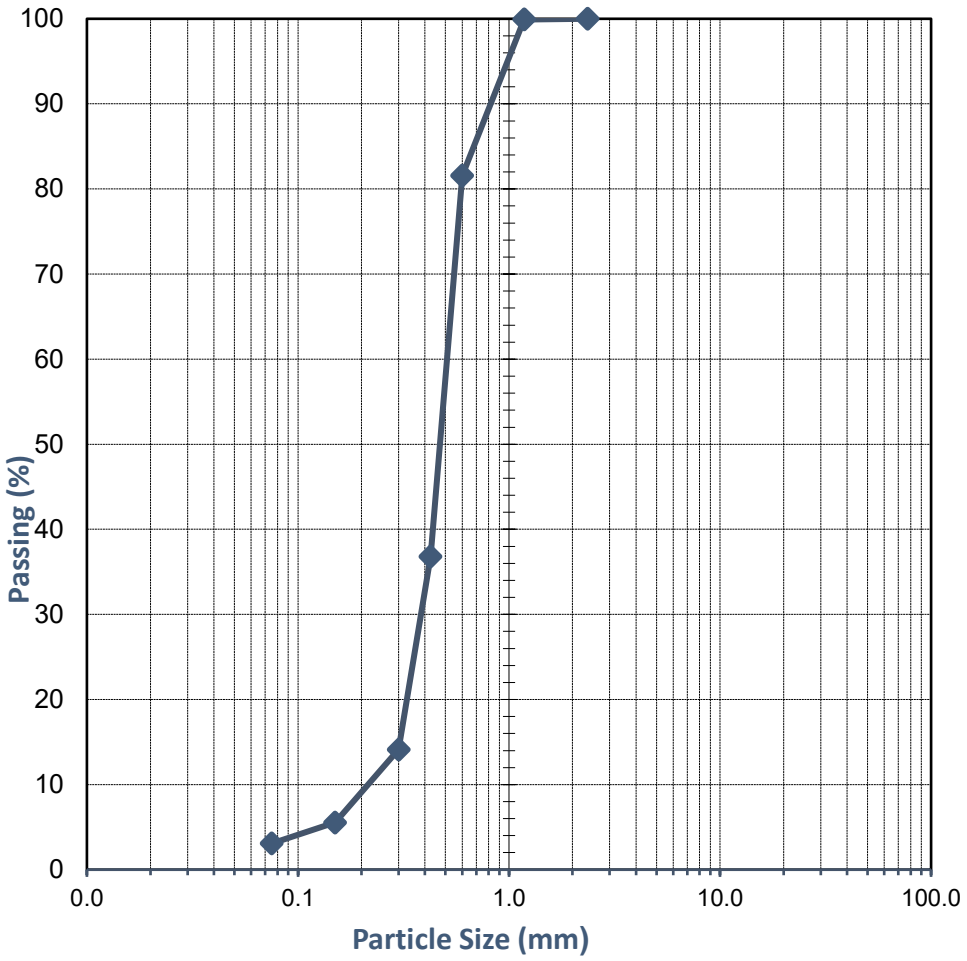
TEST REPORT - AS 1289.3.6.1

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3212_1_PSD
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3212
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24/02/2021
Sample Identification:	16, 0.5m	*Date Tested:*	2/03/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	82
0.425	37
0.300	14
0.150	6
0.075	3



Comments:

Approved Signatory:

Name: Matt van Herk

Date: 03/March/2021

NATA

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

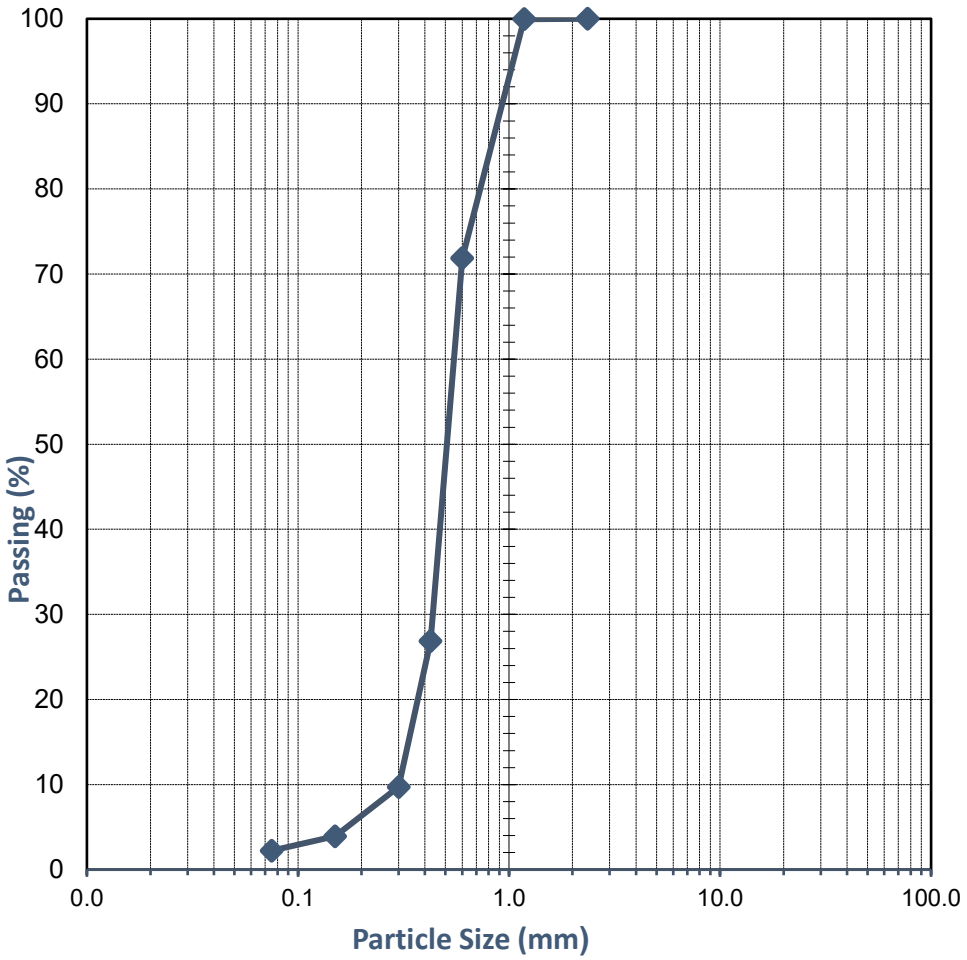
TEST REPORT - AS 1289.3.6.1

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3213_1_PSD
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3213
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24/02/2021
Sample Identification:	17, 1.2m	*Date Tested:*	2/03/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	72
0.425	27
0.300	10
0.150	4
0.075	2



Comments:

Approved Signatory:

Name: Matt van Herk

Date: 03/March/2021

NATA

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3207_1_PI
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3207
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24-02-2021
Sample Identification:	6, 2.0m	*Date Tested:*	3-03-2021

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**21**
AS 1289.3.2.1	**Plastic Limit (%)**	**13**
AS 1289.3.3.1	**Plasticity Index (%)**	**8**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**1.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Curled**

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 04-March-2021

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3209_1_PI
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3209
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24-02-2021
Sample Identification:	9, 2.0m	*Date Tested:*	3-03-2021

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**22**
AS 1289.3.2.1	**Plastic Limit (%)**	**13**
AS 1289.3.3.1	**Plasticity Index (%)**	**9**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**2.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Cracked, Curled**

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 04-March-2021

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3212_1_MMDD
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3212
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24-02-2021
Sample Identification:	16, 0.5m	*Date Tested:*	2-03-2021

TEST RESULTS - Modified Maximum Dry Density

Sampling Method: Sampled by Client, Tested as Received

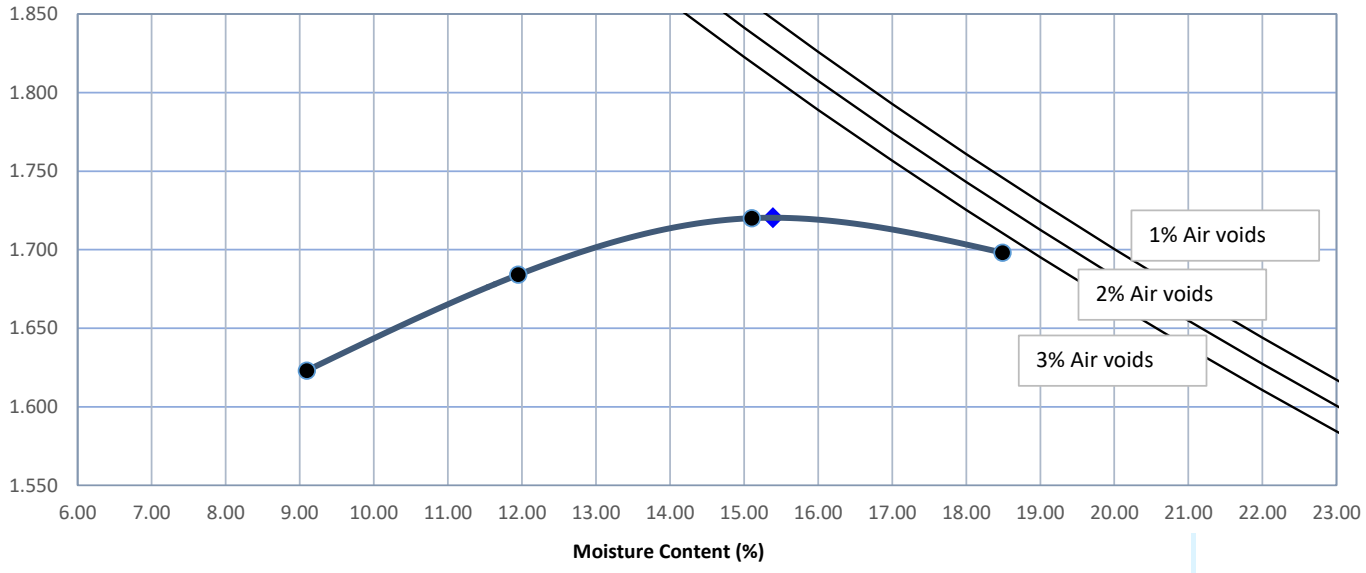
Sample Curing Time: 2 Hours

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 0 **Material + 37.5mm (%)** -

Moisture Content (%)	**9.1**	**12.0**	**15.1**	**18.5**	
Dry Density (t/m³)	**1.623**	**1.684**	**1.720**	**1.698**	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³) **1.72**

Optimum Moisture Content (%) **15.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.616 t/m³*

Approved Signatory:

Name: Cody O'Neill

Date: 03-March-2021

NATA **Accreditation No. 20599**
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

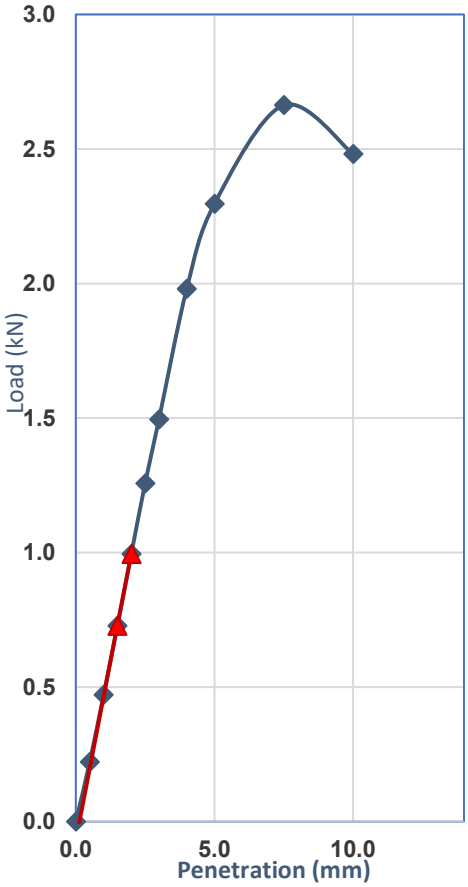
Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3212_1_SCBR
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3212
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24-02-2021
Sample Identification:	16, 0.5m	*Date Tested:*	2/3 - 8/3/2021

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2 Hours
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.72	Optimum Moisture (%)	15.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.62	Moisture Content (%)	15.8
Density Ratio (%)	94.5	Moisture Ratio (%)	102.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.62	Dry Density Ratio (%)	94.5
Moisture Content (%)	16.5	Moisture Ratio (%)	107.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	14.9	Remaining Depth (%)	15.3

Correction applied to Penetration: 0.1mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 12%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 09-March-2021

NATA WORLD RECOGNISED ACCREDITATION

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Stantec Australia Pty Ltd	*Ticket No.*	S2579
Client Address:	-	*Report No.*	WG21/3203-3211_1_ORG
Project:	Proposed Dayton Primary School	*Sample No.*	WG21/3203-3211
Location:	11 Blundell Street, Dayton, WA	*Date Sampled:*	24-02-2021
Sample Identification:	Various - see below	*Date Tested:*	26-02-2021

TEST RESULTS - Organic Content

Sampling Method: Sampled by Client, Tested as Received

Testing Completed By: WGLS - EB

Furnace Temperature (°C): 440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG21/3203	2, 0.1m	97.9	2.1
WG21/3205	4, 0.1m	95.6	4.4
WG21/3208	7, 0.1m	97.0	3.0
WG21/3210	11, 0.1m	95.3	4.7
WG21/3211	15, 0.1m	98.7	1.3

Comments:

Approved Signatory:

Name: Erin Bullen

Date: 02-March-2021

NATA ACCREDITATION

Accreditation No. 20599

Accredited for compliance with ISO/IEC 17025 - Testing

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph 08 9317 2505 fax 08 9317 4163
lab@mpl.com.au
www.mpl.com.au

CERTIFICATE OF ANALYSIS 257726

Client Details

Client	Western Geotechnical & Laboratory Services
Attention	Brooke Elliott
Address	235 Bank Street, Welshpool, WA, 6101

Sample Details

Your Reference	**S2579 - Stantec Australia Pty Ltd**
Number of Samples	3 Soil
Date samples received	25/02/2021
Date completed instructions received	25/02/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	04/03/2021
Date of Issue	04/03/2021

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Heram Halim, Operations Manager

Authorised By

Michael Kubiak, Laboratory Manager

Miscellaneous Inorg - soil				
Our Reference		257726-1	257726-2	257726-3
Your Reference	UNITS	WG21/3204 - 2, 1.0m	WG21/3207 - 6, 2.0m	WG21/3209 - 9, 2.0m
Depth		1.0m	2.0m	2.0m
Date Sampled		24/02/2021	24/02/2021	24/02/2021
Type of sample		Soil	Soil	Soil
Date prepared	-	03/03/2021	03/03/2021	03/03/2021
Date analysed	-	03/03/2021	03/03/2021	03/03/2021
pH	pH Units	6.0	6.9	6.2
Sulphate	mg/kg	<10	49	31
Chloride	mg/kg	<10	53	47

Method ID	Methodology Summary
INORG-001	pH - Measured using pH meter and electrode base on APHA latest edition, Method 4500-H+. Please note that the results for water analyses may be indicative only, as analysis can be completed outside of the APHA recommended holding times. Soils are reported from a 1:5 water extract unless otherwise specified.
INORG-081	Anions - a range of anions are determined by Ion Chromatography based on APHA latest edition Method 4110-B. Soils and other sample types reported from a water extract unless otherwise specified (standard soil extract ratio 1:5).

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	257726-2
Date prepared	-			03/03/2021	1	03/03/2021	03/03/2021		03/03/2021	03/03/2021
Date analysed	-			03/03/2021	1	03/03/2021	03/03/2021		03/03/2021	03/03/2021
pH	pH Units		INORG-001	[NT]	1	6.0	5.8	3	101	[NT]
Sulphate	mg/kg	10	INORG-081	<10	1	<10	<10	0	101	106
Chloride	mg/kg	10	INORG-081	<10	1	<10	<10	0	99	101

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Appendix E

CIRCLY Results

CIRCLY Pro - Version 6.0 (20 June 2017) - *** Public Version - Pre-Release ***

Job Title: Dayton Primary School

Damage Factor Calculation

Assumed number of damage pulses per movement:
Combined pulse for gear (i.e. ignore NROWS)

Traffic Spectrum Details:

Load No.	Load ID	Movements
1	ESA750-Full	1.00E+05

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 165
Y: 0

Details of Layered System:

ID: 201389.00 Title: Dayton Primary School (City of Swan Pavement)

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Asph 1410	Iso.	1.41E+03	0.40			
2	rough	Asph 1500	Iso.	1.50E+03	0.40			
3	rough	Gran_250	Aniso.	2.50E+02	0.35	1.85E+02	1.25E+02	0.35
4	rough	Sub_CBR12	Aniso.	1.20E+02	0.45	8.28E+01	6.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
1	bottom	Asph 1410	ETH	0.005337	5.000	1.130
2	bottom	Asph 1500	ETH	0.005219	5.000	1.130
4	top	Sub_CBR12	EZZ	4.000000	7.000	1.640

Reliability Factors:
Project Reliability: Austroads 95%

Layer No.	Reliability Factor	Material Type
1	1.00	Asphalt
2	1.00	Asphalt
4	1.00	Subgrade (Austroads 2004)

Details of Layers to be sublayered:
Layer no. 3: Austroads (2004) sublayering

Results:

Layer No.	Thickness	Material ID	Load ID	Critical Strain	CDF
1	30.00	Asph 1410	ESA750-Full	2.69E-06	1.13E-32
2	40.00	Asph 1500	ESA750-Full	-5.33E-04	1.26E+00
3	200.00	Gran_250	n/a	n/a	n/a
4	0.00	Sub_CBR12	ESA750-Full	7.79E-04	1.75E-21

CIRCLY Pro - Version 6.0 (20 June 2017) - *** Public Version - Pre-Release ***

Job Title: Dayton Primary School

Damage Factor Calculation

Assumed number of damage pulses per movement:
Combined pulse for gear (i.e. ignore NROWS)

Traffic Spectrum Details:

Load No.	Load ID	Movements
1	ESA750-Full	1.00E+05

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 165
Y: 0

Details of Layered System:

ID: 201389.00 Title: Dayton Primary School (Intermediate Course Increased Thickness)

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Asph 1410	Iso.	1.41E+03	0.40			
2	rough	Asph 1500	Iso.	1.50E+03	0.40			
3	rough	Gran_250	Aniso.	2.50E+02	0.35	1.85E+02	1.25E+02	0.35
4	rough	Sub_CBR12	Aniso.	1.20E+02	0.45	8.28E+01	6.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
1	bottom	Asph 1410	ETH	0.005337	5.000	1.130
2	bottom	Asph 1500	ETH	0.005219	5.000	1.130
4	top	Sub_CBR12	EZZ	4.000000	7.000	1.640

Reliability Factors:
Project Reliability: Austroads 95%

Layer No.	Reliability Factor	Material Type
1	1.00	Asphalt
2	1.00	Asphalt
4	1.00	Subgrade (Austroads 2004)

Details of Layers to be sublayered:
Layer no. 3: Austroads (2004) sublayering

Results:

Layer No.	Thickness	Material ID	Load ID	Critical Strain	CDF
1	30.00	Asph 1410	ESA750-Full	5.05E-06	1.13E-32
2	50.00	Asph 1500	ESA750-Full	-5.08E-04	9.90E-01
3	200.00	Gran_250	n/a	n/a	n/a
4	0.00	Sub_CBR12	ESA750-Full	7.39E-04	1.20E-21

CIRCLY Pro - Version 6.0 (20 June 2017) - *** Public Version - Pre-Release ***

Job Title: Dayton Primary School

Damage Factor Calculation

Assumed number of damage pulses per movement:
Combined pulse for gear (i.e. ignore NROWS)

Traffic Spectrum Details:

Load No.	Load ID	Movements
1	ESA750-Full	1.00E+05

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 165
Y: 0

Details of Layered System:

ID: 201389.00 Title: Dayton Primary School (Crushed Rock Base, CRB)

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Asph 1410	Iso.	1.41E+03	0.40			
2	rough	Asph 1500	Iso.	1.50E+03	0.40			
3	rough	Gran_500	Aniso.	5.00E+02	0.35	3.70E+02	2.50E+02	0.35
4	rough	Sub_CBR12	Aniso.	1.20E+02	0.45	8.28E+01	6.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
1	bottom	Asph 1410	ETH	0.005337	5.000	1.130
2	bottom	Asph 1500	ETH	0.005219	5.000	1.130
4	top	Sub_CBR12	EZZ	4.000000	7.000	1.640

Reliability Factors:
Project Reliability: Austroads 95%

Layer No.	Reliability Factor	Material Type
1	1.00	Asphalt
2	1.00	Asphalt
4	1.00	Subgrade (Austroads 2004)

Details of Layers to be sublayered:
Layer no. 3: Austroads (2004) sublayering

Results:

Layer No.	Thickness	Material ID	Load ID	Critical Strain	CDF
1	30.00	Asph 1410	ESA750-Full	-6.42E-06	2.86E-10
2	40.00	Asph 1500	ESA750-Full	-4.40E-04	4.80E-01
3	200.00	Gran_500	n/a		n/a
4	0.00	Sub_CBR12	ESA750-Full	7.53E-04	1.38E-21

CIRCLY Pro - Version 6.0 (20 June 2017) - *** Public Version - Pre-Release ***

Job Title: Dayton Primary School

Damage Factor Calculation

Assumed number of damage pulses per movement:
Combined pulse for gear (i.e. ignore NROWS)

Traffic Spectrum Details:

Load No.	Load ID	Movements
1	ESA750-Full	1.00E+05

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 165
Y: 0

Details of Layered System:

ID: 201389.00 Title: Dayton Primary School (Douglas Partners Alternative Pavement))

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Asph 1410	Iso.	1.41E+03	0.40			
2	rough	Gran_500	Aniso.	5.00E+02	0.35	3.70E+02	2.50E+02	0.35
3	rough	Sub_CBR12	Aniso.	1.20E+02	0.45	8.28E+01	6.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
1	bottom	Asph 1410	ETH	0.005337	5.000	1.130
3	top	Sub_CBR12	EZZ	4.000000	7.000	1.640

Reliability Factors:
Project Reliability: Austroads 95%

Layer No.	Reliability Factor	Material Type
1	1.00	Asphalt
3	1.00	Subgrade (Austroads 2004)

Details of Layers to be sublayered:
Layer no. 2: Austroads (2004) sublayering

Results:

Layer No.	Thickness	Material ID	Load ID		Critical Strain	CDF
1	30.00	Asph 1410	ESA750-Full		-2.40E-04	2.06E-02
2	200.00	Gran_500		n/a		n/a
3	0.00	Sub_CBR12	ESA750-Full		1.03E-03	1.19E-20

Appendix F

Acid Sulfate Soils Test Results

Table F-1: Summary of Screening and Chromium Suite Results

Test Location	Sample ID	Depth (m)	Soil Type	Screening Tests [1]				Chromium Suite Results					
				pH_F	pH_{FOX}	RxN [2] Strength	Δ [3] pH	pH_{KCl}	S-TAA [4] (%S)	S_{CR} [5] (%S)	S-NAS [6] (%S)	ANC_{BT} [7] (%S)	Net [8] Acidity (%S)
Assessment Criteria				*<4*	*<3*								*>0.03*
1	1	0.5	SAND SP: grey with trace silt	6.1	5.2	low	0.9	-	-	-	-	-	-
1	2	1	SAND SP: grey with trace silt	5.9	4.6	low	1.3	-	-	-	-	-	-
1	3	1.5	Silty SAND SM: dark brown	6.8	4.8	low	2	-	-	-	-	-	-
1	4	2	Silty SAND SM: dark brown	6.4	4	Medium	2.4	6.5	<0.01	<0.005	NT	NT	<0.005
3	5	0.5	SAND SP: light grey with trace silt	4.7	3.7	low	1	-	-	-	-	-	-
3	6	1	SAND SP: light grey with trace silt	5	4.2	low	0.8	-	-	-	-	-	-
3	7	1.5	SAND SP: light grey with trace silt	5.3	4.2	low	1.1	-	-	-	-	-	-
3	8	2	SAND SP-SC: light grey with clay	5.1	3.9	low	1.2	6.4	<0.01	<0.005	NT	NT	<0.005
3	9	2.5	SAND SP: light grey with trace clay	5.9	4.1	low	1.8	-	-	-	-	-	-
5	10	0.5	SAND SP: light grey with trace silt	5.1	2.9	low	2.2	7.1	<0.01	<0.005	NT	0.05	<0.005
5	11	1	SAND SP: light grey with trace silt	5.3	4.2	low	1.1	-	-	-	-	-	-
5	12	1.5	SAND SP: light grey with trace silt	5.2	4.5	low	0.7	-	-	-	-	-	-
5	13	2	Silty SAND SM: dark brown	5.8	4.1	low	1.7	-	-	-	-	-	-
5	14	2.5	Silty SAND SP-SM: brown	5.5	4.1	low	1.4	-	-	-	-	-	-
8	15	0.5	SAND SP: light grey with trace silt	5.2	3.3	low	1.9	-	-	-	-	-	-
8	16	1	SAND SP: light grey with trace silt	5	3.8	low	1.2	-	-	-	-	-	-
8	17	1.5	SAND SP: light grey with trace silt	5	3.8	low	1.2	-	-	-	-	-	-
8	18	2	SAND SP: light grey with trace silt	5.1	4.2	low	0.9	-	-	-	-	-	-
8	19	2.5	Clayey SAND CI: grey-brown mottled orange-brown	6.2	3.9	Medium	2.3	6.1	<0.01	<0.005	NT	NT	0.005

Table F-1: Summary of Screening and Chromium Suite Results

Test Location	Sample ID	Depth (m)	Soil Type	Screening Tests [1]				Chromium Suite Results					
				pH_F	pH_{FOX}	RxN [2] Strength	Δ [3] pH	pH_{KCl}	S-TAA [4] (%S)	S_{CR} [5] (%S)	S-NAS [6] (%S)	ANC_{BT} [7] (%S)	Net [8] Acidity (%S)
Assessment Criteria				*<4*	*<3*								*>0.03*
11	20	0.5	SAND SP: light grey with trace silt	4.9	4	low	0.9	-	-	-	-	-	-
11	21	1	SAND SP: light grey with trace silt	5	4.1	low	0.9	6.9	<0.01	<0.005	NT	0.02	<0.005
11	22	1.5	SAND SP: light grey with trace silt	5.2	4.5	low	0.7	-	-	-	-	-	-
11	23	2	SAND SP: light grey with trace silt	5.2	4.3	low	0.9	-	-	-	-	-	-
15	24	0.5	SAND SP: light grey with trace silt	5.2	3.8	low	1.4	6.7	<0.01	<0.005	NT	0.05	<0.005
15	25	1	SAND SP: yellow-brown with trace silt	5.6	4.2	low	1.4	-	-	-	-	-	-
15	26	1.5	SAND SP: yellow-brown with trace silt	5.8	4.3	low	1.5	-	-	-	-	-	-
15	27	2	SAND SP: yellow-brown with trace silt	6.2	4.6	low	1.6	-	-	-	-	-	-
15	28	2.5	SAND SP: yellow-brown with trace silt	6	4.4	low	1.6	-	-	-	-	-	-
15	29	2.9	SAND SP: yellow-brown with trace silt	6	4.7	low	1.3	-	-	-	-	-	-

Notes:
1. Screening Tests undertaken by MPL Laboratories
2. Slight – indicates no or slight effervescence in hydrogen peroxide
   Moderate – indicates moderate effervescence in hydrogen peroxide
   High – indicates vigorous effervescence in hydrogen peroxide
3. **Δ pH** – pH_F - pH_{FOX}
4. TAA – titratable actual acidity
5. Scr – chromium reducible sulfur
6. S-NAS – net acid soluble sulfur (reported for pHkCL < 4.5)
7. ANC_{BT} – acid neutralising capacity (reported for pHkCl > 6.5).
8. Net Acidity = TAA + Scr + NAS – ANC/FF
9. **0.03** = exceedence of adopted criteria

\- Sample not selected for analysis
NT Not tested

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph 08 9317 2505 fax 08 9317 4163
lab@mpl.com.au
www.mpl.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Perth
Attention	Rob Shapland

Sample Login Details

Your reference	201389.00
MPL Reference	257431
Date Sample Received	19/02/2021
Date Instructions Received	19/02/2021
Date Results Expected to be Reported	22/02/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	29 frozen soils
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	Frozen
Cooling Method	Ice
Sampling Date Provided	Yes

Comments

Nil

Please direct any queries to:

Heram Halim	Meredith Conroy
Phone: 08 9317 2505	**Phone: 08 9317 2505**
Fax: 08 9317 4163	**Fax: 08 9317 4163**
Email: hhalim@mpl.com.au	**Email: mconroy@mpl.com.au**

Analysis Underway, details on the following page:

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph 08 9317 2505 fax 08 9317 4163
lab@mpl.com.au
www.mpl.com.au

Sample ID	sPOCAS field test
1 0.5	✓
1 1.0	✓
1 1.5	✓
1 2.0	✓
3 0.5	✓
3 1.0	✓
3 1.5	✓
3 2.0	✓
3 2.5	✓
5 0.5	✓
5 1.0	✓
5 1.5	✓
5 2.0	✓
5 2.5	✓
8 0.5	✓
8 1.0	✓
8 1.5	✓
8 2.0	✓
8 2.5	✓
11 0.5	✓
11 1.0	✓
11 1.5	✓
11 2.0	✓
15 0.5	✓
15 1.0	✓
15 1.5	✓
15 2.0	✓
15 2.5	✓
15 2.9	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
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lab@mpl.com.au
www.mpl.com.au

CERTIFICATE OF ANALYSIS 257431

Client Details

Client	Douglas Partners Perth
Attention	Rob Shapland
Address	36 O'Malley St, Osborne Park, WA, 6017

Sample Details

Your Reference	**201389.00**
Number of Samples	29 frozen soils
Date samples received	19/02/2021
Date completed instructions received	19/02/2021
Location	Geotechnical Invest Dayton

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	22/02/2021
Date of Issue	22/02/2021

Results Approved By
Stacey Hawkins, Acid Soils Supervisor

Authorised By

Michael Kubiak, Laboratory Manager

sPOCAS field test						
Our Reference		257431-1	257431-2	257431-3	257431-4	257431-5
Your Reference	UNITS	1 0.5	1 1.0	1 1.5	1 2.0	3 0.5
Date Sampled		15/02/2021	15/02/2021	15/02/2021	15/02/2021	15/02/2021
Type of sample		Frozen soil	Frozen soil	Frozen soil	Frozen soil	Frozen soil
Date prepared	-	19/02/2021	19/02/2021	19/02/2021	19/02/2021	19/02/2021
Date analysed	-	22/02/2021	22/02/2021	22/02/2021	22/02/2021	22/02/2021
pH_F (field pH test)*	pH Units	6.1	5.9	6.8	6.4	4.7
pHFOX (field peroxide test)*	pH Units	5.2	4.6	4.8	4.0	3.7
Reaction Rate*	-	low	low	low	Medium	low

sPOCAS field test						
Our Reference		257431-6	257431-7	257431-8	257431-9	257431-10
Your Reference	UNITS	3 1.0	3 1.5	3 2.0	3 2.5	5 0.5
Date Sampled		15/02/2021	15/02/2021	15/02/2021	15/02/2021	15/02/2021
Type of sample		Frozen soil	Frozen soil	Frozen soil	Frozen soil	Frozen soil
Date prepared	-	19/02/2021	19/02/2021	19/02/2021	19/02/2021	19/02/2021
Date analysed	-	22/02/2021	22/02/2021	22/02/2021	22/02/2021	22/02/2021
pH_F (field pH test)*	pH Units	5.0	5.3	5.1	5.9	5.1
pHFOX (field peroxide test)*	pH Units	4.2	4.2	3.9	4.1	2.9
Reaction Rate*	-	low	low	low	low	low

sPOCAS field test						
Our Reference		257431-11	257431-12	257431-13	257431-14	257431-15
Your Reference	UNITS	5 1.0	5 1.5	5 2.0	5 2.5	8 0.5
Date Sampled		15/02/2021	15/02/2021	15/02/2021	15/02/2021	15/02/2021
Type of sample		Frozen soil	Frozen soil	Frozen soil	Frozen soil	Frozen soil
Date prepared	-	19/02/2021	19/02/2021	19/02/2021	19/02/2021	19/02/2021
Date analysed	-	22/02/2021	22/02/2021	22/02/2021	22/02/2021	22/02/2021
pH_F (field pH test)*	pH Units	5.3	5.2	5.8	5.5	5.2
pHFOX (field peroxide test)*	pH Units	4.2	4.5	4.1	4.1	3.3
Reaction Rate*	-	low	low	low	low	low

sPOCAS field test						
Our Reference		257431-16	257431-17	257431-18	257431-19	257431-20
Your Reference	UNITS	8 1.0	8 1.5	8 2.0	8 2.5	11 0.5
Date Sampled		15/02/2021	15/02/2021	15/02/2021	15/02/2021	15/02/2021
Type of sample		Frozen soil	Frozen soil	Frozen soil	Frozen soil	Frozen soil
Date prepared	-	19/02/2021	19/02/2021	19/02/2021	19/02/2021	19/02/2021
Date analysed	-	22/02/2021	22/02/2021	22/02/2021	22/02/2021	22/02/2021
pH_F (field pH test)*	pH Units	5.0	5.0	5.1	6.2	4.9
pHFOX (field peroxide test)*	pH Units	3.8	3.8	4.2	3.9	4.0
Reaction Rate*	-	low	low	low	Medium	low

sPOCAS field test						
Our Reference		257431-21	257431-22	257431-23	257431-24	257431-25
Your Reference	UNITS	11 1.0	11 1.5	11 2.0	15 0.5	15 1.0
Date Sampled		15/02/2021	15/02/2021	15/02/2021	15/02/2021	15/02/2021
Type of sample		Frozen soil	Frozen soil	Frozen soil	Frozen soil	Frozen soil
Date prepared	-	19/02/2021	19/02/2021	19/02/2021	19/02/2021	19/02/2021
Date analysed	-	22/02/2021	22/02/2021	22/02/2021	22/02/2021	22/02/2021
pH_F (field pH test)*	pH Units	5.0	5.2	5.2	5.2	5.6
pHFOX (field peroxide test)*	pH Units	4.1	4.5	4.3	3.8	4.2
Reaction Rate*	-	low	low	low	low	low

sPOCAS field test					
Our Reference		257431-26	257431-27	257431-28	257431-29
Your Reference	UNITS	15 1.5	15 2.0	15 2.5	15 2.9
Date Sampled		15/02/2021	15/02/2021	15/02/2021	15/02/2021
Type of sample		Frozen soil	Frozen soil	Frozen soil	Frozen soil
Date prepared	-	19/02/2021	19/02/2021	19/02/2021	19/02/2021
Date analysed	-	22/02/2021	22/02/2021	22/02/2021	22/02/2021
pH_F (field pH test)*	pH Units	5.8	6.2	6.0	6.0
pHFOX (field peroxide test)*	pH Units	4.3	4.6	4.4	4.7
Reaction Rate*	-	low	low	low	low

Method ID	Methodology Summary
INORG-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	1	19/02/2021	19/02/2021		[NT]	[NT]
Date analysed	-			[NT]	1	22/02/2021	22/02/2021		[NT]	[NT]
pH_F (field pH test)*	pH Units		INORG-063	[NT]	1	6.1	6.1	0	[NT]	[NT]
pHFOX (field peroxide test)*	pH Units		INORG-063	[NT]	1	5.2	4.9	6	[NT]	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	19/02/2021	19/02/2021		[NT]	[NT]
Date analysed	-			[NT]	11	22/02/2021	22/02/2021		[NT]	[NT]
pH_F (field pH test)*	pH Units		INORG-063	[NT]	11	5.3	5.2	2	[NT]	[NT]
pHFOX (field peroxide test)*	pH Units		INORG-063	[NT]	11	4.2	4.1	2	[NT]	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	19/02/2021	19/02/2021		[NT]	[NT]
Date analysed	-			[NT]	21	22/02/2021	22/02/2021		[NT]	[NT]
pH_F (field pH test)*	pH Units		INORG-063	[NT]	21	5.0	5.0	0	[NT]	[NT]
pHFOX (field peroxide test)*	pH Units		INORG-063	[NT]	21	4.1	4.1	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY Despatch Sheet

Project Name: Geotechnical Invest Dayton
Project No: 201389.00
DP Contact Person: Rob Shapland
Prior Storage: Freezer

To: MPL Envirolab
16-18 Hayden Court
Myaree
Ph: 9317 2505

Sample ID	Depth (m)	Sampling Date	Sample Type S - Soil W - Water	Preservation	Lab ID	Analytes: pHF	pHFox										NOTES
1	0.5	15/02/21	S	Freezer	1	x	x										
1	1.0				2												
1	1.5				3												
1	2.0				4												
3	0.5				5												
3	1.0				6												
3	1.5				7												
3	2.0				8												
3	2.5				9												
5	0.5				10												
5	1.0				11												
5	1.5				12												
5	2.0				13												
5	2.5				14												
8	0.5				15												
LOR (S)																	
LOR (W)																	

ALS Laboratories
Job No: 257431
Date Rec'd: 19/2/21
Time Rec'd: 12:35
Rec'd By: Cm
Temp: Ambient
Cooling: Ice Pack / None
Security Seal: Yes / No

LOR = Limit of Reporting, *As per Laboratory Method Detection Limit

Sampled By: Paul Druskovich
Received By: Cm
Relinquished By: Rhys Kotrich
Relinquished By:
Sign:
Sign:
Date/Time: 19/02/2021
Date/Time: 19/2/21 12:35

** IMPORTANT: PLEASE SIGN AND DATE TO ACKNOWLEDGE RECIEPT OF SAMPLES AND RETURN BY EMAIL**

Send Results to:
Douglas Partners Pty Ltd
36 O'Malley Street
OSBORNE PARK 6017
Ph: (08) 9204 3511
Fax: (08) 9204 3522
Accounts:
perth@douglaspartners.com.au

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY Despatch Sheet

Project Name: Geotechnical Invest Dayton
Project No: 201389.00
DP Contact Person: Rob Shapland
Prior Storage: Freezer

To: MPL Envirolab
16-18 Hayden Court
Myaree
Ph: 9317 2505

Sample ID	Depth (m)	Sampling Date	Sample Type S - Soil W - Water	Preservation	Lab ID	Analytes: pHf	pHfox										NOTES
8	1.0	15/02/21	S	Freezer	16	X	X										
8	1.5				17												
8	2.0				18												
8	2.5				19												
11	0.5				20												
11	1.0				21												
11	1.5				22												
11	2.0				23												
15	0.5				24												
15	1.0				25												
15	1.5				26												
15	2.0				27												
15	2.5				28												
15	2.9				29												
LOR (S)																	
LOR (W)																	

LOR = Limit of Reporting, *As per Laboratory Method Detection Limit

Sampled By: Paul Druskovich
Received By: Am
Relinquished By: Rhys Katich
Relinquished By:
Sign:
Sign:
Date/Time: 19/02/2021
Date/Time: 19/2/21 12:35

** IMPORTANT: PLEASE SIGN AND DATE TO ACKNOWLEDGE RECIEPT OF SAMPLES AND RETURN BY EMAIL**

Send Results to:
Douglas Partners Pty Ltd
36 O'Malley Street
OSBORNE PARK 6017
Ph: (08) 9204 3511
Fax: (08) 9204 3522
Accounts:
perth@douglaspartners.com.au

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph 08 9317 2505 fax 08 9317 4163
lab@mpl.com.au
www.mpl.com.au

DATA QUALITY ASSESSMENT SUMMARY

Report Details

Envirolab Report Reference	**257431**
Client ID	Douglas Partners Perth
Project Reference	201389.00
Date Issued	22/02/2021

QC DATA

All laboratory QC data was within the Envirolab Group's specifications.

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HOLDING TIME COMPLIANCE EVALUATION

All preservation / holding times (based on AS/ASPHA/ISO/NEPM/USEPA reference documents and standards) are compliant except:

Holding Time Exceedances

Analysis	Sample No	Date Sampled	Date Extracted	Date Analysed	Accepted
sPOCAS field test					
	257431-1	15/02/2021	19/02/2021	22/02/2021	✗
	257431-2	15/02/2021	19/02/2021	22/02/2021	✗
	257431-3	15/02/2021	19/02/2021	22/02/2021	✗
	257431-4	15/02/2021	19/02/2021	22/02/2021	✗
	257431-5	15/02/2021	19/02/2021	22/02/2021	✗
	257431-6	15/02/2021	19/02/2021	22/02/2021	✗
	257431-7	15/02/2021	19/02/2021	22/02/2021	✗
	257431-8	15/02/2021	19/02/2021	22/02/2021	✗
	257431-9	15/02/2021	19/02/2021	22/02/2021	✗
	257431-10	15/02/2021	19/02/2021	22/02/2021	✗
	257431-11	15/02/2021	19/02/2021	22/02/2021	✗
	257431-12	15/02/2021	19/02/2021	22/02/2021	✗
	257431-13	15/02/2021	19/02/2021	22/02/2021	✗
	257431-14	15/02/2021	19/02/2021	22/02/2021	✗
	257431-15	15/02/2021	19/02/2021	22/02/2021	✗
	257431-16	15/02/2021	19/02/2021	22/02/2021	✗
	257431-17	15/02/2021	19/02/2021	22/02/2021	✗
	257431-18	15/02/2021	19/02/2021	22/02/2021	✗
	257431-19	15/02/2021	19/02/2021	22/02/2021	✗
	257431-20	15/02/2021	19/02/2021	22/02/2021	✗
	257431-21	15/02/2021	19/02/2021	22/02/2021	✗
	257431-22	15/02/2021	19/02/2021	22/02/2021	✗
	257431-23	15/02/2021	19/02/2021	22/02/2021	✗
	257431-24	15/02/2021	19/02/2021	22/02/2021	✗
	257431-25	15/02/2021	19/02/2021	22/02/2021	✗
	257431-26	15/02/2021	19/02/2021	22/02/2021	✗
	257431-27	15/02/2021	19/02/2021	22/02/2021	✗

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Holding Time Exceedances

Analysis	Sample No	Date Sampled	Date Extracted	Date Analysed	Accepted
	257431-28	15/02/2021	19/02/2021	22/02/2021	✗
	257431-29	15/02/2021	19/02/2021	22/02/2021	✗

Certain analyses have had their recommended technical holding times elongated by filtering and/or freezing on receipt at the laboratory (e.g. BOD, chlorophyll/Pheophytin, nutrients and acid sulphate soil tests).

COMPLIANCE TO QC FREQUENCY (NEPM)

Internal laboratory QC rate complies with NEPM requirements (LCS/MB/MS 1 in 20, Duplicates 1 in 10 samples). Note, samples are batched together with other sample consignments in order to assign QC sample frequency.

QC Evaluation

Duplicate(s) was performed as per NEPM frequency	✓
Laboratory Control Sample(s) were analysed with the samples received	✓
A Method Blank was performed with the samples received	✓
Matrix spike(s) was performed as per NEPM frequency (Not Applicable for Air samples)	✓

Refer to Certificate of Analysis for all Quality Control data.

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SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Perth
Attention	Rhys Katich

Sample Login Details

Your reference	201389.00
MPL Reference	257601
Date Sample Received	19/02/2021
Date Instructions Received	23/02/2021
Date Results Expected to be Reported	04/03/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	6 dried soils
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	Ambient
Cooling Method	Not applicable
Sampling Date Provided	Yes

Comments

Nil

Please direct any queries to:

Heram Halim	Meredith Conroy
Phone: 08 9317 2505	**Phone: 08 9317 2505**
Fax: 08 9317 4163	**Fax: 08 9317 4163**
Email: hhalim@mpl.com.au	**Email: mconroy@mpl.com.au**

Analysis Underway, details on the following page:

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Sample ID	Chromium Suite
1 2.0m	✓
3 2.0m	✓
5 0.5m	✓
8 2.5m	✓
11 1.0m	✓
15 0.5m	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.

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CERTIFICATE OF ANALYSIS 257601

Client Details

Client	Douglas Partners Perth
Attention	Rhys Katich
Address	36 O'Malley St, Osborne Park, WA, 6017

Sample Details

Your Reference	**201389.00**
Number of Samples	6 dried soils
Date samples received	19/02/2021
Date completed instructions received	23/02/2021
Location	Geotechnical Invest. Dayton

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	04/03/2021
Date of Issue	04/03/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Stacey Hawkins, Acid Soils Supervisor

Authorised By

Michael Kubiak, Laboratory Manager

Chromium Suite						
Our Reference		257601-1	257601-2	257601-3	257601-4	257601-5
Your Reference	UNITS	1 2.0m	3 2.0m	5 0.5m	8 2.5m	11 1.0m
Date Sampled		15/02/2021	15/02/2021	15/02/2021	15/02/2021	15/02/2021
Type of sample		Dried soil	Dried soil	Dried soil	Dried soil	Dried soil
Date analysed	-	04/03/2021	04/03/2021	04/03/2021	04/03/2021	04/03/2021
pH $_{kcl}$	pH units	6.5	6.4	7.1	6.1	6.9
TAA	moles H^+ /t	<5	<5	<5	<5	<5
S_{KCl}	%w/w S	NT	NT	NT	NT	NT
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
ANC_{BT}	% $CaCO_3$	NT	NT	0.1	NT	0.05
S_{HCl}	%w/w S	NT	NT	NT	NT	NT
s-TAA	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
a-Chromium Reducible Sulfur	moles H^+ /t	<5	<5	<5	<5	<5
a-ANC_{BT}	moles H^+ /t	NT	NT	29	NT	9.9
s-ANC_{BT}	%w/w S	NT	NT	0.05	NT	0.02
Fineness Factor		1.50	1.50	1.50	1.50	1.50
S_{NAS}	%w/w S	NT	NT	NT	NT	NT
a-S_{NAS}	moles H^+ /t	NT	NT	NT	NT	NT
s-SNAS	%w/w S	NT	NT	NT	NT	NT
s-Net Acidity	%w/w S	<0.005	<0.005	<0.005	0.005	<0.005
a-Net Acidity	moles H^+ /t	<5	<5	<5	<5	<5
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without ANCE	% w/w S	<0.005	<0.005	<0.005	0.005	<0.005
a-Net Acidity without ANCE	moles H^+ /t	<5	<5	<5	<5	<5
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	<0.75

Chromium Suite		
Our Reference		257601-6
Your Reference	UNITS	15 0.5m
Date Sampled		15/02/2021
Type of sample		Dried soil
Date analysed	-	04/03/2021
pH $_{kcl}$	pH units	6.7
TAA	moles H^+ /t	<5
S_{KCl}	%w/w S	NT
Chromium Reducible Sulfur	%w/w	<0.005
ANC_{BT}	% $CaCO_3$	0.1
S_{HCl}	%w/w S	NT
s-TAA	%w/w S	<0.01
a-Chromium Reducible Sulfur	moles H^+ /t	<5
a-ANC_{BT}	moles H^+ /t	29
s-ANC_{BT}	%w/w S	0.05
Fineness Factor		1.50
S_{NAS}	%w/w S	NT
a-S_{NAS}	moles H^+ /t	NT
s-SNAS	%w/w S	NT
s-Net Acidity	%w/w S	<0.005
a-Net Acidity	moles H^+ /t	<5
Liming rate	kg $CaCO_3$ /t	<0.75
s-Net Acidity without ANCE	% w/w S	<0.005
a-Net Acidity without ANCE	moles H^+ /t	<5
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75

Method ID	Methodology Summary
INORG-064	Suspension Peroxide Oxidation Combined Acidity and Sulphate (SPOCAS) using ASSMAC guidelines.
INORG-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date analysed	-			04/03/2021	1	04/03/2021	04/03/2021		04/03/2021	[NT]
pH $_{kcl}$	pH units		INORG-064	[NT]	1	6.5	6.5	0	99	[NT]
TAA	moles H^+/t	5	INORG-064	[NT]	1	<5	<5	0	92	[NT]
S_{KCl}	%w/w S	0.005	INORG-064	[NT]	1	NT	NT		[NT]	[NT]
Chromium Reducible Sulfur	%w/w	0.005	INORG-068	[NT]	1	<0.005	<0.005	0	99	[NT]
ANC_{BT}	% $CaCO_3$	0.01	INORG-068	[NT]	1	NT	NT		103	[NT]
S_{HCl}	%w/w S	0.005	INORG-068	[NT]	1	NT	NT		[NT]	[NT]
s-TAA	%w/w S	0.01	INORG-068	[NT]	1	<0.01	<0.01	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+/t	5	INORG-068	[NT]	1	<5	<5	0	[NT]	[NT]
a-ANC_{BT}	moles H^+/t	5	INORG-068	[NT]	1	NT	NT		[NT]	[NT]
s-ANC_{BT}	%w/w S	0.01	INORG-068	[NT]	1	NT	<0.01		[NT]	[NT]
Fineness Factor			INORG-064	[NT]	1	1.50	1.50	0	[NT]	[NT]
S_{NAS}	%w/w S	0.005	INORG-068	[NT]	1	NT	NT		[NT]	[NT]
a-S_{NAS}	moles H^+/t	5	INORG-064	[NT]	1	NT	NT		[NT]	[NT]
s-SNAS	%w/w S	0.01	INORG-064	[NT]	1	NT	NT		[NT]	[NT]
s-Net Acidity	%w/w S	0.005	INORG-064	[NT]	1	<0.005	<0.005	0	[NT]	[NT]
a-Net Acidity	moles H^+/t	5	INORG-064	[NT]	1	<5	<5	0	[NT]	[NT]
Liming rate	kg $CaCO_3$/t	0.75	INORG-068	[NT]	1	<0.75	<0.75	0	[NT]	[NT]
s-Net Acidity without ANCE	% w/w S	0.005	INORG-064	[NT]	1	<0.005	<0.005	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+/t	5	INORG-064	[NT]	1	<5	<5	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	INORG-064	[NT]	1	<0.75	<0.75	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
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Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
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Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

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Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

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Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

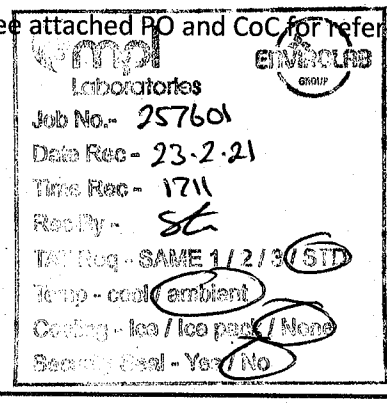
Stacey Hawkins

From: Rhys Katich <Rhys.Katich@douglaspartners.com.au>
Sent: Tuesday, 23 February 2021 5:11 PM
To: Stacey Hawkins
Cc: Rob Shapland
Subject: Chromium suite analysis for 257431
Attachments: 201389.00.M.001.Rev0.PO MPL Chromium 20210223.pdf; 257431 COC.pdf

Hi Stacey,

Can you please conduct Chromium suite testing on the following samples (see attached PO and CoC for reference):

- ID4: 1 2.0 m;
- ID8: 3 2.0 m;
- ID10: 5 0.5 m;
- ID19: 8 2.5 m;
- ID21: 11 1.0 m; and
- ID24: 15 0.5 m.



Kind Regards,

Rhys Katich | Environmental Engineer
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au
36 O'Malley Street Osborne Park WA 6017
P: 08 9204 3511 | E: Rhys.Katich@douglaspartners.com.au

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph 08 9317 2505 fax 08 9317 4163
lab@mpl.com.au
www.mpl.com.au

DATA QUALITY ASSESSMENT SUMMARY

Report Details

Envirolab Report Reference	**257601**
Client ID	Douglas Partners Perth
Project Reference	201389.00
Date Issued	04/03/2021

QC DATA

All laboratory QC data was within the Envirolab Group's specifications.

HOLDING TIME COMPLIANCE EVALUATION

All preservation / holding times (based on AS/ASPHA/ISO/NEPM/USEPA reference documents and standards) are compliant.

Certain analyses have had their recommended technical holding times elongated by filtering and/or freezing on receipt at the laboratory (e.g. BOD, chlorophyll/Pheophytin, nutrients and acid sulphate soil tests).

COMPLIANCE TO QC FREQUENCY (NEPM)

Internal laboratory QC rate complies with NEPM requirements (LCS/MB/MS 1 in 20, Duplicates 1 in 10 samples). Note, samples are batched together with other sample consignments in order to assign QC sample frequency.

QC Evaluation

Duplicate(s) was performed as per NEPM frequency	✓
Laboratory Control Sample(s) were analysed with the samples received	✓
A Method Blank was performed with the samples received	✓
Matrix spike(s) was performed as per NEPM frequency (Not Applicable for Air samples)	✓

Refer to Certificate of Analysis for all Quality Control data.

Dayton Primary School

Transport Impact Assessment

PREPARED FOR:
Christou Design Group Pty Ltd

March 2021

Document history and status

Author	Revision	Approved by	Date	Revision type
R White	r01	B Bordbar	18/03/2021	

File name: t20344-rw-r01.docx

Author: Robin White

Project manager: Behnam Bordbar

Client: Christou Design Group Pty Ltd

Project: Dayton Primary School

Document revision: r01

Project number: t20.344

TABLE OF CONTENTS

REPORT FIGURES

REPORT TABLES

1.0 Introduction

This Transport Impact Assessment has been prepared by Transcore for Christou Design Group Pty Ltd in relation to the proposed Dayton Primary School in the City of Swan.

The site is located within the developing suburb of Dayton. It is bounded by Cranleigh Street on the southern side and Arthur Street on the western side. Figure 1 illustrates the location of the proposed school site in the context of the West Swan (East) District Structure Plan.

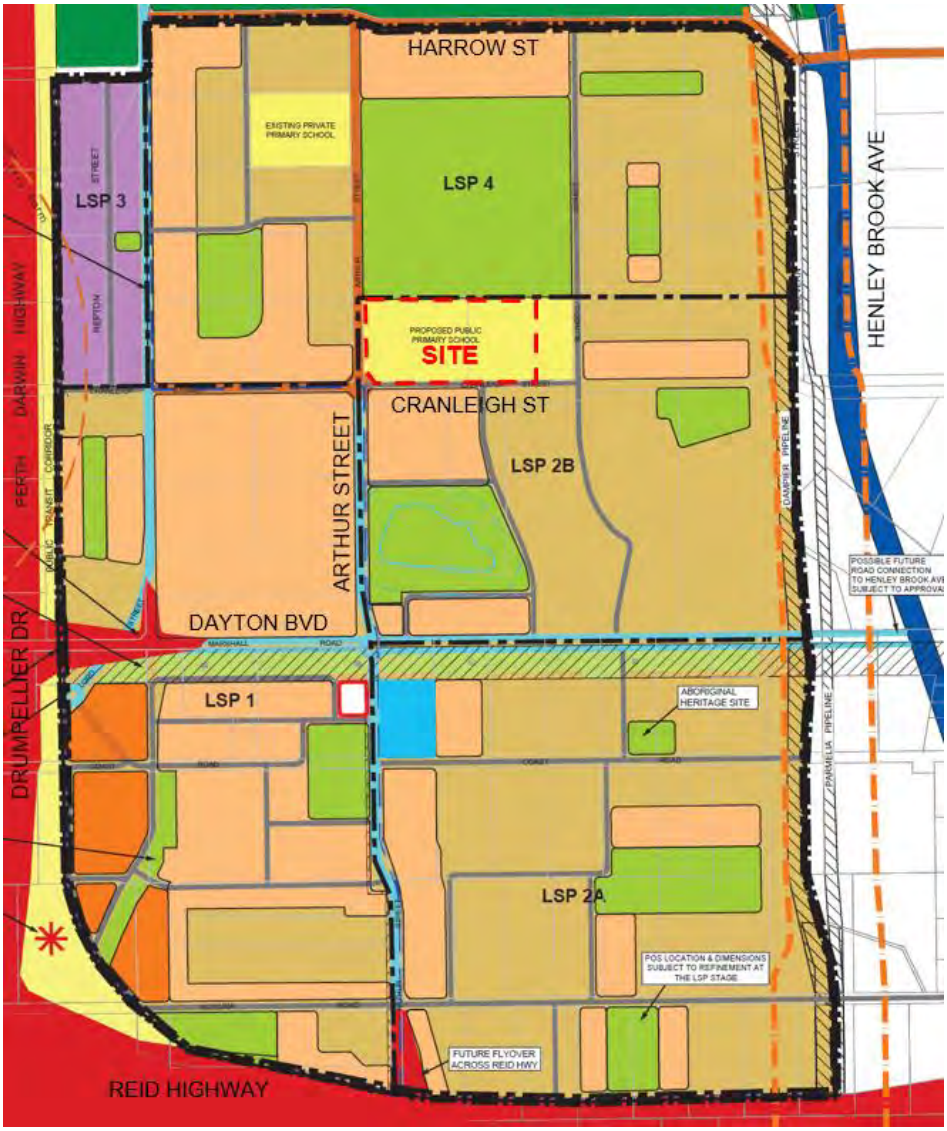


Figure 1: Site location

Key issues that will be addressed in this report include traffic flows and parking, public transport and access for pedestrians and cyclists.

2.0 Proposed Development

The proposed Dayton Primary School site is identified in the West Swan (East) District Structure Plan, as shown in Figure 1 and in Appendix B.

The school is designed as a standard pattern primary school for 540 students (primary, pre-primary and kindergarten) but will also accommodate a number of transportable classrooms on the site while required to increase the total capacity to 870 students. This total comprises 750 pre-primary to year 6 students (full time) and 120 kindergarten students (part time) for a total full time equivalent (FTE) of 810 students.

The site is proposed to have driveway accesses from the roads abutting the site on the west and south sides of the site, with two access points on each side as shown on the proposed masterplan in Figure 2 and Appendix A.

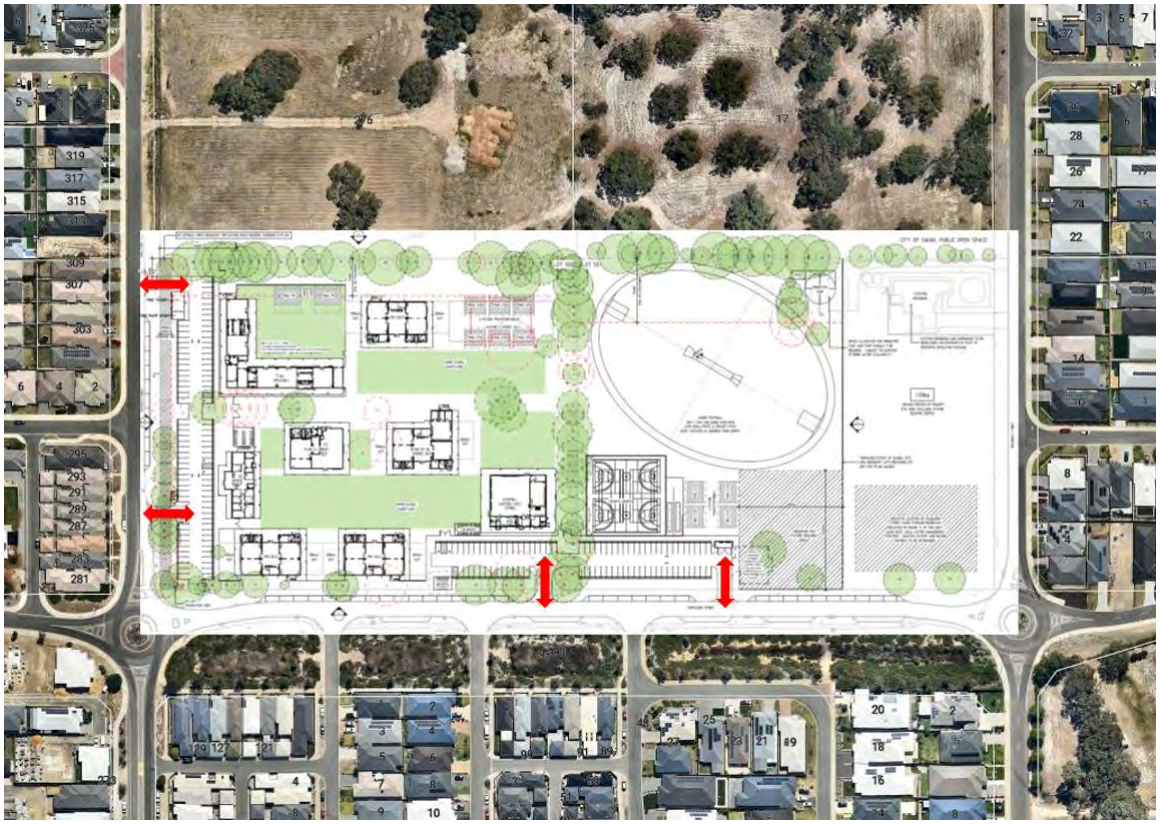


Figure 2: Proposed Primary School site layout

The Master Plan shows 171 parking bays on site including 5 accessible bays. In addition, there are 42 embayed parking spaces shown on street adjacent to the school site on the south and west boundary roads for a total parking provision of 213 parking spaces.

Bicycle racks will be provided on-site (32 racks to accommodate 64 bicycles).

The master plan includes a comprehensive internal path network within the site with connections to the boundary roads on the south and west sides of the site.

3.0 Existing Situation

3.1 Land Use

The subject site and adjacent land to the north is currently rural land. Surrounding land uses to the south, west and east of the subject site are predominantly residential subdivision development, as can be seen in Figure 3.

Figure 3: Existing land uses

There is an existing Caversham Primary School (528 students in 2019: source MySchools website) on Coast Road approximately 1km southeast of the subject site and an existing Riverlands Montessori School (76 students in 2019) on the western side of Arthur Street approximately 250m north of the subject site.

3.2 Existing Road Network

The existing road network around the site is illustrated in Figure 3 and the existing MRWA functional road hierarchy in this area is illustrated in Figure 4.

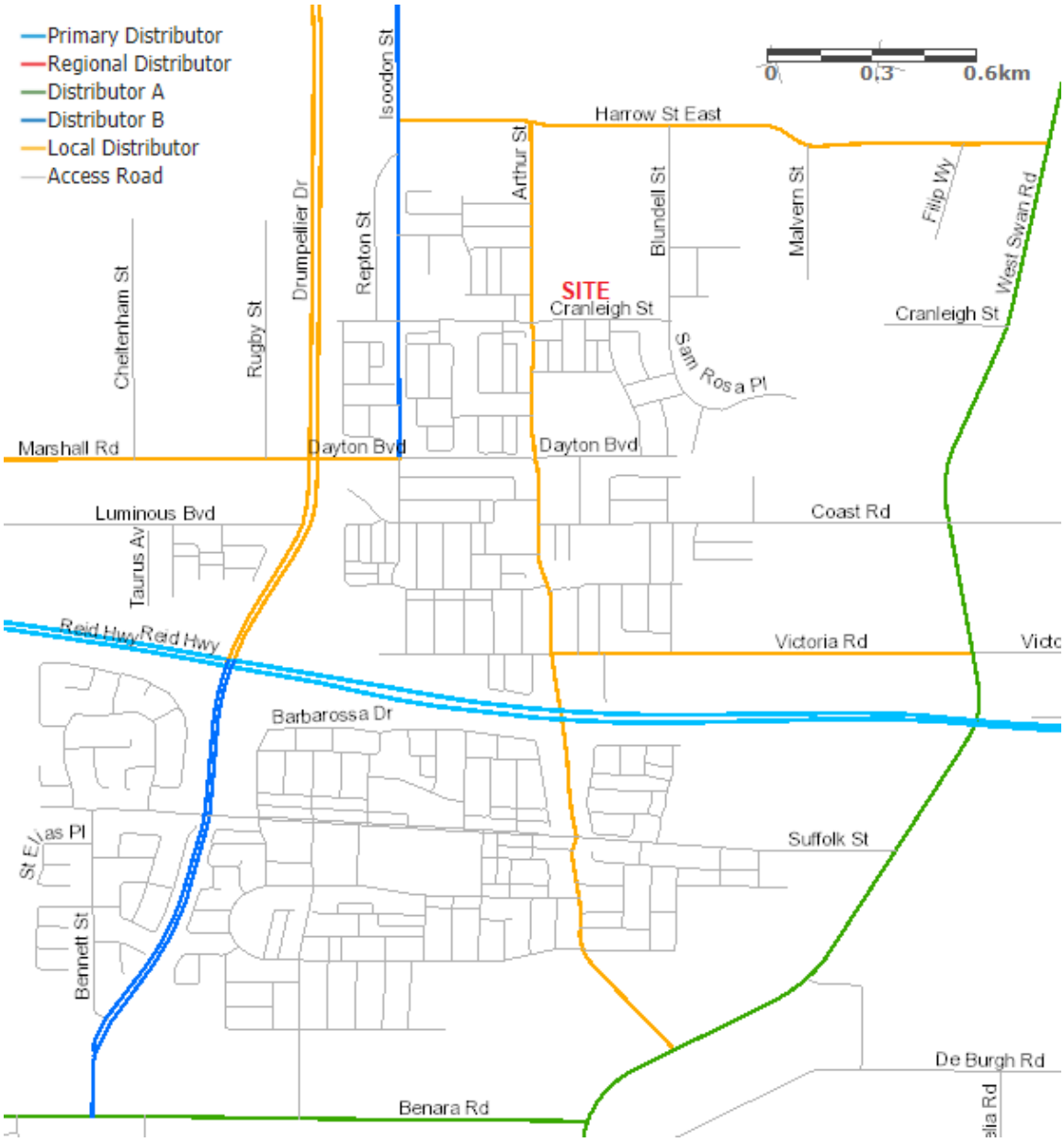


Figure 4: Existing road hierarchy

Arthur Street

Arthur Street is currently classified as a Local Distributor road in the Main Roads WA functional road hierarchy with a posted speed limit of 60km/h and school speed zone of 40km/h (7.30-9AM and 2.30-4PM school days) at the Riverlands Montessori School north of the subject site. Adjacent to the subject site, Arthur Street (north of Cranleigh Street) is constructed as a single carriageway, two-lane road with approximately 7.4m sealed width. It is kerbed and drained on the western side but unkerbed on the eastern side.

The section between Cranleigh Street and Aurum Parade has two indented parking bays in the western verge as visitor parking for adjacent residentianl development that has vehicular access via a rear laneway parallel to Arthur Street. North of Aurum Parade the residential lots have direct driveway access on Arthur Street.

Cranleigh Street
Cranleigh Street is classified as an Access Road in the Main Roads WA functional road hierarchy with a posted speed limit of 60km/h. Adjacent to the subject site, Cranleigh Street (east of Arthur Street) is constructed as a single carriageway, two-lane road with approximately 6.5m sealed width. It is kerbed on both sides.

The section between Arthur Street and Blundell Street has five sets of three indented parking bays in the southern verge. Residential development on the southern side is separated from Cranleigh Street by a wide drainage swale and there is no driveway access on the southern side.

Blundell Street
Blundell Street is classified as an Access Road in the Main Roads WA functional road hierarchy and the default built up area speed limit of 50km/h applies. It is constructed as a single carriageway, two-lane road with approximately 7.4m sealed width. It is kerbed on both sides and has direct driveway access to residential properties on the eastern side.

Existing intersections
The street block containing the proposed school site and future Frankland Park is bounded by Arthur Street, Cranleigh Street and Blundell Street. There are two existing roundabouts (single lane roundabouts with 16m central island diameter) around this street block as follows:

- Arthur Street / Cranleigh Street 4-way roundabout; and
- Cranleigh St / Blundell St / Sam Rosa Place 4-way roundabout.

There are also five existing full-movement T-intersections around this street block as follows:

- Arthur St / Aurum Pde T-intersection (western side of school site);
- Cranleigh St / Kabiana Way T-intersection (southern side of school site);
- Cranleigh St / Synandra Way T-intersection (southern side of school site);
- Cranleigh St / Featherflower Ave T-intersection (southern side of school site); and
- Blundell St / Alabaster Rd T-intersection (eastern side of Blundell St).

3.3 Road Safety

Crash data information available on the Main Roads WA website for the five-year period from 2016 to 2020 indicates that no crashes have been recorded on the sections of Arthur Street, Cranleigh Street and Blundell Street around the street block containing the proposed school site during this period.

3.4 Public Transport

Transperth Bus Route No. 353 (Henley Brook bus station – Bassendean Station) runs on Arthur Street adjacent to the subject site, as shown in Figure 5. It generally provides an hourly service during the day on all days, and up to three per hour during 7-9AM and 3.30-5PM peak periods on weekdays.

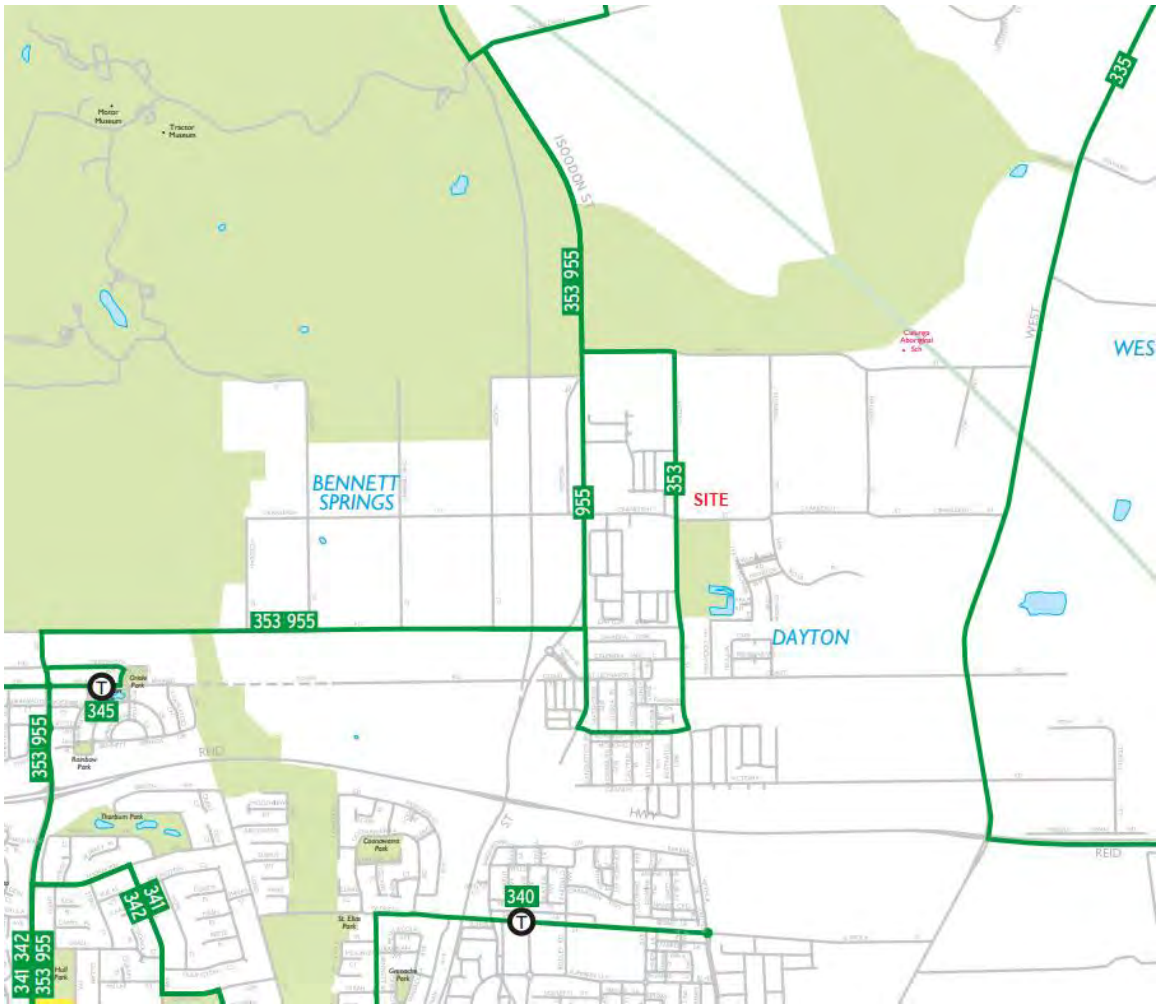


Figure 5: Existing bus routes

3.5 Pedestrian and Cyclist Facilities

The subdivisional road network around the subject site includes a comprehensive network of shared paths and footpaths in accordance with WAPC Liveable Neighbourhoods requirements. This includes a 2.3m path on the western side verge of Arthur Street, 1.8m to 2.5m paths on the southern side of Cranleigh Street and a 2.3m wide path on the eastern side of Blundell Street.

The Perth Bike Maps (see Figure 6) show the existing shared paths and other cycling facilities in the wider surrounding area to the extent that they had been developed

when that map was prepared in 2016, noting that substantial residential subdivision has progressed in the surrounding area since then.

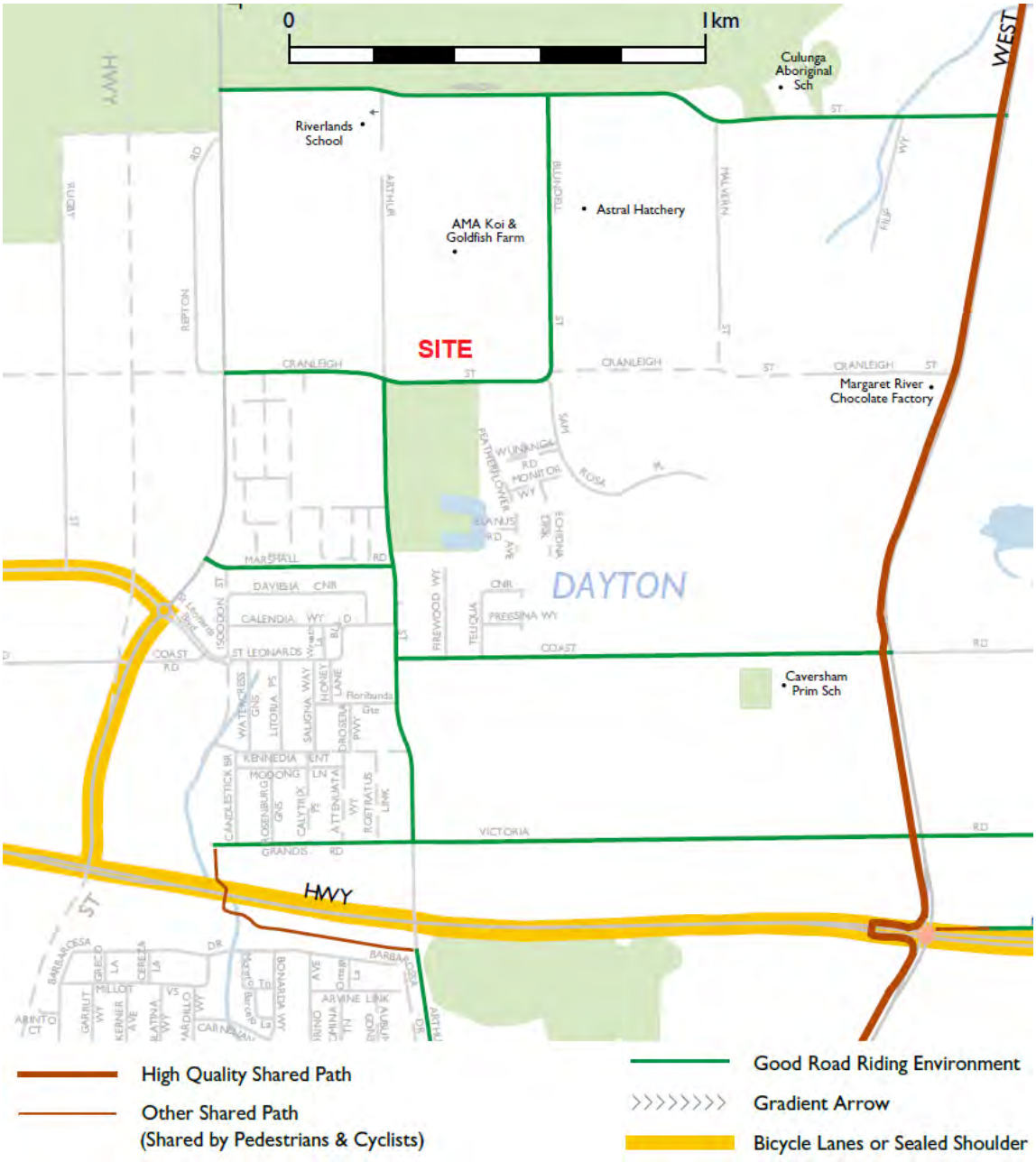


Figure 6: Existing bicycle facilities (2016)

3.6 Changes to Surrounding Land Use and Transport Networks

A substantial amount of residential subdivision development has already progressed in Dayton in accordance with the overall structure planning for this area, as shown in Figure 1 and Appendix B.

The planned road hierarchy around the proposed school site was set out in the Transport Assessment report for Dayton Local Structure Plan 2B (LSP2B), as shown in **Figure 7**. Arthur Street (north of Cranleigh Street) was planned as a Neighbourhood Connector A under the WAPC Liveable Neighbourhoods policy and Cranleigh Street (east of Arthur Street) and Blundell Street were planned as Access Street B.

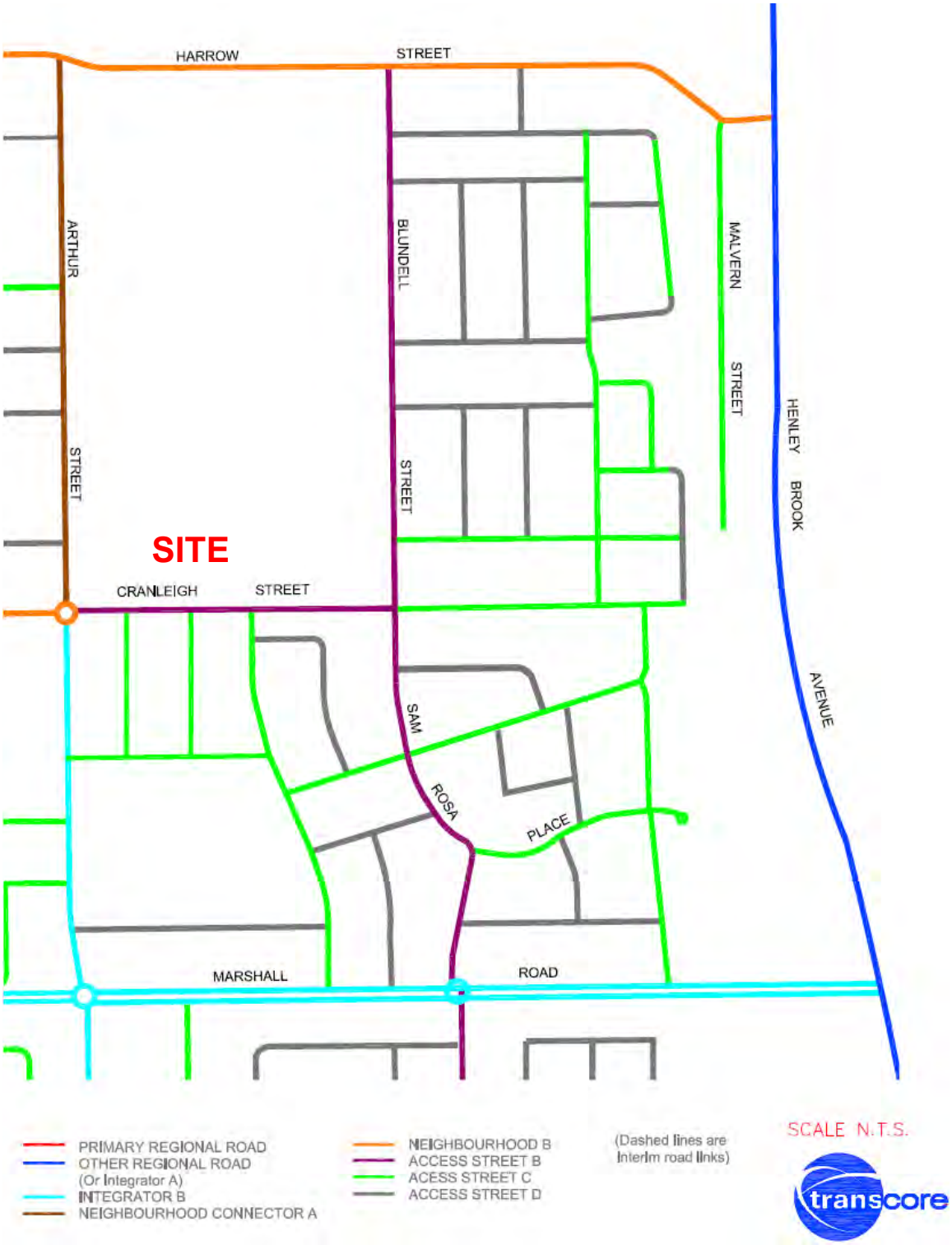


Figure 7: Planned Road Hierarch (LSP2B)

It should be noted that Arthur Street (south of Cranleigh Street) is planned as an Integrator B and Cranleigh Street west of Arthur Street as a Neighbourhood Connector B, which are each one step higher in the road hierarchy than the corresponding road sections adjacent to the subject site.

This road hierarchy reflects the planned Activity Corridor route within the West Swan (East) District Structure Plan (Dayton was previously known as West Swan East). That Activity Corridor route runs on Isoodon Street (which was formerly Lord Street) north of Cranleigh Street, then turns eastwards on Cranleigh Street, then southwards on Arthur Street to cross over Reid Highway via the recently constructed Arthur Street flyover.

LSP2B includes a 5m road widening requirement on the eastern side of Arthur Street. This 5m road widening is to accommodate the planned Integrator B standard of Arthur Street south of Cranleigh Street and the planned Neighbourhood Connector A standard of Arthur Street north of Cranleigh Street. Accordingly, there is a 5-metre road widening requirement affecting the western frontage of the proposed school site and this land is identified for that purpose on the proposed school masterplan.

However, it should be noted that the DSP and LSP2B date back to the period when the Primary Regional Roads Reservation (red road) on the western side of Dayton was for the planned future alignment for the Perth-Darwin National Highway (PDNH). Road network planning has subsequently changed and the new PDNH alignment shifted further to the west as an extension of Tonkin Highway recently constructed as the NorthLink WA project. Under the previous plans there would have been no direct road connections from Dayton to the PDNH alignment, only a flyover to the west at Marshall Road and the Arthur Street flyover across Reid Highway to the south.

Following the realignment of the PDNH, the Primary Regional Roads Reservation (red road) on the western side of Dayton has now been constructed as a dual carriageway road (Drumpellier Drive) with a signalised 4-way intersection at Drumpellier Dr / Marshall Rd / Dayton Rd, which allows full movement access to this district distributor road on the western side of Dayton. This will have resulted in a very different traffic distribution than would have occurred if there was only a flyover and no direct connection at Marshall Road. Most importantly, it is anticipated that future traffic volumes on Arthur Street (north of Cranleigh Street, adjacent to the subject site) will be significantly lower than previously forecast and this section of Arthur Street may never need to be upgraded to the previously planned Neighbourhood Connector A standard (which would involve a 2m or 2.5m median and on-road cycle lanes). The 5m road widening requirement is proposed to be retained in case that future upgrade of Arthur Street is required, but there are no plans to actually construct that road upgrade at this stage.

4.0 Traffic Assessment

4.1 Assessment Period

The analysis of the transport network in this report is based upon the future situation with full development of this area. Daily traffic flows are used to assess overall impact on the road network and 8-9 AM peak hour traffic flows and 3-4 PM after school traffic flows are assessed for intersection operation in terms of school-related traffic.

The assessment year that has been adopted for this analysis is nominally 2031 with full development of Dayton.

4.2 Trip Generation

The Primary School Brief prepared by Building Management and Works and the Department of Education includes section 5.7: Traffic Management. It specifies a peak hour school trip generation rate of 1 vph (vehicles per hour) per student and 2.6 vpd (vehicles per day) per student for new schools. Staff traffic movements are included in these trip rates.

Therefore, the proposed primary school's maximum enrolment of up to 870 students will generate approximately 2,262vpd and 870vph in the before and after school peak periods.

4.3 Trip Distribution

The catchment area for the proposed school is assumed to encompass all of Dayton, although the existing Caversham Primary School will continue to attract students from this area as well.

Based on the location of future urban development within this area the resultant overall distribution on the approach roads around the street block containing the proposed school site is shown in Table 1.

Table 1: Trip Distribution

Approach Road	Proportion
Arthur Street (north)	8%
Aurum Parade (west)	4%
Cranleigh Street (west)	10%
Arthur Street (south)	34%
Featherflower Ave, etc. (south)	6%
Sam Rosa Place (south)	24%
Creanleigh Street (east)	4%
Blundell Street (north)	10%
Total	**100%**

4.4 Traffic Volumes

The vehicle trips generated by the proposed school were manually assigned to the surrounding local road network based on the trip distribution discussed above for the longer-term situation with full development of the school and surrounding areas.

The future weekday traffic flows associated with the future land uses in the surrounding area have been derived from the traffic model previously used and progressively developed by Transcore for the Transport Impact Assessment for various Structure Plans in Dayton (most recently the Dayton Commercial Precinct Structure Plan in 2019).

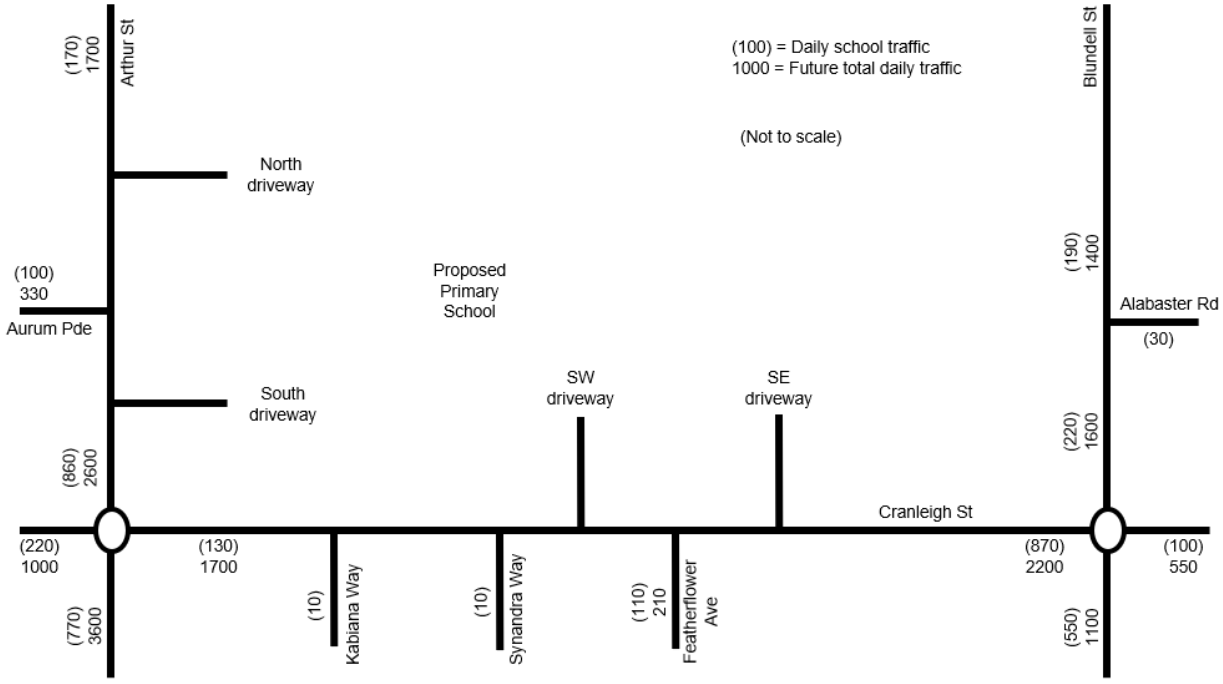


Figure 8: 2031 daily traffic flows (with primary school 870 students)

Base traffic flows (i.e. excluding the school traffic) on the surrounding road network in the 8-9AM and 3-4PM peak hours of school traffic generation have been estimated by applying hourly factors for residential trip generation based on WAPC Transport Impact Assessment Guidelines (1/4 inbound: 3/4 outbound in the AM peak and 5/8 inbound: 3/8 outbound in the PM peak) with these peak hours typically representing 10% of the total daily traffic flow.

The resultant peak hour traffic flows generated by the proposed school with its maximum capacity of 870 students are shown in Figure 9 (the same for both AM and PM peak hours). Total peak hour traffic flows at the proposed driveway crossovers and key intersections on the surrounding road network are shown in Figure 10 (8-9AM peak hour) and Figure 11 (3-4PM peak hour).

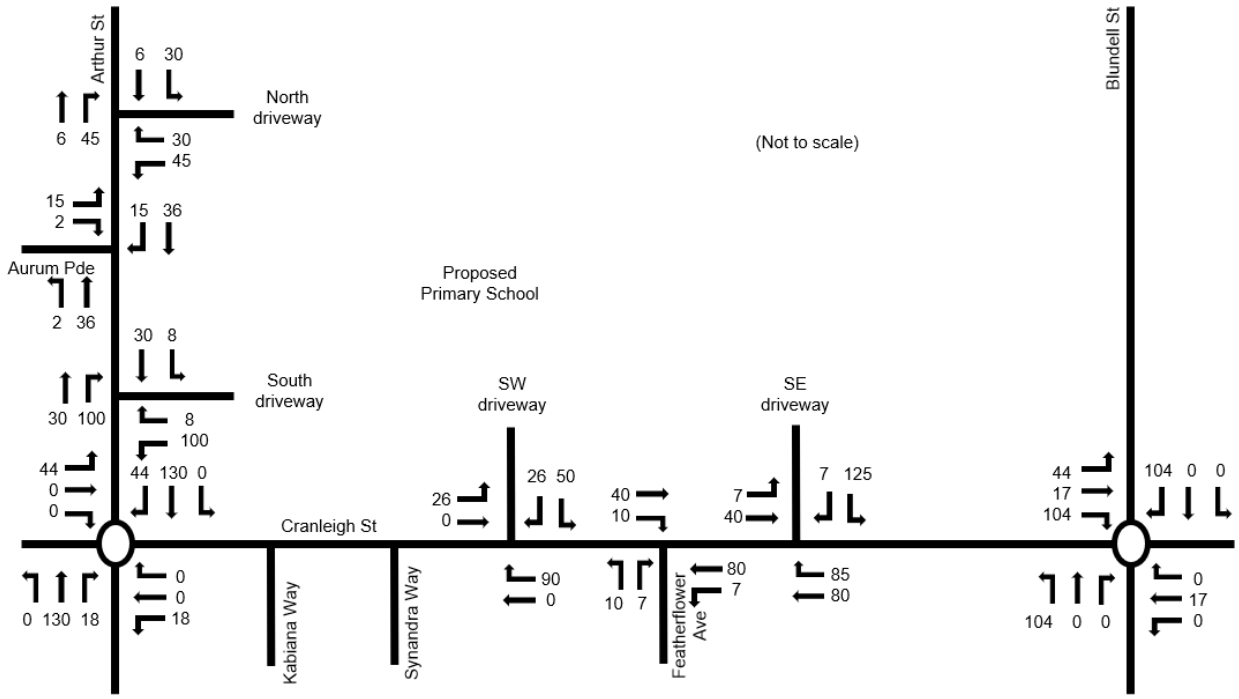


Figure 9: 2031 AM and PM peak hour school traffic flows (870 students)

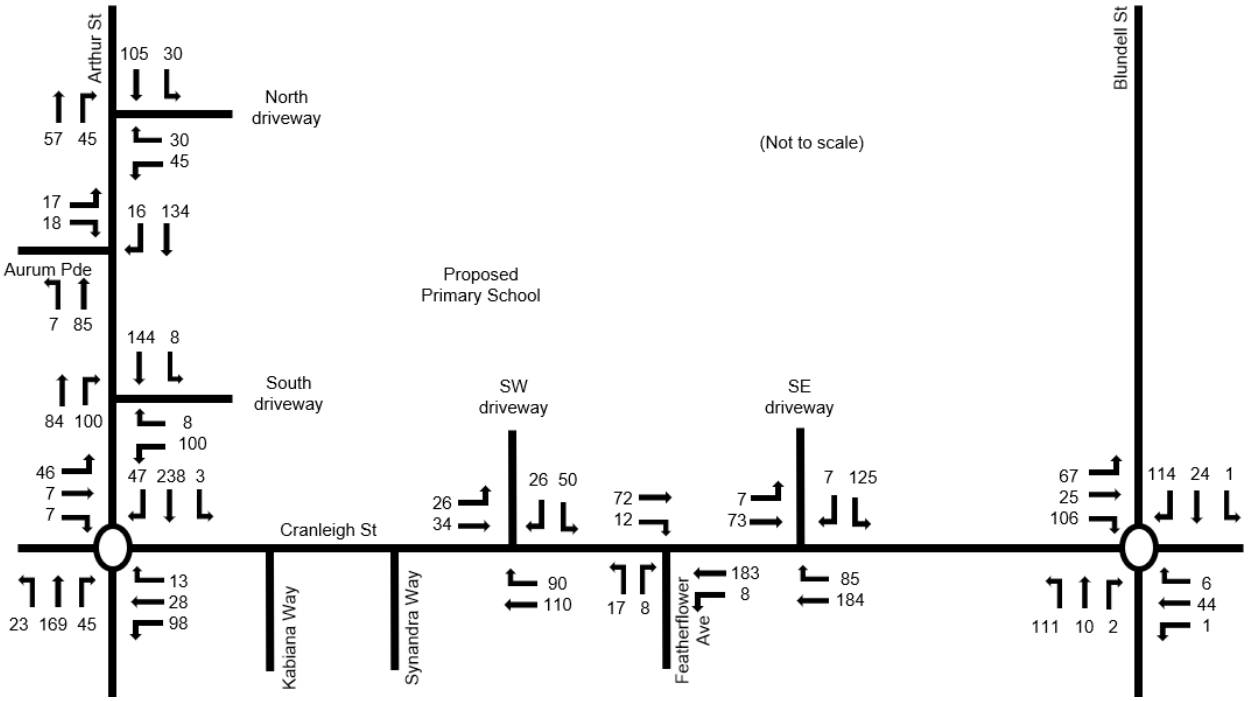


Figure 10: 2031 8-9AM total traffic flows (870 students)

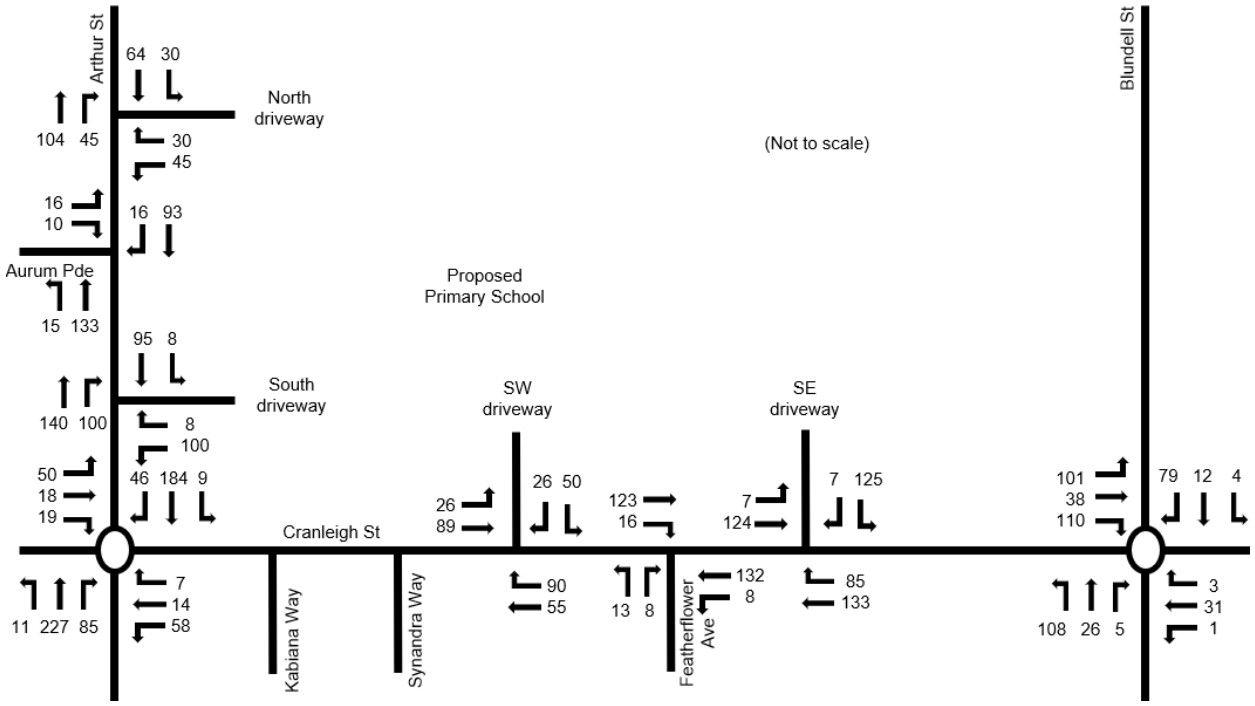


Figure 11: 2031 3-4PM total traffic flows (870 students)

4.5 Analysis of Intersections and Site Accesses

The proposed school development will have four driveway crossovers on the west and south boundary roads as shown on the masterplan at Appendix A. Those four driveway intersections have therefore been assessed to confirm satisfactory operation under the modelled 2031 8-9AM and 3-4PM school traffic peak period flows. Four other key intersections connecting onto the surrounding road network have also been analysed. The full list of intersections and driveway crossovers analysed is as follows:

- Arthur St / north driveway intersection
- Arthur St / Aurum Pde T-intersection
- Arthur St / south driveway intersection
- Arthur St / Cranleigh St roundabout
- Cranleigh St / southwest driveway intersection
- Cranleigh St / Featherflower Ave T-intersection
- Cranleigh St / southwest driveway intersection
- Cranleigh St / Blundell St / Sam Rosa Pl roundabout

The SIDRA computer software package has been used for this capacity analysis. SIDRA is an intersection modelling tool commonly used by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- Degree of Saturation is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for infrequent traffic flow up to one for saturated flow or capacity.
- Level of Service is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- Average Delay is the average of all travel time delays for vehicles through the intersection.
- 95% Queue is the queue length below which 95% of all observed queue lengths fall.

The results of the SIDRA analyses are summarised in Appendix C.

The SIDRA analysis indicates that all of these eight intersections and driveway crossovers will operate satisfactorily at level of service A (the best possible level of service in this analysis) on all movements with minimal traffic queues and delays.

4.6 Impact on Surrounding Roads

Future total daily traffic flows on the surrounding road network are shown in Figure 8. Arthur Street (north of Cranleigh Street), Cranleigh Street and other Access Streets around the school site will remain well within the 3,000vpd capacity of an Access Street or Neighbourhood Connector B in the WAPC Liveable Neighbourhoods policy. The traffic volumes on Arthur Street south of Cranleigh Street will increase above 3,000vpd but that section of Arthur Street is planned as an Integrator B with capacity for up to 15,000vpd, so it is clearly able to accommodate the traffic generated by the proposed school. The anticipated future traffic flows are consistent with the planned standard of these roads, so no significant traffic impact is anticipated.

4.7 Traffic Noise and Vibration

It generally requires a doubling of traffic volumes on a road to produce a perceptible 3dB(A) increase in road noise. It should also be acknowledged that traffic noise levels are not an issue on low traffic volume residential roads such as access streets. On all roads around the school site the traffic generated by the proposed school will either be significantly less than 50% of future total traffic volumes, so there would not be a perceptible difference in future traffic noise levels with or without the proposed school; or those total traffic volumes will be so low that traffic noise is not an issue anyway.

The nature of the development means it normally will not generate significant traffic volumes at night, so night-time traffic noise and vibration are not an issue for this development either.

4.8 Road Safety

As noted in section 3.3, the available intersection crash history does not indicate any existing road safety problems in the immediate area around the proposed school site.

The driveway crossovers and indented on-street parking proposed for the school site have been checked for satisfactory driveway sight lines in accordance with the requirements of AS2890.1 (Parking facilities – Off-street car parking) for the 40km/h school zone speed limit that will apply before and after school.

5.0 Parking

The parking requirements specified by the Department of Education are set out in section 5.7 of the Primary School Brief and the parking calculation is summarised in spreadsheet 5.7a of the brief (included at Appendix D of this TIA report).

For the proposed maximum capacity of 870 students (810 FTE) the calculation indicates a total requirement of 209 bays including 5 universal access bays. However, the client has specified an overall total of 211 bays instead of the 209 calculated in this spreadsheet. The difference is because 2 Universal Access bays (for standard pattern 540 student school) are to be counted in addition not included in the overall total calculated in the spreadsheet. Other Universal Access bays are still to be counted as included in the overall total.

Up to 105 of those bays would be allowed to be in on-street parking embayments, although that is not fully achievable at this site and must therefore be accommodated on site as proposed.

The Master Plan shows 171 parking bays on site including 5 accessible bays. In addition, there are 42 embayed parking spaces shown on street adjacent to the school site on the south and west boundary roads for a total parking provision of 213 parking spaces.

Accordingly, this total provision of 213 parking bays satisfies the required parking provision of 211 parking bays for this proposed primary school.

6.0 Public Transport

Transperth Bus Route No. 353 (Henley Brook bus station – Bassendean Station) runs on Arthur Street adjacent to the subject site, as shown in Figure 5, with the closest bus stop located approximately 50m north of the subject site.

In future it is anticipated this bus route would become a feeder bus service to the future Ellenbrook railway line, providing further enhancement of public transport accessibility for the subject site.

The Primary School Brief requires provision of space for one temporary bus bay on street for use as and when required. As on-street parking space is under-provided at this site already, it is recommended that this temporary bus bay should be provided on Arthur Street just to the north of the primary school site (i.e. south of the existing southbound bus stop location). This location would be in close proximity to the school and would also provide a useful facility for the future public open space on the northern side of the proposed school site.

7.0 Pedestrians and Cyclists

As noted in section 3.5, the subdivisional road network around the subject site includes a comprehensive network of shared paths and footpaths in accordance with WAPC Liveable Neighbourhoods requirements.

No paths have been constructed yet on the road verges directly abutting the subject site. 2.5m shared paths will be required on the school side verge of Arthur Street and Cranleigh Street. It is recommended that these paths should also extend northward about 50m on Arthur Street to the existing bus stop location and eastward on Cranleigh Street to connect to existing paths at the Cranleigh St / Blundell St / Sam Rosa Place roundabout.

The proposed primary school masterplan at Appendix A provides appropriate pathway links into the school site from those shared paths on each of the surrounding road frontages.

The Primary School Brief (section 5.7.4.13) specifies a requirement to accommodate 48 bicycles for a 430-student primary school and 60 student bicycles for a 540-student primary school. In the absence of other bicycle parking requirements the Primary School Brief recommends provision of 1 space/bay for every 25 to 35 staff and 1 space/bay for every 10 children. For the additional 330 students and 33 staff in the 870-student school capacity this would equate to an additional 34 bicycle spaces.

Accordingly, the total bicycle parking requirement would be 94 bicycles for the proposed maximum 870 student capacity of the proposed primary school.

The proposed primary school masterplan at Appendix A shows a parking compound for 64 bicycles on the southern side of the school site, which satisfies the 60 bicycles parking requirement for a standard pattern 540 student primary school. Accordingly, it may be necessary to add another 30-bicycle parking facility in future when the planned future transportable classrooms are added on this site. However, it would be appropriate to review this requirement at that time when actual bicycle parking demand at this site can be observed and determined.

8.0 Conclusions

This transport impact assessment addresses the proposed Dayton Primary School in the City of Swan.

The proposed school is designed as a standard pattern primary school for 540 students (primary, pre-primary and kindergarten) but will also accommodate a number of transportable classrooms on the site while required to increase the total capacity to 870 students (810 FTE). Accordingly, this report addresses that maximum capacity.

At this full capacity the school would generate approximately 2,260 vehicle trips in the full school day, with before and after school peak hour traffic flows of approximately 870 vehicles per hour.

The surrounding road network is able to accommodate the traffic flows generated by the proposed school at this maximum capacity.

Dayton Local Structure Plan 2B includes a 5m road widening requirement on the eastern side of Arthur Street, encroaching on the proposed school site. Due to changes in regional road network planning over the last decade (i.e. realignment of the Perth-Darwin National Highway alignment further west and construction of Drumpellier Drive instead with a full-movement signalised intersection at Drumpellier Dr / Marshall Rd / Dayton Rd) it is now considered likely that the planned upgrading of this section of Arthur Street may not actually be required in future. Nonetheless, the 5m road widening requirement is proposed to be retained and is accommodated in the proposed primary school masterplan in case that future upgrade of Arthur Street is required, but there are no plans to actually construct that road upgrade at this stage.

Intersection capacity analysis indicates that the site access driveways and intersections adjacent to the proposed school site will all operate satisfactorily during peak periods of school traffic flows.

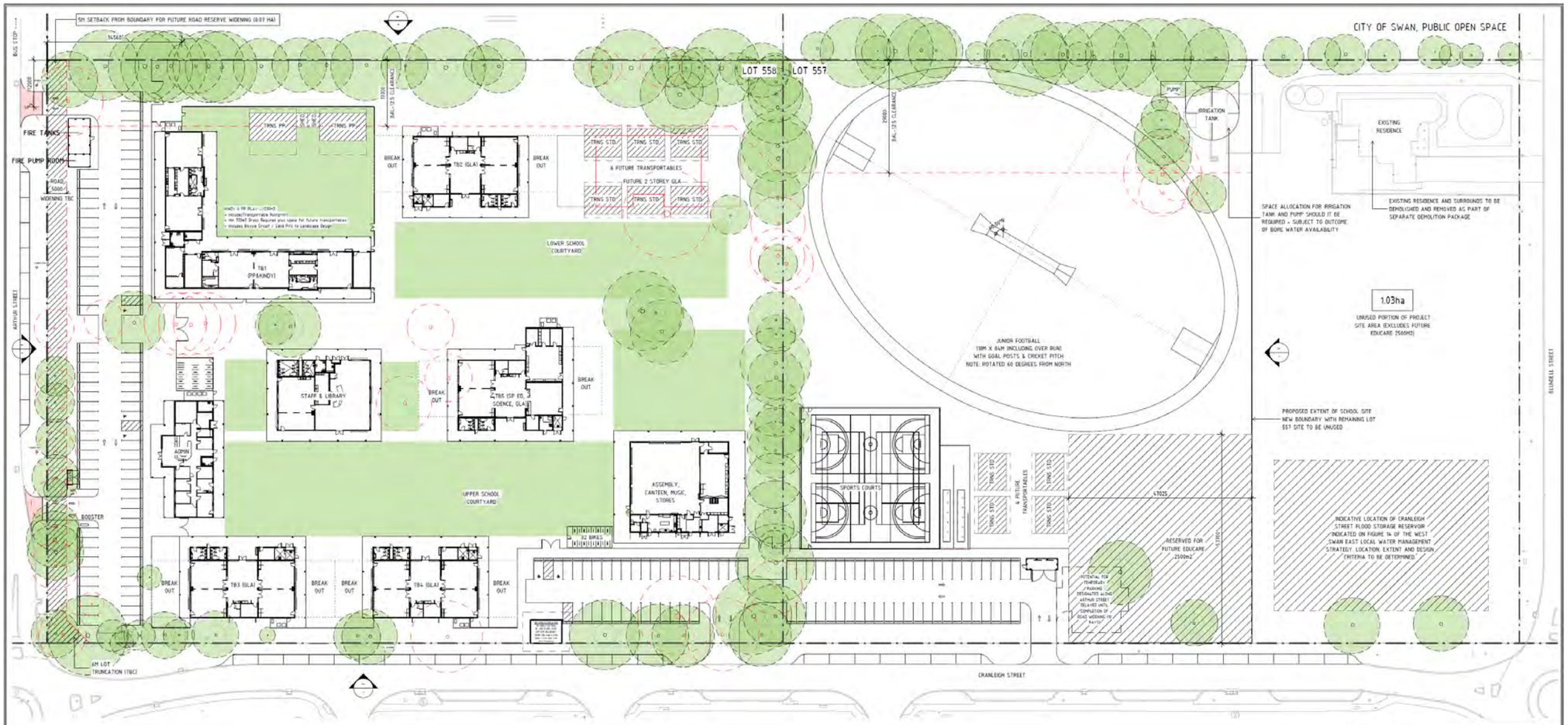
The parking requirement for the proposed school is calculated as 211 parking spaces in accordance with the requirements of the Department of Education's Primary School Brief. The proposed school master plan indicates a total of 213 parking spaces, including 42 on-street spaces, so the required parking provision is satisfied on site.

Based on the requirements of the Primary School Brief a total of 94 bicycles should be accommodated on site for the proposed maximum 870 student capacity of the proposed primary school. The proposed master plan currently provides parking for 64 bicycles on the southern side of the school site, which satisfies the 60 bicycles parking requirement for a standard pattern 540 student primary school. Accordingly, it may be necessary to add another 30-bicycle parking facility in future when the planned future transportable classrooms are added on this site. However, it would

be appropriate to review this requirement at that time when actual bicycle parking demand at this site can be observed and determined.

Appendix A

Proposed Dayton Primary School Masterplan



LAND SCHEDULE (OPTION 2B)		
EXISTING		
LOT 557	28,344m2	2.83 ha
LOT 558	28,286m2	2.84 ha
TOTAL	56,628m2	5.65 ha
PROPOSED		
TOTAL SCHOOL SITE	46,297m2	4.63 ha
- BUSHFIRE BAL-29 EXCLUSION ZONE	4,709m2	0.47 ha
- 5M ROAD RESERVE & TRUNCATION	352m2	0.03 ha
- FUTURE EDUCARE AREA	2,500m2	0.25 ha
REMAINING DEVELOPMENT SITE	38,336m2	3.83 ha
UNUSED PORTION	10,331m2	1.03 ha

PARKING SCHEDULE (OPTION 2B)	
TYPE	
STREET	42 BAYS
OFF-STREET	166 BAYS
ACCESSIBLE (D)	5 BAYS
TOTAL	213 BAYS
ABBR (INCLUDES FUTURE PROVISIONS)	
CARS:	206 BAYS + 5 ACCESSIBLE (211 TOTAL REQ.)
CYCLES:	32 RACKS (64 BIKES)

LEGEND	
	EXISTING TREE TO REMAIN (SUBJECT TO ARBORIST'S REPORT)
	EXISTING TREE TO BE REMOVED (SUBJECT TO ARBORIST'S REPORT)
	2100MM GARRISON FENCE
	1200MM CHAIN MESH FENCE
	1800MM CHAIN MESH FENCE
	3600MM CHAINMESH FENCE (SPORTS COURTS)
	2100MM EXPANDED MESH ENCLOSURE

REV	DATE	DESCRIPTION	BY
D	04/03/2021	ISSUED FOR COORDINATION	
C	26/02/2021	ISSUED FOR COORDINATION	
B	19/02/2021	ISSUED FOR COORDINATION	
A	17/02/2021	ISSUED FOR COORDINATION	

CHRISTOU
ARCHITECTURE / URBAN DESIGN / INTERIOR DESIGN
12 QUIGLEY STREET CLAREMONT WA 6010
T / +61 8 9285 6888
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E / studio@christou.com.au
ABN 87 152 933 085
ACN 152 933 085

Government of Western Australia
Department of Finance
Buildings and Contracts

ARCHITECTURAL

DEPARTMENT OF FINANCE

DAYTON PRIMARY SCHOOL

LOT 557, 11 BLUNDELL STREET DAYTON & LOT 558 ON PLAN 3698

SITE PLANS

OVERALL SITE PLAN

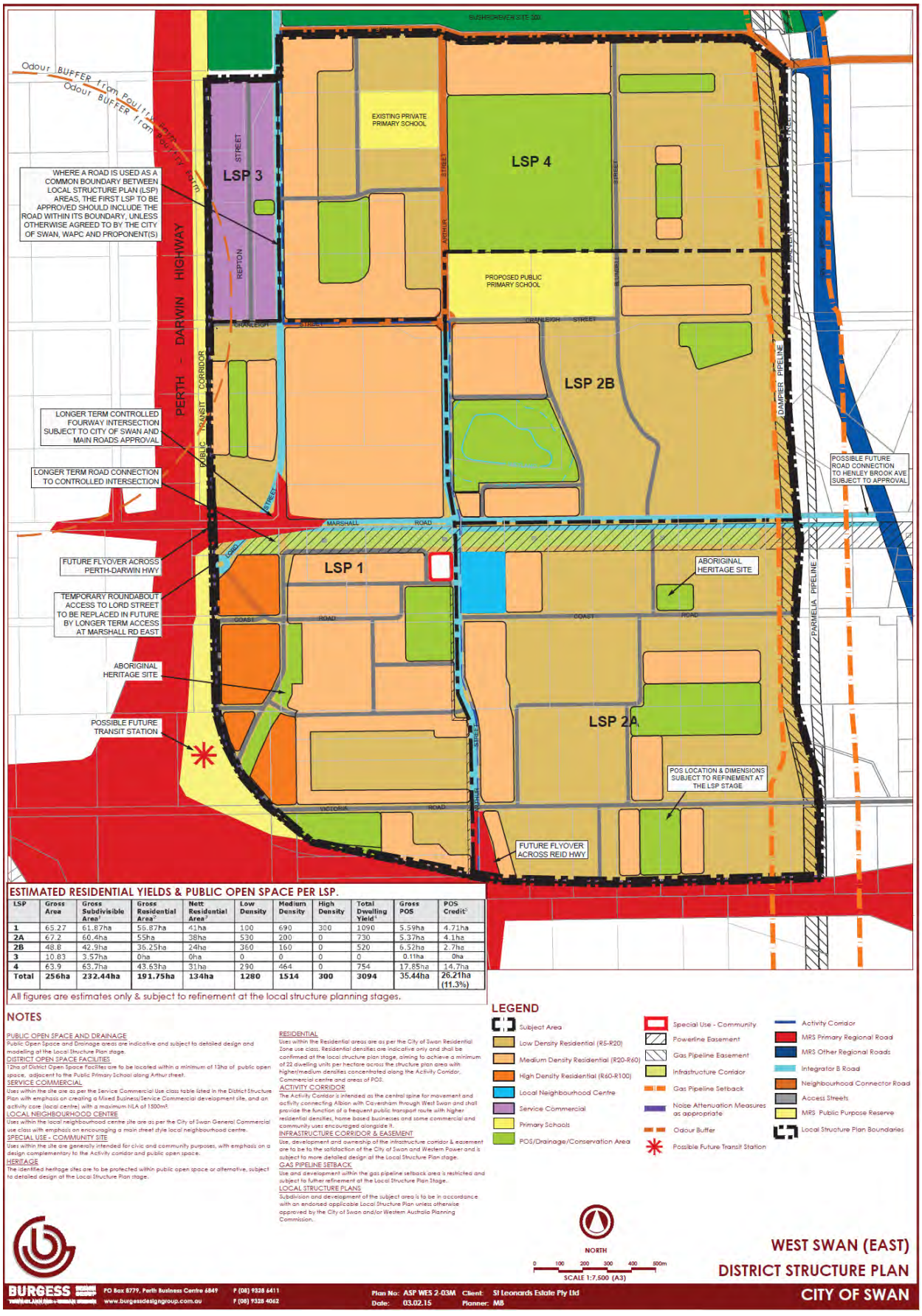
DRAWN MLM	DESIGNED HB	REDUCTION	
CHECKED HB	PRINCIPAL	0 12.5M	
APPROVED SS			
SCALE 1 : 500 @ A1	DATE 04/03/2021	DRAWING No. A0-1101	REV D
PROJECT No. 20056	DF FILE No.		

THIS IS A CADD DRAWING DO NOT AMEND MANUALLY

DPSAS-1101A1

Appendix B

Structure Plans



ESTIMATED RESIDENTIAL YIELDS & PUBLIC OPEN SPACE PER LSP.

LSP	Gross Area	Gross Subdivisible Area[1]	Gross Residential Area[2]	Nett Residential Area[3]	Low Density	Medium Density	High Density	Total Dwelling Yield[4]	Gross POS	POS Credit[5]
1	65.27	61.87ha	56.87ha	41ha	100	690	300	1090	5.59ha	4.71ha
2A	67.2	60.4ha	55ha	38ha	530	200	0	730	5.37ha	4.1ha
2B	48.8	42.9ha	36.25ha	24ha	360	160	0	520	6.52ha	2.7ha
3	10.83	3.57ha	0ha	0ha	0	0	0	0	0.1ha	0ha
4	63.9	63.7ha	43.63ha	31ha	290	464	0	754	17.85ha	14.7ha
Total	256ha	232.44ha	191.75ha	134ha	1280	1514	300	3094	35.44ha	26.21ha (11.3%)

All figures are estimates only & subject to refinement at the local structure planning stages.

NOTES

PUBLIC OPEN SPACE AND DRAINAGE
Public Open Space and Drainage areas are indicative and subject to detailed design and modelling at the Local Structure Plan stage.

DISTRICT OPEN SPACE FACILITIES
12ha of District Open Space Facilities are to be located within a minimum of 13ha of public open space, adjacent to the Public Primary School along Arthur street.

SERVICE COMMERCIAL
Uses within the site are as per the Service Commercial Use class table listed in the District Structure Plan with emphasis on creating a Mixed Business/Service Commercial development site, and an activity core (local centre) with a maximum NLA of 1500m².

LOCAL NEIGHBOURHOOD CENTRE
Uses within the local neighbourhood centre site are as per the City of Swan General Commercial use class with emphasis on encouraging a main street style local neighbourhood centre.

SPECIAL USE - COMMUNITY SITE
Uses within the site are generally intended for civic and community purposes, with emphasis on a design complementary to the Activity corridor and public open space.

HERITAGE
The identified heritage sites are to be protected within public open space or alternative, subject to detailed design at the Local Structure Plan stage.

RESIDENTIAL
Uses within the Residential areas are as per the City of Swan Residential Zone use class. Residential densities are indicative only and shall be confirmed at the local structure plan stage, aiming to achieve a minimum of 22 dwelling units per hectare across the structure plan area with higher/medium densities concentrated along the Activity Corridor, Commercial centre and areas of POS.

ACTIVITY CORRIDOR
The Activity Corridor is intended as the central spine for movement and activity connecting Albion with Caversham through West Swan and shall provide the function of a frequent public transport route with higher residential densities, home based businesses and some commercial and community uses encouraged alongside it.

INFRASTRUCTURE CORRIDOR & EASEMENT
Use, development and ownership of the infrastructure corridor & easement are to be to the satisfaction of the City of Swan and Western Power and is subject to more detailed design at the Local Structure Plan stage.

GAS PIPELINE SETBACK
Use and development within the gas pipeline setback area is restricted and subject to futher refinement at the Local Structure Plan Stage.

LOCAL STRUCTURE PLANS
Subdivision and development of the subject area is to be in accordance with an endorsed applicable Local Structure Plan unless otherwise approved by the City of Swan and/or Western Australia Planning Commission.

LEGEND

- Subject Area
- Low Density Residential (R5-R20)
- Medium Density Residential (R20-R60)
- High Density Residential (R60-R100)
- Local Neighbourhood Centre
- Service Commercial
- Primary Schools
- POS/Drainage/Conservation Area
- Special Use - Community
- Powerline Easement
- Gas Pipeline Easement
- Infrastructure Corridor
- Gas Pipeline Setback
- Noise Attenuation Measures as appropriate
- Odour Buffer
- Possible Future Transit Station
- Activity Corridor
- MRS Primary Regional Road
- MRS Other Regional Roads
- Integrator B Road
- Neighbourhood Connector Road
- Access Streets
- MRS Public Purpose Reserve
- Local Structure Plan Boundaries

NORTH
0 100 200 300 400 500m
SCALE 1:7,500 (A3)

WEST SWAN (EAST) DISTRICT STRUCTURE PLAN

CITY OF SWAN

BURGESS DESIGN GROUP
PO Box 8779, Perth Business Centre 6849
www.burgessdesigngroup.com.au
P (08) 9328 6411
F (08) 9328 4062

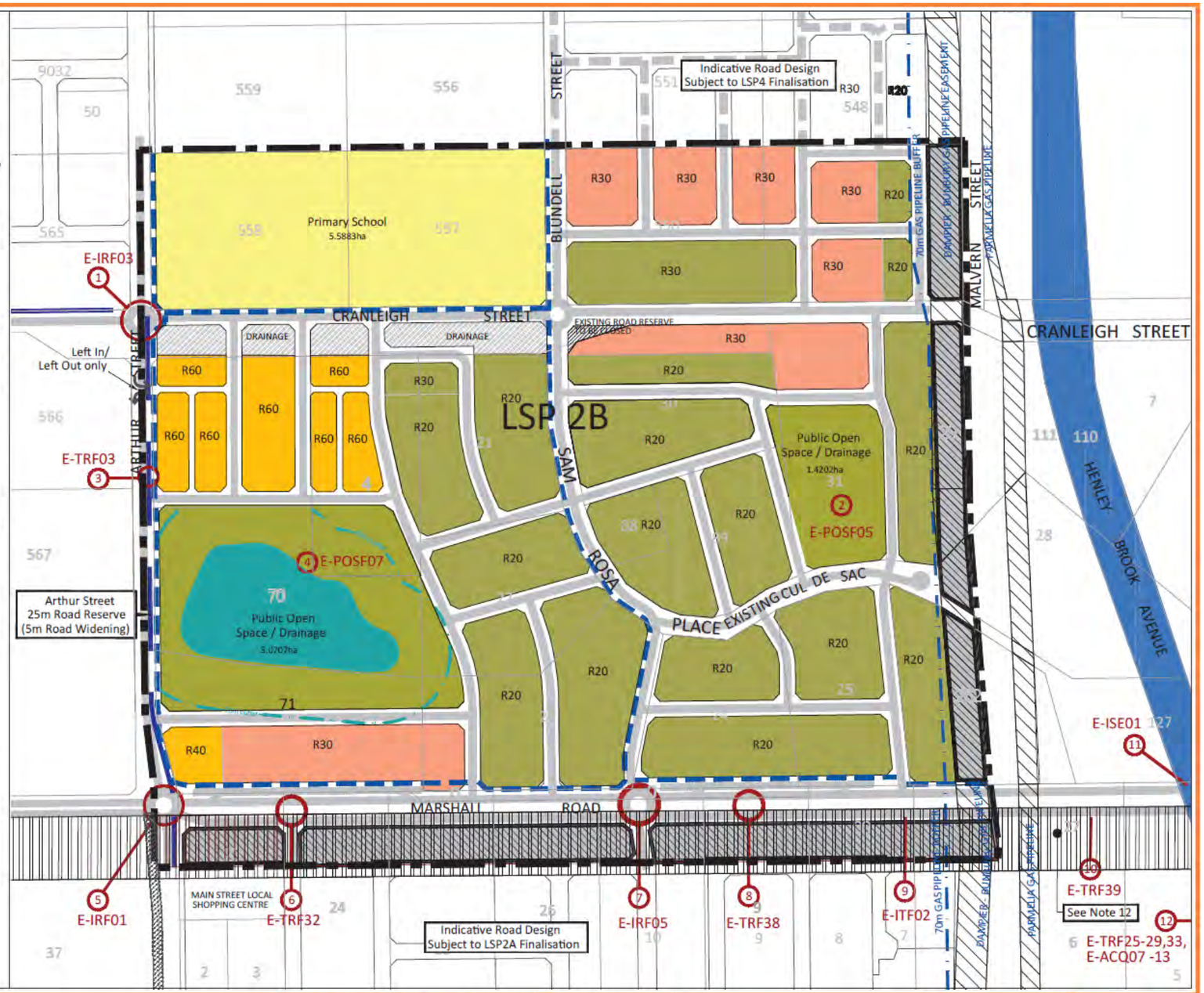
Plan No: ASP WES 2-03M Client: St Leonards Estate Pty Ltd
Date: 03.02.15 Planner: MB

NOTES:

1. Areas and dimensions are subject to survey.
2. The road layout is subject to final design at subdivision. See Traffic Assessment Report (Appendix 2) and Concept Plans (Appendix 7) for further information.
3. All corner lots that are coded R20 can be developed/subdivided to a maximum density of R30.
4. The function and design of public open space areas shall be generally in accordance with the concept plans included in the LSP 2 documentation, though still subject to refinement as part of Landscape Management Plans to be approved prior to construction.
5. Subdivision and development within residential areas shall comply with the 'Residential' zone of Local Planning Scheme No.17 and the Residential Design Codes as they apply to the designated R Codes reflected on this plan , or referred to in Note 3 above .
6. No dwellings permitted within gas pipeline buffer. Notifications on title apply to lots containing gas pipeline buffer.
7. Use and development within the designated 330KV Powerline Easement shall be subject to approval by Western Power and the City of Swan, the intention being for this corridor to be utilized for low maintenance open space, community garden opportunities, pedestrian/cyclist path network, road reserves and car parking in a manner consistent with the existing power line easement .
8. A Developer Contribution Plan (DCP) applies to this cell & should be read in conjunction with the Structure Plan. Triggers for DCP Items/Works (see s.6.2).
9. Detailed Area Plans may be required by the WAPC on advice from the City of Swan as a condition of subdivision (see s.5.2.6.).
10. Any subdivision of Lots 26, 28, 29 and 127 is to be designed in a manner that achieves satisfactory road access to a constructed public road for the balance rural lots.
11. The existing drainage basin on Lot 27 Coast Road is to be relocated/redesigned as a result of the Structure Plan development at the developers expense.
12. Any artificial dam located within the Structure Plan area is to be formally closed via City of Swan engineering certification as part of the subsequent development of the land by the applicable landowner/developer.
13. Prior to subdivision of Lots 26 or 29 Sam Rosa Place or Lot 549 Malvern Street, a Risk Management Plan must be prepared in accordance with the requirements of the WAPC's Planning Bulletin 87. Such Risk Management Plan is to be approved by the Parmelia Gas Pipeline operator and implemented to the satisfaction of the Western Australian Planning Commission.
14. The residential laneway immediately south of Cranleigh Street is to have left in, left out access only from Arthur Street.

LEGEND

- Subject Area: LSP 2B
- Residential Zone
- Public Purpose Reserve (Primary School)
- Public Open Space/Drainage
- Resource Enhancement Wetland
- 50m Wetland Buffer
- MRS Other Regional Road
- Indicative Carriageway
- Activity Corridor - Home Based Business / Home Office Opportunites
- Dual Use Path
- Public Utility
- 330KV Powerline Easement & Road Reserves
- Gas Pipeline Easement
- 70m Buffer to Parmelia Gas Pipeline
- DCP Item (s6.2 Table 6)



LOCAL STRUCTURE PLAN 2B

City of Swan

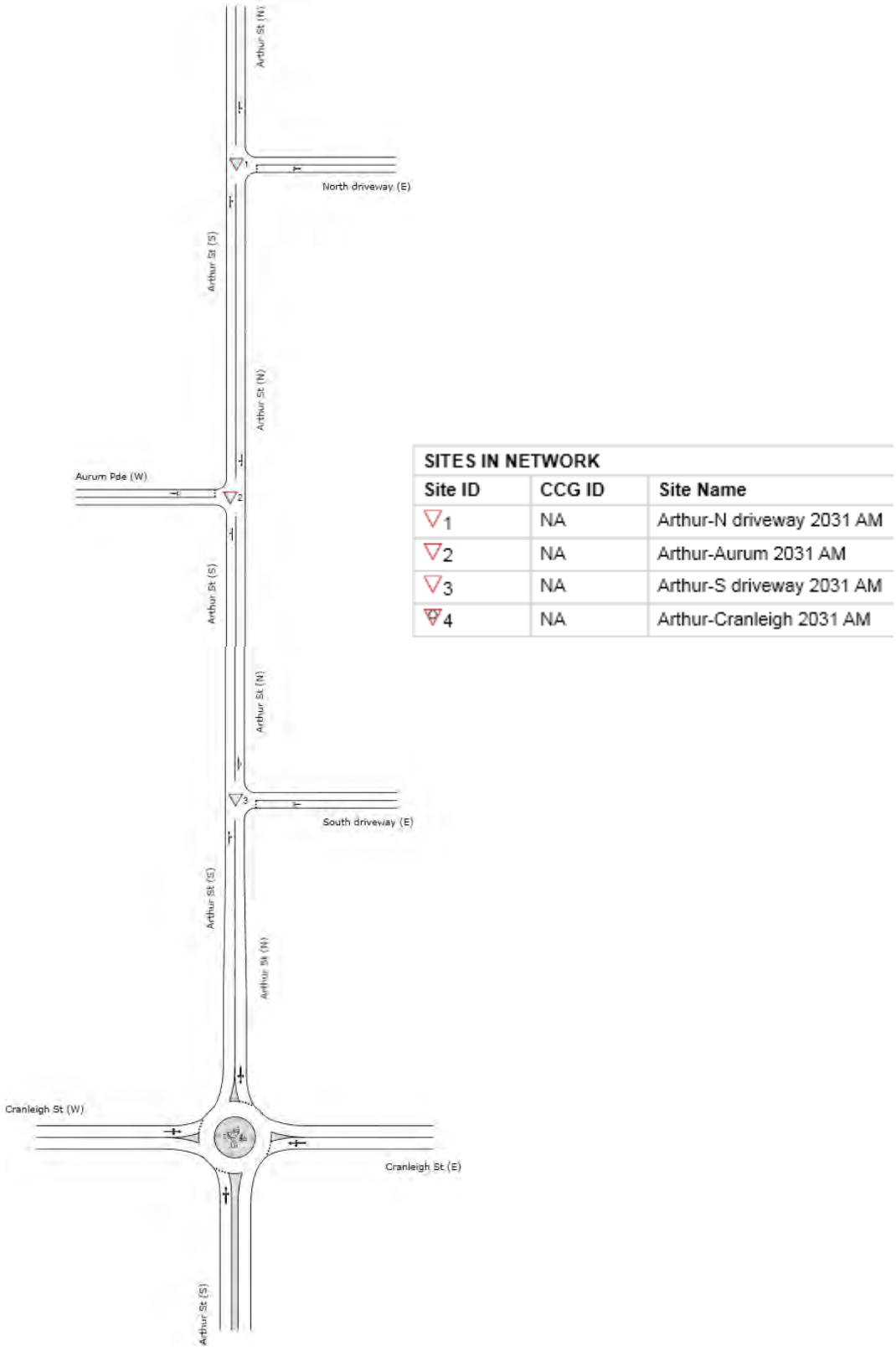
SCALE 1:4000 @ A3
DATE: 7th JULY 2020
FILE: 978_07.07.2020.dwg
DRAW: - SB
CHECKED: -

e: admin@dynamicplanning.net.au
t: (08) 9275 4433
f: (08) 9275 4455
SUITE 15, 29 COLLIER ROAD
MORLEY WA 6062
ABN: 99 169 411 705

DYNAMIC PLANNING
AND DEVELOPMENTS

Appendix C

SIDRA Intersection Analysis



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
1	NA	Arthur-N driveway 2031 AM
2	NA	Arthur-Aurum 2031 AM
3	NA	Arthur-S driveway 2031 AM
4	NA	Arthur-Cranleigh 2031 AM

Figure C1. Arthur Street intersections and school driveways layout analysed in SIDRA Network

Table C1a. SIDRA results – Arthur St / north driveway intersection – 8-9AM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Arthur St (S)														
2	T1	60	5.0	60	5.0	0.061	0.3	LOS A	0.3	1.9	0.21	0.22	0.21	34.5
3	R2	47	0.0	47	0.0	0.061	3.5	LOS A	0.3	1.9	0.21	0.22	0.21	25.8
Approach		107	2.8	107	2.8	0.061	1.7	NA	0.3	1.9	0.21	0.22	0.21	31.7
East: North driveway (E)														
4	L2	47	0.0	47	0.0	0.062	2.6	LOS A	0.2	1.7	0.22	0.46	0.22	20.4
6	R2	32	0.0	32	0.0	0.062	3.1	LOS A	0.2	1.7	0.22	0.46	0.22	31.4
Approach		79	0.0	79	0.0	0.062	2.8	LOS A	0.2	1.7	0.22	0.46	0.22	27.3
North: Arthur St (N)														
7	L2	32	0.0	32	0.0	0.074	3.4	LOS A	0.0	0.0	0.00	0.10	0.00	28.3
8	T1	111	5.0	111	5.0	0.074	0.0	LOS A	0.0	0.0	0.00	0.10	0.00	37.1
Approach		142	3.9	142	3.9	0.074	0.8	NA	0.0	0.0	0.00	0.10	0.00	34.4
All Vehicles		328	2.6	328	2.6	0.074	1.6	NA	0.3	1.9	0.12	0.23	0.12	32.0

Table C1b. SIDRA results – Arthur St / north driveway intersection – 3-4PM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Arthur St (S)														
2	T1	109	5.0	109	5.0	0.086	0.1	LOS A	0.3	2.1	0.13	0.15	0.13	36.2
3	R2	47	0.0	47	0.0	0.086	3.3	LOS A	0.3	2.1	0.13	0.15	0.13	27.9
Approach		157	3.5	157	3.5	0.086	1.1	NA	0.3	2.1	0.13	0.15	0.13	34.5
East: North driveway (E)														
4	L2	47	0.0	47	0.0	0.061	2.5	LOS A	0.2	1.6	0.16	0.45	0.16	20.9
6	R2	32	0.0	32	0.0	0.061	3.2	LOS A	0.2	1.6	0.16	0.45	0.16	31.6
Approach		79	0.0	79	0.0	0.061	2.8	LOS A	0.2	1.6	0.16	0.45	0.16	27.8
North: Arthur St (N)														
7	L2	32	0.0	32	0.0	0.052	3.4	LOS A	0.0	0.0	0.00	0.15	0.00	27.8
8	T1	67	5.0	67	5.0	0.052	0.0	LOS A	0.0	0.0	0.00	0.15	0.00	36.0
Approach		99	3.4	99	3.4	0.052	1.1	NA	0.0	0.0	0.00	0.15	0.00	32.6
All Vehicles		335	2.6	335	2.6	0.086	1.5	NA	0.3	2.1	0.10	0.22	0.10	32.6

Table C1c. SIDRA results – Arthur St / Aurum Pde T-intersection – 8-9AM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Arthur St (S)														
7	L2	7	2.0	7	2.0	0.050	2.9	LOS A	0.0	0.0	0.00	0.04	0.00	25.3
8	T1	89	5.0	89	5.0	0.050	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	37.9
Approach		97	4.8	97	4.8	0.050	0.2	NA	0.0	0.0	0.00	0.04	0.00	35.5
North: Arthur St (N)														
2	T1	141	5.0	141	5.0	0.084	0.0	LOS A	0.1	0.9	0.05	0.05	0.05	35.5
3	R2	17	2.0	17	2.0	0.084	3.4	LOS A	0.1	0.9	0.05	0.05	0.05	24.1
Approach		158	4.7	158	4.7	0.084	0.4	NA	0.1	0.9	0.05	0.05	0.05	32.7
West: Aurum Pde (W)														
4	L2	18	2.0	18	2.0	0.031	3.4	LOS A	0.1	0.8	0.20	0.47	0.20	21.9
6	R2	19	2.0	19	2.0	0.031	4.2	LOS A	0.1	0.8	0.20	0.47	0.20	21.9
Approach		37	2.0	37	2.0	0.031	3.8	LOS A	0.1	0.8	0.20	0.47	0.20	21.9
All Vehicles		292	4.4	292	4.4	0.084	0.8	NA	0.1	0.9	0.05	0.10	0.05	31.4

Table C1d. SIDRA results – Arthur St / Aurum Pde T-intersection – 3-4PM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Arthur St (S)														
7	L2	16	2.0	16	2.0	0.081	2.9	LOS A	0.0	0.0	0.00	0.05	0.00	25.1
8	T1	140	5.0	140	5.0	0.081	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	37.2
Approach		156	4.7	156	4.7	0.081	0.3	NA	0.0	0.0	0.00	0.05	0.00	34.3
North: Arthur St (N)														
2	T1	98	5.0	98	5.0	0.062	0.1	LOS A	0.1	0.9	0.09	0.07	0.09	33.6
3	R2	17	2.0	17	2.0	0.062	3.5	LOS A	0.1	0.9	0.09	0.07	0.09	23.6
Approach		115	4.6	115	4.6	0.062	0.6	NA	0.1	0.9	0.09	0.07	0.09	30.5
West: Aurum Pde (W)														
4	L2	17	2.0	17	2.0	0.022	3.6	LOS A	0.1	0.6	0.24	0.47	0.24	21.6
6	R2	11	2.0	11	2.0	0.022	4.3	LOS A	0.1	0.6	0.24	0.47	0.24	21.6
Approach		27	2.0	27	2.0	0.022	3.8	LOS A	0.1	0.6	0.24	0.47	0.24	21.6
All Vehicles		298	4.4	298	4.4	0.081	0.7	NA	0.1	0.9	0.06	0.10	0.06	31.0

Table C1e. SIDRA results – Arthur St / south driveway intersection – 8-9AM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Arthur St (S)														
2	T1	88	5.0	88	5.0	0.114	0.4	LOS A	0.5	4.0	0.26	0.27	0.26	24.6
3	R2	105	0.0	105	0.0	0.114	3.6	LOS A	0.5	4.0	0.26	0.27	0.26	24.5
Approach		194	2.3	194	2.3	0.114	2.1	NA	0.5	4.0	0.26	0.27	0.26	24.5
East: South driveway (E)														
4	L2	105	0.0	105	0.0	0.082	2.8	LOS A	0.3	2.4	0.25	0.46	0.25	20.5
6	R2	8	0.0	8	0.0	0.082	3.7	LOS A	0.3	2.4	0.25	0.46	0.25	20.5
Approach		114	0.0	114	0.0	0.082	2.8	LOS A	0.3	2.4	0.25	0.46	0.25	20.5
North: Arthur St (N)														
7	L2	8	0.0	8	0.0	0.083	2.9	LOS A	0.0	0.0	0.00	0.02	0.00	23.2
8	T1	152	5.0	152	5.0	0.083	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	38.4
Approach		160	4.7	160	4.7	0.083	0.2	NA	0.0	0.0	0.00	0.02	0.00	36.7
All Vehicles		467	2.6	467	2.6	0.114	1.6	NA	0.5	4.0	0.17	0.23	0.17	26.5

Table C1f. SIDRA results – Arthur St / south driveway intersection – 3-4PM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Arthur St (S)														
2	T1	147	5.0	147	5.0	0.141	0.2	LOS A	0.6	4.5	0.18	0.20	0.18	27.2
3	R2	105	0.0	105	0.0	0.141	3.4	LOS A	0.6	4.5	0.18	0.20	0.18	26.2
Approach		253	2.9	253	2.9	0.141	1.6	NA	0.6	4.5	0.18	0.20	0.18	26.7
East: South driveway (E)														
4	L2	105	0.0	105	0.0	0.079	2.6	LOS A	0.3	2.4	0.19	0.44	0.19	21.1
6	R2	8	0.0	8	0.0	0.079	3.8	LOS A	0.3	2.4	0.19	0.44	0.19	21.1
Approach		114	0.0	114	0.0	0.079	2.7	LOS A	0.3	2.4	0.19	0.44	0.19	21.1
North: Arthur St (N)														
7	L2	8	0.0	8	0.0	0.056	2.9	LOS A	0.0	0.0	0.00	0.04	0.00	23.1
8	T1	100	5.0	100	5.0	0.056	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	37.8
Approach		108	4.6	108	4.6	0.056	0.2	NA	0.0	0.0	0.00	0.04	0.00	35.3
All Vehicles		475	2.6	475	2.6	0.141	1.5	NA	0.6	4.5	0.14	0.22	0.14	26.9

Table C1g. SIDRA results – Arthur St / Cranleigh St roundabout – 8-9AM traffic with primary school (870 students)

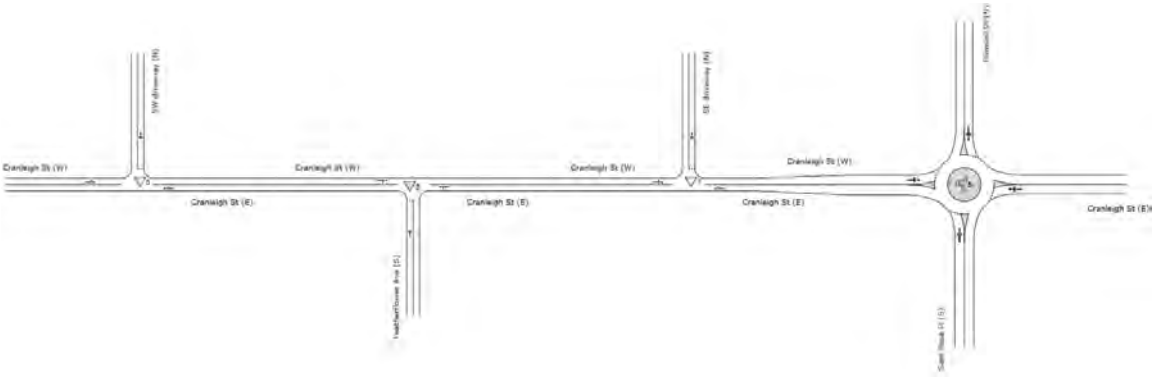
Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Arthur St (S)														
1	L2	24	5.0	24	5.0	0.192	2.4	LOS A	1.0	7.4	0.24	0.35	0.24	38.4
2	T1	178	5.0	178	5.0	0.192	2.0	LOS A	1.0	7.4	0.24	0.35	0.24	36.8
3	R2	47	5.0	47	5.0	0.192	5.9	LOS A	1.0	7.4	0.24	0.35	0.24	39.6
Approach		249	5.0	249	5.0	0.192	2.8	LOS A	1.0	7.4	0.24	0.35	0.24	37.8
East: Cranleigh St (E)														
4	L2	103	5.0	103	5.0	0.136	3.4	LOS A	0.7	5.1	0.43	0.49	0.43	38.2
5	T1	27	5.0	27	5.0	0.136	3.1	LOS A	0.7	5.1	0.43	0.49	0.43	39.1
6	R2	14	5.0	14	5.0	0.136	7.0	LOS A	0.7	5.1	0.43	0.49	0.43	36.1
Approach		144	5.0	144	5.0	0.136	3.7	LOS A	0.7	5.1	0.43	0.49	0.43	38.3
North: Arthur St (N)														
7	L2	3	5.0	3	5.0	0.227	1.9	LOS A	1.2	9.0	0.20	0.32	0.20	37.9
8	T1	251	5.0	251	5.0	0.227	1.7	LOS A	1.2	9.0	0.20	0.32	0.20	39.6
9	R2	49	5.0	49	5.0	0.227	5.3	LOS A	1.2	9.0	0.20	0.32	0.20	39.9
Approach		303	5.0	303	5.0	0.227	2.3	LOS A	1.2	9.0	0.20	0.32	0.20	39.6
West: Cranleigh St (W)														
10	L2	48	5.0	48	5.0	0.058	3.0	LOS A	0.3	2.0	0.36	0.44	0.36	35.9
11	T1	7	5.0	7	5.0	0.058	2.7	LOS A	0.3	2.0	0.36	0.44	0.36	39.2
12	R2	7	5.0	7	5.0	0.058	6.6	LOS A	0.3	2.0	0.36	0.44	0.36	39.5
Approach		63	5.0	63	5.0	0.058	3.4	LOS A	0.3	2.0	0.36	0.44	0.36	37.1
All Vehicles		760	5.0	760	5.0	0.227	2.8	LOS A	1.2	9.0	0.27	0.37	0.27	38.5

Table C1h. SIDRA results – Arthur St / Cranleigh St roundabout – 3-4PM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Arthur St (S)														
1	L2	12	5.0	12	5.0	0.249	2.3	LOS A	1.3	10.2	0.22	0.35	0.22	38.3
2	T1	239	5.0	239	5.0	0.249	1.9	LOS A	1.3	10.2	0.22	0.35	0.22	36.7
3	R2	89	5.0	89	5.0	0.249	5.9	LOS A	1.3	10.2	0.22	0.35	0.22	39.6
Approach		340	5.0	340	5.0	0.249	3.0	LOS A	1.3	10.2	0.22	0.35	0.22	37.9
East: Cranleigh St (E)														
4	L2	61	5.0	61	5.0	0.076	3.1	LOS A	0.4	2.8	0.39	0.45	0.39	38.3
5	T1	15	5.0	15	5.0	0.076	2.7	LOS A	0.4	2.8	0.39	0.45	0.39	39.2
6	R2	7	5.0	7	5.0	0.076	6.7	LOS A	0.4	2.8	0.39	0.45	0.39	36.3
Approach		83	5.0	83	5.0	0.076	3.4	LOS A	0.4	2.8	0.39	0.45	0.39	38.4
North: Arthur St (N)														
7	L2	9	5.0	9	5.0	0.210	2.3	LOS A	1.0	8.1	0.29	0.38	0.29	37.4
8	T1	194	5.0	194	5.0	0.210	2.0	LOS A	1.0	8.1	0.29	0.38	0.29	39.1
9	R2	48	5.0	48	5.0	0.210	5.7	LOS A	1.0	8.1	0.29	0.38	0.29	39.4
Approach		252	5.0	252	5.0	0.210	2.7	LOS A	1.0	8.1	0.29	0.38	0.29	39.1
West: Cranleigh St (W)														
10	L2	53	5.0	53	5.0	0.090	3.5	LOS A	0.4	3.3	0.44	0.51	0.44	35.2
11	T1	19	5.0	19	5.0	0.090	3.2	LOS A	0.4	3.3	0.44	0.51	0.44	38.8
12	R2	20	5.0	20	5.0	0.090	7.1	LOS A	0.4	3.3	0.44	0.51	0.44	39.1
Approach		92	5.0	92	5.0	0.090	4.2	LOS A	0.4	3.3	0.44	0.51	0.44	37.4
All Vehicles		766	5.0	766	5.0	0.249	3.1	LOS A	1.3	10.2	0.29	0.39	0.29	38.2



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
5	NA	Cranleigh-SW driveway 2031 AM
6	NA	Cranleigh-Featherflower 2031 AM
7	NA	Cranleigh-SE driveway 2031 AM
8	NA	Cranleigh-Blundell-SamRosa 2031 AM

Figure C2. Cranleigh Street intersections and school driveways layout analysed in SIDRA Network

Table C2a. SIDRA results – Cranleigh St / southwest driveway intersection – 8-9AM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cranleigh St (E)														
2	T1	116	5.0	116	5.0	0.118	0.1	LOS A	0.5	3.7	0.14	0.22	0.14	36.2
3	R2	95	0.0	95	0.0	0.118	3.6	LOS A	0.5	3.7	0.14	0.22	0.14	26.3
Approach		211	2.8	211	2.8	0.118	1.7	NA	0.5	3.7	0.14	0.22	0.14	33.6
North: SW driveway (N)														
4	L2	53	0.0	53	0.0	0.060	2.4	LOS A	0.2	1.6	0.09	0.44	0.09	21.2
6	R2	27	0.0	27	0.0	0.060	3.3	LOS A	0.2	1.6	0.09	0.44	0.09	34.0
Approach		80	0.0	80	0.0	0.060	2.7	LOS A	0.2	1.6	0.09	0.44	0.09	29.6
West: Cranleigh St (W)														
7	L2	27	0.0	27	0.0	0.034	3.4	LOS A	0.0	0.0	0.00	0.20	0.00	30.0
8	T1	36	5.0	36	5.0	0.034	0.0	LOS A	0.0	0.0	0.00	0.20	0.00	36.6
Approach		63	2.8	63	2.8	0.034	1.5	NA	0.0	0.0	0.00	0.20	0.00	33.3
All Vehicles		354	2.1	354	2.1	0.118	1.9	NA	0.5	3.7	0.10	0.27	0.10	32.9

Table C2b. SIDRA results – Cranleigh St / southwest driveway intersection – 3-4PM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cranleigh St (E)														
2	T1	58	5.0	58	5.0	0.090	0.3	LOS A	0.4	3.2	0.23	0.31	0.23	34.8
3	R2	95	0.0	95	0.0	0.090	3.8	LOS A	0.4	3.2	0.23	0.31	0.23	24.1
Approach		153	1.9	153	1.9	0.090	2.5	NA	0.4	3.2	0.23	0.31	0.23	30.2
North: SW driveway (N)														
4	L2	53	0.0	53	0.0	0.062	2.6	LOS A	0.2	1.7	0.19	0.46	0.19	20.6
6	R2	27	0.0	27	0.0	0.062	3.3	LOS A	0.2	1.7	0.19	0.46	0.19	33.7
Approach		80	0.0	80	0.0	0.062	2.8	LOS A	0.2	1.7	0.19	0.46	0.19	29.2
West: Cranleigh St (W)														
7	L2	27	0.0	27	0.0	0.065	3.4	LOS A	0.0	0.0	0.00	0.11	0.00	30.9
8	T1	94	5.0	94	5.0	0.065	0.0	LOS A	0.0	0.0	0.00	0.11	0.00	38.1
Approach		121	3.9	121	3.9	0.065	0.8	NA	0.0	0.0	0.00	0.11	0.00	36.1
All Vehicles		354	2.1	354	2.1	0.090	2.0	NA	0.4	3.2	0.14	0.27	0.14	32.4

Table C2c. SIDRA results – Cranleigh St / Featherflower Ave T-intersection – 8-9AM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Featherflower Ave (S)														
4	L2	18	2.0	18	2.0	0.022	3.8	LOS A	0.1	0.6	0.29	0.49	0.29	21.2
6	R2	8	2.0	8	2.0	0.022	4.5	LOS A	0.1	0.6	0.29	0.49	0.29	21.2
Approach		26	2.0	26	2.0	0.022	4.0	LOS A	0.1	0.6	0.29	0.49	0.29	21.2
East: Cranleigh St (E)														
7	L2	8	2.0	8	2.0	0.108	3.2	LOS A	0.0	0.0	0.00	0.02	0.00	34.7
8	T1	193	5.0	193	5.0	0.108	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	38.8
Approach		201	4.9	201	4.9	0.108	0.1	NA	0.0	0.0	0.00	0.02	0.00	38.5
West: Cranleigh St (W)														
2	T1	76	5.0	76	5.0	0.049	0.1	LOS A	0.1	0.7	0.10	0.07	0.10	33.5
3	R2	13	2.0	13	2.0	0.049	4.1	LOS A	0.1	0.7	0.10	0.07	0.10	30.9
Approach		88	4.6	88	4.6	0.049	0.7	NA	0.1	0.7	0.10	0.07	0.10	32.8
All Vehicles		316	4.5	316	4.5	0.108	0.6	NA	0.1	0.7	0.05	0.07	0.05	34.4

Table C2d. SIDRA results – Cranleigh St / Featherflower Ave T-intersection – 3-4PM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Featherflower Ave (S)														
4	L2	14	2.0	14	2.0	0.018	3.6	LOS A	0.1	0.5	0.24	0.48	0.24	21.5
6	R2	8	2.0	8	2.0	0.018	4.5	LOS A	0.1	0.5	0.24	0.48	0.24	21.5
Approach		22	2.0	22	2.0	0.018	3.9	LOS A	0.1	0.5	0.24	0.48	0.24	21.5
East: Cranleigh St (E)														
7	L2	8	2.0	8	2.0	0.079	3.2	LOS A	0.0	0.0	0.00	0.03	0.00	34.5
8	T1	139	5.0	139	5.0	0.079	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	38.4
Approach		147	4.8	147	4.8	0.079	0.2	NA	0.0	0.0	0.00	0.03	0.00	38.0
West: Cranleigh St (W)														
2	T1	129	5.0	129	5.0	0.081	0.1	LOS A	0.1	0.9	0.07	0.06	0.07	34.8
3	R2	17	2.0	17	2.0	0.081	3.9	LOS A	0.1	0.9	0.07	0.06	0.07	31.6
Approach		146	4.7	146	4.7	0.081	0.5	NA	0.1	0.9	0.07	0.06	0.07	34.2
All Vehicles		316	4.6	316	4.6	0.081	0.6	NA	0.1	0.9	0.05	0.07	0.05	34.3

Table C2e. SIDRA results – Cranleigh St / southeast driveway intersection – 8-9AM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cranleigh St (E)														
2	T1	194	5.0	194	5.0	0.158	0.1	LOS A	0.5	4.1	0.13	0.16	0.13	35.8
3	R2	89	0.0	89	0.0	0.158	3.9	LOS A	0.5	4.1	0.13	0.16	0.13	33.9
Approach		283	3.4	283	3.4	0.158	1.3	NA	0.5	4.1	0.13	0.16	0.13	35.1
North: SE driveway (N)														
4	L2	132	0.0	132	0.0	0.094	2.5	LOS A	0.4	2.9	0.17	0.43	0.17	21.4
6	R2	7	0.0	7	0.0	0.094	3.9	LOS A	0.4	2.9	0.17	0.43	0.17	21.4
Approach		139	0.0	139	0.0	0.094	2.6	LOS A	0.4	2.9	0.17	0.43	0.17	21.4
West: Cranleigh St (W)														
7	L2	7	0.0	7	0.0	0.045	2.9	LOS A	0.0	0.0	0.00	0.04	0.00	11.5
8	T1	77	5.0	77	5.0	0.045	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	37.5
Approach		84	4.6	84	4.6	0.045	0.3	NA	0.0	0.0	0.00	0.04	0.00	29.4
All Vehicles		506	2.7	506	2.7	0.158	1.5	NA	0.5	4.1	0.12	0.21	0.12	32.8

Table C2f. SIDRA results – Cranleigh St / southeast driveway intersection – 3-4PM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cranleigh St (E)														
2	T1	140	5.0	140	5.0	0.132	0.3	LOS A	0.5	4.0	0.20	0.20	0.20	34.7
3	R2	89	0.0	89	0.0	0.132	4.1	LOS A	0.5	4.0	0.20	0.20	0.20	33.0
Approach		229	3.1	229	3.1	0.132	1.8	NA	0.5	4.0	0.20	0.20	0.20	34.0
North: SE driveway (N)														
4	L2	132	0.0	132	0.0	0.098	2.7	LOS A	0.4	3.0	0.23	0.45	0.23	20.7
6	R2	7	0.0	7	0.0	0.098	3.9	LOS A	0.4	3.0	0.23	0.45	0.23	20.7
Approach		139	0.0	139	0.0	0.098	2.8	LOS A	0.4	3.0	0.23	0.45	0.23	20.7
West: Cranleigh St (W)														
7	L2	7	0.0	7	0.0	0.074	2.9	LOS A	0.0	0.0	0.00	0.02	0.00	11.5
8	T1	131	5.0	131	5.0	0.074	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	38.4
Approach		138	4.7	138	4.7	0.074	0.2	NA	0.0	0.0	0.00	0.02	0.00	32.7
All Vehicles		506	2.7	506	2.7	0.132	1.6	NA	0.5	4.0	0.15	0.22	0.15	31.8

Table C2g. SIDRA results – Cranleigh St / Blundell St / Sam Rosa Pl roundabout – 8-9AM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Sam Rosa Pl (S)														
10	L2	117	5.0	117	5.0	0.110	2.7	LOS A	0.5	4.0	0.32	0.40	0.32	34.1
11	T1	11	5.0	11	5.0	0.110	2.4	LOS A	0.5	4.0	0.32	0.40	0.32	39.0
12	R2	2	2.0	2	2.0	0.110	6.2	LOS A	0.5	4.0	0.32	0.40	0.32	39.5
Approach		129	5.0	129	5.0	0.110	2.8	LOS A	0.5	4.0	0.32	0.40	0.32	34.9
East: Cranleigh St (E)														
1	L2	1	2.0	1	2.0	0.050	3.1	LOS A	0.2	1.7	0.37	0.40	0.37	36.6
2	T1	46	2.0	46	2.0	0.050	2.7	LOS A	0.2	1.7	0.37	0.40	0.37	33.4
3	R2	6	2.0	6	2.0	0.050	6.6	LOS A	0.2	1.7	0.37	0.40	0.37	38.8
Approach		54	2.0	54	2.0	0.050	3.2	LOS A	0.2	1.7	0.37	0.40	0.37	34.5
North: Blundell St (N)														
4	L2	1	2.0	1	2.0	0.130	2.7	LOS A	0.7	5.0	0.32	0.53	0.32	35.1
5	T1	25	5.0	25	5.0	0.130	2.4	LOS A	0.7	5.0	0.32	0.53	0.32	36.5
6	R2	120	5.0	120	5.0	0.130	6.3	LOS A	0.7	5.0	0.32	0.53	0.32	31.2
Approach		146	5.0	146	5.0	0.130	5.6	LOS A	0.7	5.0	0.32	0.53	0.32	32.5
West: Cranleigh St (W)														
7	L2	71	5.0	71	5.0	0.144	2.1	LOS A	0.7	5.3	0.09	0.44	0.09	36.1
8	T1	26	2.0	26	2.0	0.144	1.7	LOS A	0.7	5.3	0.09	0.44	0.09	38.0
9	R2	112	5.0	112	5.0	0.144	5.6	LOS A	0.7	5.3	0.09	0.44	0.09	38.4
Approach		208	4.6	208	4.6	0.144	3.9	LOS A	0.7	5.3	0.09	0.44	0.09	37.5
All Vehicles		538	4.5	538	4.5	0.144	4.0	LOS A	0.7	5.3	0.24	0.45	0.24	35.4

Table C2h. SIDRA results – Cranleigh St / Blundell St / Sam Rosa Pl roundabout – 3-4PM traffic with primary school (870 students)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Sam Rosa Pl (S)														
10	L2	114	5.0	114	5.0	0.119	2.5	LOS A	0.6	4.3	0.26	0.37	0.26	34.4
11	T1	27	5.0	27	5.0	0.119	2.1	LOS A	0.6	4.3	0.26	0.37	0.26	39.1
12	R2	5	2.0	5	2.0	0.119	6.0	LOS A	0.6	4.3	0.26	0.37	0.26	39.7
Approach		146	4.9	146	4.9	0.119	2.6	LOS A	0.6	4.3	0.26	0.37	0.26	36.0
East: Cranleigh St (E)														
1	L2	1	2.0	1	2.0	0.033	2.9	LOS A	0.1	1.1	0.33	0.36	0.33	36.9
2	T1	33	2.0	33	2.0	0.033	2.5	LOS A	0.1	1.1	0.33	0.36	0.33	33.9
3	R2	3	2.0	3	2.0	0.033	6.4	LOS A	0.1	1.1	0.33	0.36	0.33	39.1
Approach		37	2.0	37	2.0	0.033	2.9	LOS A	0.1	1.1	0.33	0.36	0.33	34.7
North: Blundell St (N)														
4	L2	4	2.0	4	2.0	0.090	2.8	LOS A	0.4	3.4	0.33	0.53	0.33	35.0
5	T1	13	5.0	13	5.0	0.090	2.5	LOS A	0.4	3.4	0.33	0.53	0.33	36.4
6	R2	83	5.0	83	5.0	0.090	6.4	LOS A	0.4	3.4	0.33	0.53	0.33	31.1
Approach		100	4.9	100	4.9	0.090	5.8	LOS A	0.4	3.4	0.33	0.53	0.33	32.3
West: Cranleigh St (W)														
7	L2	106	5.0	106	5.0	0.188	2.2	LOS A	0.9	7.3	0.14	0.42	0.14	36.2
8	T1	40	2.0	40	2.0	0.188	1.8	LOS A	0.9	7.3	0.14	0.42	0.14	38.1
9	R2	116	5.0	116	5.0	0.188	5.7	LOS A	0.9	7.3	0.14	0.42	0.14	38.5
Approach		262	4.5	262	4.5	0.188	3.7	LOS A	0.9	7.3	0.14	0.42	0.14	37.5
All Vehicles		545	4.5	545	4.5	0.188	3.7	LOS A	0.9	7.3	0.22	0.42	0.22	36.1

Appendix D

Parking Analysis

Department of Education and Training - TRAFFIC MANAGEMENT BRIEF

Note: This spreadsheet should be read in conjunction with 4.3 Accommodation Schedule and 5.7 Traffic Management. It is based on a (430 student) standard pattern primary school, but is not a guarantee to achieving development approval. It is a guide which incorporates minimum parking requirements for DoE and establishes the basis for discussions with the relevant local government authority.
Calculations must be based on full potentail school population inclusive of planned future Transportable classrooms

CAR PARKING - STANDARD PROVISIONS

SCHOOL

Proposed Primary School (excluding an Education Support Centre)

STUDENT POPULATION

	FTE		
Full Time	750	-	Pre-Primary to Year 6 Students
Part Time	60	120	40 Kindy Students only = 20 full time Equivalent
Total	810		Total Full time Equivalent. (Total Student population = 430)

MINIMUM COMPULSORY PARKING REQUIRED

Purpose	Number of bays	Formula	Limit	Location	Comments
Staff and Visitors	75	10 for every 100 Pre-Primary to Year 6 student. 46 minimum for new schools only .	Maximum, variable	On-site	Includes 3 visitors' bays
Early Childhood	25	Minium of 15. Not varied by student numbers	Minimum, fixed	On-site	Includes a drive in drop-off and pick-up area in close proximity to the Early Childhood block
Embayments	105	14 bays for every 100 Pre-Primary to Year 6 students. Minimum of 60 bays for new schools only.	Minimum, variable	Off-site	Site configuration as determined by structure plan must maximise road reserve parking opportunities to the minimum on site requirements
Total	205	Inclusive of Universal Access bays (see below)			
Universal Access	4	1 in every 30 on-site bays. Minimum 2 bays.	Minimum, variable	On-site	Universal Access bays are evenly distributed across the site with at least one bay provided in each area.

ADDITIONAL NON-COMPULSORY PARKING

Canteen	4	1 bay for a Manager and 3 bays for parent assistants	Minimum, variable	On-site	Parking in close proximity to the canteen service area
Dental Therapy Clinic	0	2 bays for therapists and 4 bays for visiting parents	Maximum, fixed	On-site	Parking in close proximity to the Dental Therapy clinic
Overall Total	209	Inclusive of Universal Access bays (see below)			
Universal Access	5	As required or as determined by specific clientele	variable	On-site	There are generally three individual car parking areas with at least one bay provided in each area

STUDENT NUMBERS

Year Group	*No.of students per class*
Kindy	20
Kindy Tranportables	20
Pre-Primary	27
Pre-Primary Transportables	25
Year 1	24
Year 2	24
Year 3	24
Year 4	32
Year 5	32
Year 6	32
General Transportables	28

Note: The client has specified an overall total of 211 bays instead of the 209 calculated in this spreadsheet. The difference is because 2 Universal Access bays (for standard pattern 540 student school) are to be counted in addition not included in the overall total shown above. Other Universal Access bays are still to be counted as included in the overall total.

Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details

Site Address / Plan Reference: Dayton Primary School - Lot 557 (11) Blundell Street & Lot 558		
Suburb: Dayton	**State:** WA	**P/code:** 6055
Local government area: City of Swan		
Description of the planning proposal: Development Application		
BMP Plan / Reference Number: 201091	**Version:** v1.1	**Date of Issue:** 2/03/2021
Client / Business Name: Department of Education		

Reason for referral to DFES	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	☐	☑
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the BPC elements)?	☐	☑

Is the proposal any of the following special development types (see SPP 3.7 for definitions)?

Unavoidable development (in BAL-40 or BAL-FZ)	☐	☑
Strategic planning proposal (including rezoning applications)	☐	☑
Minor development (in BAL-40 or BAL-FZ)	☐	☑
High risk land-use	☐	☑
Vulnerable land-use	☑	☐

If the development is a special development type as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

The proposed development is for the construction of a new Primary School to accommodate young children for educational purposes. This site is therefore considered a vulnerable land use.

Note: The decision maker (e.g. local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name	Accreditation Level	Accreditation No.	Accreditation Expiry
Kathy Nastov	3	27794	2021
Company		**Contact No.**	
Bushfire Prone Planning		64771144	

I declare that the information provided within this bushfire management plan is to the best of my knowledge true and correct

Signature of Practitioner  **Date** 2/03/2021

Bushfire Management Plan

Dayton Primary School

Lot 557 (11) Blundell Street & Lot 558, Dayton

City of Swan

Planning Stage:	Development Application (Standard BMP)
Planning Development Type:	Construction of a Class 4 - 9 Building
Bushfire Policy – Specific Development or Use Type:	Vulnerable Land Use (Non-Tourism)

Job Number:	201091
Assessment Date:	13 January 2021
Report Date:	2 March 2021

BPP Group Pty Ltd t/a Bushfire Prone Planning
ACN: 39 166 551 784 | ABN: 39 166 551 784

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DOCUMENT CONTROL

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Co-Author:	Select.	
Review/Authorise:	Kathy Nastov (BPAD Level 3 - No. 27794)	

VERSION HISTORY		
Version	**Version Details**	**Date**
1.0	Original	24 February 2021
1.1	Amendments to Original Document	2 March 2021

DISTRIBUTION				
Destination	**Version**	**No. Copies**	**Hard Copy**	**Electronic Copy**
Person/Business: Christou Design Group – Matthew Le Meur Email: mlemeur@christou.com.au	1.1		☐	☒
Person/Business: Email:			☐	☐

Limitation of Liability: The measures contained in this Bushfire Management Plan, are considered to be minimum requirements and they do not guarantee that a building will not be damaged in a bushfire, persons injured, or fatalities occur either on the subject site or off the site while evacuating. This is substantially due to the unpredictable nature and behaviour of fire and fire weather conditions. Additionally, the correct implementation of the required bushfire protection measures will depend upon, among other things, the ongoing actions of the landowners and/or operators over which Bushfire Prone Planning has no control.

All surveys, forecasts, projections and recommendations made in this report associated with the proposed development are made in good faith based on information available to Bushfire Prone Planning at the time. All maps included herein are indicative in nature and are not to be used for accurate calculations.

Notwithstanding anything contained therein, Bushfire Prone Planning will not, except as the law may require, be liable for any loss or other consequences whether or not due to the negligence of their consultants, their servants or agents, arising out of the services provided by their consultants.

TABLE OF CONTENTS

LIST OF FIGURES

EXECUTIVE SUMMARY

This Bushfire Management Plan has been prepared to accompany a proposal for the construction of a new Primary School (Dayton Primary School) located at Lot 557 (11) Blundell Street and Lot 558, Dayton in the City of Swan.

The location of the proposed works is within a designated bushfire prone area and requires the application of State Planning Policy No. 3.7: Planning in Bushfire Prone Areas (SPP 3.7). The assessed bushfire risk is considered to be manageable post development works and will be achieved by the identified stakeholders implementing and maintaining the bushfire risk management measures that are presented in this Plan. Assessment of the planned location, vegetation and consideration of existing infrastructure indicates that compliance is achieved against applicable bushfire related legislation, policy, standards and guidelines, including the Bushfire Protection Criteria.

Against the Bushfire Protection Criteria, the decision maker's assessment of this Proposal is to be on the basis of:

- For Element 1 'Location', the Proposal is able to achieve the acceptable solution (by being subject to BAL-29 or less within the development site post development works);
- For Element 2 'Siting and Design' Subject to any applicable Environmental Survey Works and approval by the Local Government Authority, the proposal is able to achieve the acceptable solution as onsite vegetation modification has been undertaken (if applicable), therefore any future development will potentially be subject to a BAL rating of BAL-29 or lower;
- For Element 3 'Vehicular Access', the public vehicle access and egress is via the existing road network which enables access to the subject site. The existing local road network provides two egress routes to two different destinations. As a sealed public road, it will be available to all of the public at all times and under all weather conditions;
- For Element 4 'Water', the subject site is located within a reticulated water supply area for residential/commercial use and for fire-fighting operations. Existing hydrants are located at the regular intervals in the area. The closest external hydrant is located outside of the subject allotment on Cranleigh Street.

To implement and maintain the assessed bushfire attack levels for the proposed works, and to keep the possible bushfire risk to the proposed Primary School as low as possible, the development site and associated asset protection zones are required to be maintained to a low bushfire threat state in perpetuity.

Buildings of Class 4 to Class 9 are not required by the Building Code of Australia (BCA) to be constructed to comply with bushfire performance requirements. Bushfire Prone Planning recommends however, that some degree of upgrading be considered to improve the protection for occupants and the building's survivability.

The proposed development is assessed as a vulnerable land use. It is a requirement of State Planning Policy 3.7 that a development application for a vulnerable land use should include an Emergency Evacuation Plan for proposed occupants.

1 PROPOSAL DETAILS

1.1 Description and Associated Plans and Maps

Landowner / Proponent:	Department of Education
Bushfire Prone Planning Commissioned to Produce the Bushfire Management Plan (BMP) By:	Christou Design Group
For Submission To:	City of Swan
Purpose of the BMP:	To accompany a planning application
'Development' Site Total Area:	5.7 hectares
Description of the Proposed Development/Use:	
This Bushfire Management Plan is to accompany a development application for the construction of a new Primary School.	
Staged Development and Management of Potential Bushfire Hazard Issues	
N/A	

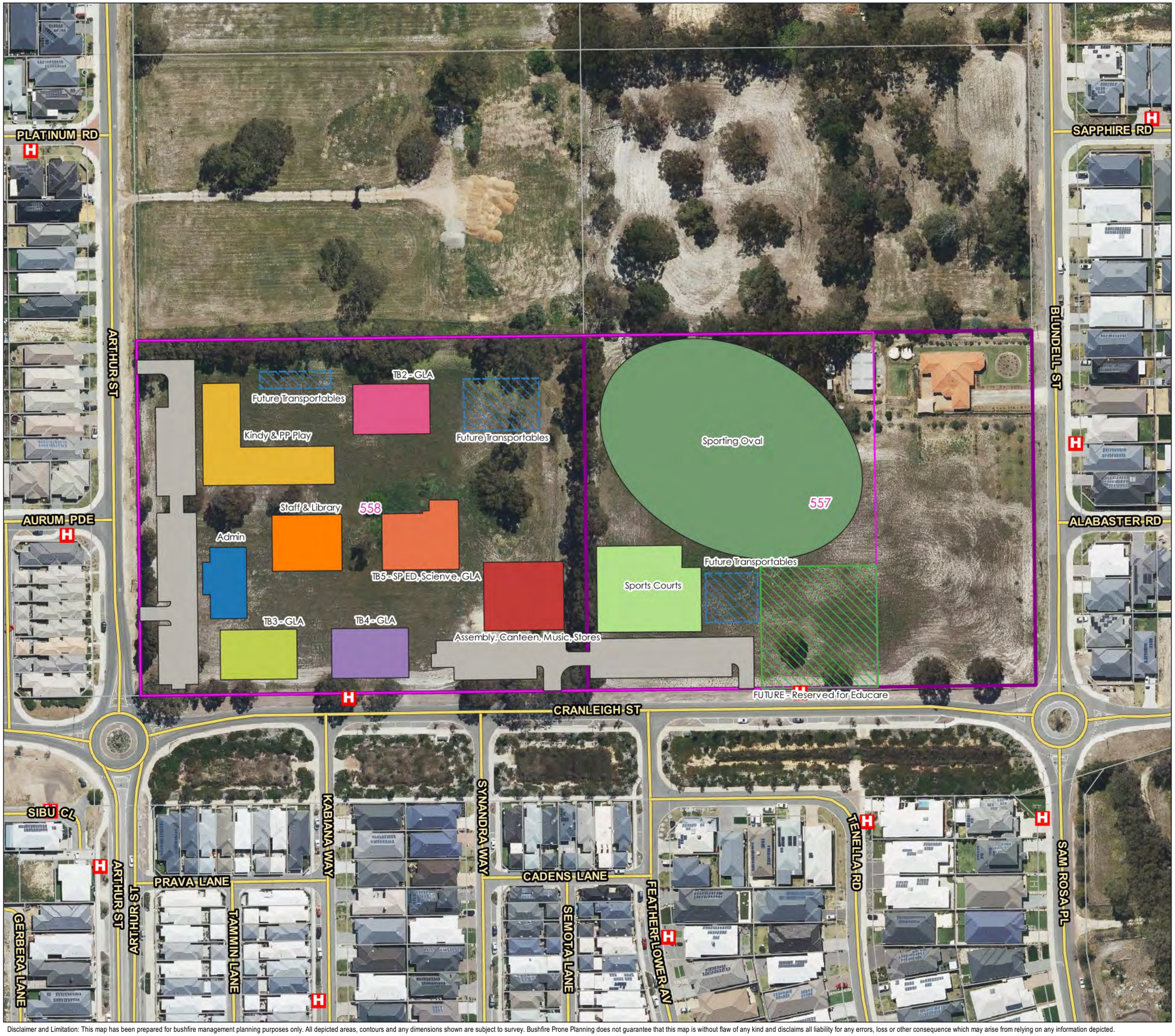


Figure 1.1

Proposed Development Map

Lot 557 on Plan / Diagram: P003698 &
Lot 558 on Plan / Diagram: P003698
Dayton Primary School
Dayton
City of Swan

------ LEGEND ------

- Hydrants
- Cadastre
- Subject Site
- Development Area

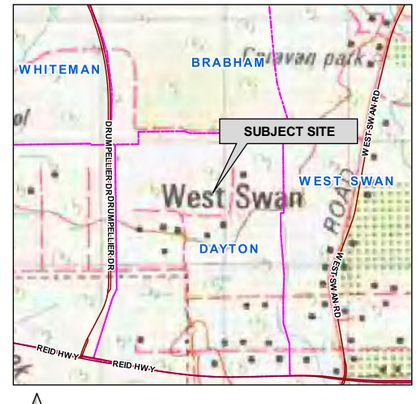
Proposal

- Admin
- Staff & Library
- Assembly, Canteen, Music, Stores
- TB1 - Kindy & PP Play
- TB2 - GLA
- TB3 - GLA
- TB4 - GLA
- TB5 - SP ED, Science, GLA
- Future Transportables
- FUTURE - Reserved for Educare
- Sports Courts
- Sporting Oval
- Carpark

0 10 20 30 40 50

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Sarina Gorman 02-03-2021
SCALE (A3): 1 : 1500

Figure 1.2

Location Plan

Lot 557 on Plan / Diagram: P003698 &
Lot 558 on Plan / Diagram: P003698
Dayton Primary School
Dayton
City of Swan

------ LEGEND ------

- Subject Site
- Local Government Authority
- Localities/Suburb
- DFES_Stations_(DFES-023)
- Legislated Lands & Waters (DBCA-011)
- Reserve
- Unallocated Crown Land

DBCA Lands of Interest

- Bush Forever Site
- Clearing Regulations (DWER-046)

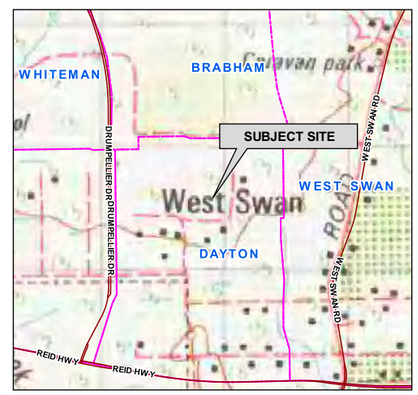
Geomorphic Wetlands (DBCA-019)

- Conservation
- Resource Enhancement

0 250 500 750 1000 1250

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Sarina Gorman 23-02-2021
SCALE (A3): 1 : 20000

BUSHFIRE PRONE PLANNING

201091_Location_Dayton_Primary_School.qgz

Figure 1.3

Bushfire Prone Area

Lot 557 on Plan / Diagram: P003698 &
Lot 558 on Plan / Diagram: P003698
Dayton Primary School
Dayton
City of Swan

PLATINUM RD
SAPPHIRE RD
ARTHUR ST
BLUNDELL ST
AURUM PDE
ALABASTER RD
CRANLEIGH ST
SIBU CL
PRAVA LANE
CADENS LANE
GERBERA LANE
KABIANA WAY
SYNANDRA WAY
TAMMIN LANE
SEMOTA LANE
FEATHERFLOWER AV
TENELLA RD
SAM ROSA PL
DAYTON

Future Transportables
TB2 - GLA
Future Transportables
Kindy & PP Play
Sporting Oval
Staff & Library
558
557
Admin
TB5 - SP ED, Scienve, GLA
Future Transportables
Sports Courts
TB3 - GLA
TB4 - GLA
Assembly, Canteen, Music, Stores
FUTURE - Reserved for Educare

------ LEGEND ------

- Bushfire Prone Areas
- Local Government Authority
- Localities/Suburb
- Cadastre
- Subject Site
- Development Area

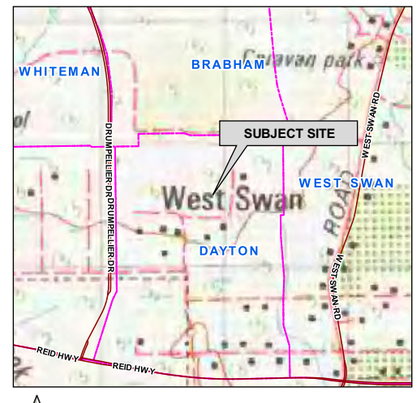
Proposal

- Admin
- Staff & Library
- Assembly, Canteen, Music, Stores
- TB1 - Kindy & PP Play
- TB2 - GLA
- TB3 - GLA
- TB4 - GLA
- TB5 - SP ED, Science, GLA
- Future Transportables
- FUTURE - Reserved for Educare
- Sports Courts
- Sporting Oval
- Carpark

0 10 20 30 40 50

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Sarina Gorman 02-03-2021
SCALE (A3): 1 : 1500

BUSHFIRE PRONE PLANNING

1.2 The Specific 'Land Use' and the Bushfire Planning Requirements

SPP 3.7, the associated Guidelines and Position Statements, define certain land uses that require additional and/or alternative bushfire related assessment and additional information to be provided. This is necessary to facilitate planning application assessment and for subsequent operational use.

When such a proposal is unable to fully achieve the implementation of all required bushfire protection measures - as established by the 'acceptable solutions' contained in the Guidelines and Position Statements – further assessments and the development of additional protection measures are required.

The land use classification that applies to the proposal is identified in Table 1.2, along with the required additional assessments and information and the form and location in which this is provided.

Table 1.2: The determined land use and assessment/information requirements.

THE PROPOSED LAND USE CLASSIFICATION AND BUSHFIRE PLANNING REQUIREMENTS			
Assessment / Information / Documents Detail			
The proposed land use classification is determined to be:		Vulnerable (Non-Tourism)	High Risk
Category, type and/or operations of the land use that have determined the classification:		Category 1: A facility designed to accommodate occupants with reduced physical or mental ability such as the elderly, children (under 18 years of age) and the sick or injured.	N/A
The Policies, Guidelines and Position Statements against which the proposed land use will be assessed, and which guide the information to be provided.[1]	SPP 3.7	☒	N/A
	Guidelines including the BPC	☒	N/A
	Guidelines excluding the BPC	N/A	N/A
	Position Statement - BPC Element 1 and 2	☒	N/A
	Position Statement - Tourism	N/A	N/A
The documents and the information developed and the format and location in which they are provided.	Bushfire Management Plan (BMP)	☒	N/A
	Risk Management Plan (RMP)	N/A	N/A
	Risk Assessment and Treatment Plan	N/A	N/A
	Vulnerability Assessment - Short Stay Accommodation/Visitation (supporting BMP and BEP)	N/A	N/A
	Bushfire Emergency Plan (BEP)	-	N/A
	BEP Supporting Information	N/A	N/A
	Additional bushfire protection measures	☐ In BMP s5.5	☐ In BMP s5.5
	Owner/operator additional responsibilities associated with the land use.	☐ In BMP s5.6	☐ In BMP s5.6
Note [1]: State Planning Policy 3.7 Planning in Bushfire Prone Areas; Guidelines for Planning in Bushfire Prone Areas WAPC 2017 v1.3; Bushfire Protection Criteria (BPC) established in the Guidelines; Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design WAPC November 2019; Position Statement: Tourism land uses in bushfire prone areas WAPC October 2019.			

1.3 Existing Documentation Relevant to the Construction of this Plan

This section acknowledges any known reports or plans that have been prepared for previous planning stages, that refer to the subject area and that may or will impact upon the assessment of bushfire risk and/or the implementation of bushfire protection measures and will be referenced in this Bushfire Management Plan.

Table 2.1: Existing relevant documentation.

RELEVANT EXISTING DOCUMENTS		
Existing Document	Copy Provided by Client	Title
Structure Plan	No	
Environmental Report	No	
Landscaping (Revegetation) Plan	No	
Bushfire Risk Assessments	No	

2 ENVIRONMENTAL CONSIDERATIONS

2.1 Native Vegetation – Restrictions to Modification and/or Clearing

Many bushfire prone areas also have high biodiversity values. SPP 3.7 policy objective 5.4 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values (Guidelines s2.3).

There is a requirement to identify any need for onsite modification and/or clearing of native vegetation and whether this may trigger potential environmental impact/referral requirements under State and Federal environmental legislation. Confirmation that any proposed native vegetation modification and/or clearing is acceptable, should be received from the relevant agencies by the proponent and provided to the bushfire consultant for inclusion in the Bushfire Management Plan if it will influence the required bushfire planning assessments and outcomes. The following table details any potential environmental restrictions of which the author of this report is aware.

Table 2.2: Native vegetation and potential environmental considerations and restrictions.

NATIVE VEGETATION MODIFICATION / CLEARING - POTENTIAL ENVIRONMENTAL RESTRICTIONS IDENTIFIED				
Environmental Considerations / Features	Potential Mapping Data Source (SLIP / Local Planning)	Relevant to Proposed Development	Data Applied	Action Required
Onsite clearing of native vegetation is required.		Possible		
Environmental impact/referral requirements under State and Federal environmental legislation may be triggered.		Unlikely		
National Park / Nature Reserve	DBCA-011	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
Conservation Covenant	DPIRD-023	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Environmentally Sensitive Areas	DWER-046	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
Bush Forever Site	DPLH-019	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
RAMSAR Wetland	DBCA-010	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
Geomorphic and Other Wetland	DBCA-011- 019, 040, 043, 044	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
Threatened and Priority Ecological Communities (TECs or PECs)	DBCA-038	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
Threatened and Priority Flora including Declared Rare Flora (DRFs)	DBCA-036	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
Land Identified as significant through a Local Biodiversity Strategy	LG - Intramaps	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None

Development Design Considerations

Establishing development in bushfire prone areas can adversely affect the retention of native vegetation through clearing associated with the creation of lots and/or asset protection zones. Where loss of vegetation is not acceptable or causes conflict with landscape or environmental objectives, it will be necessary to consider available design options to minimise the removal of native vegetation.

Table 2.3: Development design.

MINIMISE THE REMOVAL OF NATIVE VEGETATION	
Design Option	Assessment / Action
Reduction of lot yield	N/A
Cluster development	N/A
Construct building to a standard corresponding to a higher BAL as per BCA (AS 3959:2018 and/or NASH Standard)	N/A
Modify the development location	N/A
Subject to any applicable Environmental Survey Works and approval from the Local Government Authority, the proposed development can achieve asset protection zone development and maintenance of vegetation on the development site in a low threat state, which will ensure the bushfire risk will be reduced to the immediate surrounding properties due to the continued ongoing management of vegetation.	
IMPACT ON ADJOINING LAND	
Is this planning proposal able to implement the required bushfire protection measures within the boundaries of the land being developed so as not to impact on the bushfire and environmental management of neighbouring reserves, properties or conservation covenants?	Yes
The required Asset Protection Zones (APZ) can be established within the extents of the subject lot. The construction of the proposed development and the ongoing management of onsite vegetation will reduce the threat of bushfire.	

2.2 Retained Vegetation / Re-vegetation / Landscape Plans (including POS)

Riparian zones, wetland/foreshore buffers, road verges and public open space may have plans to re-vegetate or retain vegetation as part of the proposed development. Vegetation corridors may be created between offsite and onsite vegetation and provide a route for fire to enter a development area.

All retained/planned vegetation and its management will be considered in the development of this Bushfire Management Plan.

Is re-vegetation of riparian zones and/or wetland or foreshore buffers and/or public open space a part of this Proposal?	No
Is the requirement for ongoing maintenance of existing vegetation in riparian zones and/or wetland or foreshore buffers and/or public open space a part of this Proposal?	No
Has a landscape plan been developed for the proposed development?	No

3 POTENTIAL BUSHFIRE IMPACT ASSESSMENT

3.1 Assessment Input

3.1.1 Fire Danger Index (FDI) Applied

AS 3959:2018 Table 2.1 specifies the fire danger index values to apply for different regions. The values used in the model calculations are for the Forest Fire Danger Index (FFDI) and for which equivalent representative values of the Grassland Fire Danger Index (GFDI) are applied as per Appendix B. The values can be modified if appropriately justified.

Table 3.1.1: Applied FDI Value

FDI VALUE			
Vegetation Areas	As per AS 3959:2018 Table 2.1	As per DFES for the Location	Value Applied
1-8	80	N/A	80

3.1.2 Vegetation Classification and Effective Slope

Classification: Bushfire prone vegetation identification and classification has been conducted in accordance with AS 3959:2018 s2.2.3 and the Visual Guide for Bushfire Risk Assessment in WA (DoP February 2016).

When more than one vegetation type is present, each type is identified separately, and the applied classification considers the potential bushfire intensity and behaviour from the vegetation types present and ensures the worst case scenario is accounted for – this may not be from the predominant vegetation type.

The vegetation structure has been assessed as it will be in its mature state (rather than what might be observed on the day). Areas of modified vegetation are assessed as they will be in their natural unmodified state (unless maintained in a permanently low threat, minimal fuel condition, satisfying AS 3959:2018 s2.2.3.2(f) and asset protection zone standards). Vegetation destroyed or damaged by a bushfire or other natural disaster has been assessed on its revegetated mature state.

Effective Slope: Refers to the ground slope under each area of classified vegetation which most influences the bushfire attack (and is described in the direction relative to the view from the building or proposed development site). This slope has a direct and significant influence on the fire's rate of spread and intensity.

Where there is a significant change in effective slope under an area of classified vegetation, that will cause a change in fire behaviour, separate vegetation areas will be identified to enable the correct assessment.

When the effective slope, under a given area of bushfire prone vegetation, will be different relative to multiple proposed development sites, then the effective slopes corresponding to the different locations, are separately identified.

Table 3.1.2: Vegetation classification and effective slope.

ALL VEGETATION WITHIN 150 METRES OF THE PROPOSED DEVELOPMENT				
Vegetation Area	Identified Vegetation Types [1] or Description if 'Excluded'	Applied Vegetation Classification [1]	Effective Slope (degrees)[2]	
			Assessed	Applied Range
1	Grassland – G-25/G-26	Class G Grassland	0	upslope or flat
2	Forest – A-04	Class A Forest	0	upslope or flat
3	Woodland – B-05	Class B Woodland	0	upslope or flat
4	Grassland – G-26	Class G Grassland	0	upslope or flat
5	Woodland – B-05	Class B Woodland	0	upslope or flat
6	Shrub – C-10	Class B Woodland	0	upslope or flat
7	Grassland – G-26	Class G Grassland	0	upslope or flat
8	Excluded – Low Threat Vegetation	Excluded as per Section 2.2.3.2 (f) Low Threat	N/A	N/A
Representative photos of each vegetation area, descriptions and classification justification, are presented on the following pages. The areas of classified vegetation are defined, and the photo locations identified on Figure 3.1, the Existing Vegetation and Topography map.				
Note[1]: Described and classified as per AS 3959:2018 Table 2.3 and Figures 2.3 and 2.4 (A)-(H)				
Note[2]: It is assumed for the purposes of assessment that Area 8 will continue to be managed in a low threat state in perpetuity. (Established and Developing Residential Area, maintained private gardens and buildings. Cleared bitumen/hardstand areas/roads.				

VEGETATION AREA 1	
AS 3959:2018 Vegetation Classification Applied:	Class G Grassland
Vegetation Types Present:	Dense sown pasture G-25; Sown pasture G-26
Description/Justification:	Assessed as Grassland due to areas of grasses present in open areas. Currently in an unmanaged state and required to be classified in accordance with AS3959-2018. Foliage cover less than 10%.

Photo ID: 1

Photo ID: 2

Photo ID: 3

VEGETATION AREA 2	
AS 3959:2018 Vegetation Classification Applied:	Class A Forest
Vegetation Types Present:	Open forest A-03
Description/Justification:	Mixed species of trees present inclusive of Eucalypts average heights of up to 20 metres. Understorey consists of unmanaged grasses, low shrub and low trees. Canopy coverage greater than 50%. NOTE: Zoom factor has been increased at Photo ID: 4 in order to obtain a suitable image. This is due to lack of access.
	
Photo ID: 4	

VEGETATION AREA 3	
AS 3959:2018 Vegetation Classification Applied:	Class B Woodland
Vegetation Types Present:	Woodland B-05
Description/Justification:	Mixed species of trees present inclusive of Eucalypts. Trees with average height of approximately 15-20 metres at maturity. Understorey consists of predominantly very low grasses and leaf litter. Canopy coverage approximately 30%. Occasional open areas between canopies.

Photo ID: 5

Photo ID: 6

Photo ID: 7

Photo ID: 8

Photo ID: 9

Photo ID: 10

VEGETATION AREA 4	
AS 3959:2018 Vegetation Classification Applied:	Class G Grassland
Vegetation Types Present:	Sown pasture G-26
Description/Justification:	Assessed as Grassland due to areas of grasses present in open areas. Although grasses may appear to be in a managed state, there is the potential for these areas to become significantly unmanaged in future. As such this area has been classified as a precautionary measure with a worst-case scenario approach. Foliage cover less than 10%. NOTE: Remnants of Area 5 can be seen in the background of Photo ID: 12.

Photo ID: 11

Photo ID: 12

VEGETATION AREA 5	
AS 3959:2018 Vegetation Classification Applied:	Class B Woodland
Vegetation Types Present:	Woodland B-05
Description/Justification:	Mixed species of trees present inclusive of Eucalypt. Trees with average height of approximately 15-20 metres at maturity. Understorey consists of predominantly very low grasses and leaf litter. Canopy coverage approximately 30%. Occasional open areas between canopies.

Photo ID: 13

Photo ID: 14

VEGETATION AREA 6	
AS 3959:2018 Vegetation Classification Applied:	Class C Shrubland
Vegetation Types Present:	Closed heath C-10
Description/Justification:	Unmanaged shrub averaging less than 2 metres in height with mixed species composition.

Photo ID: 15

Photo ID: 16

VEGETATION AREA 7	
AS 3959:2018 Vegetation Classification Applied:	Class G Grassland
Vegetation Types Present:	Sown pasture G-26
Description/Justification:	Assessed as Grassland due to areas of grasses present in open areas. Although grasses may appear to be in a managed state, there is the potential for these areas to become significantly unmanaged in future. As such this area has been classified as a precautionary measure with a worst-case scenario approach. Foliage cover less than 10%.

Photo ID: 17

Photo ID: 18

Photo ID: 19

Photo ID: 20

VEGETATION AREA 8	
AS 3959:2018 Vegetation Classification Applied:	Excluded as per Section 2.2.3.2 (f) Low Threat Vegetation
Vegetation Types Present:	Low Threat Vegetation
Description/Justification:	A combination of an established and developing residential areas. Grasses maintained to less than 50mm in height. Footpaths, hardstand areas and street scapes/verges cleared of unmanaged vegetation.

Photo ID: 21

Photo ID: 22

Photo ID: 23

Photo ID: 24

Photo ID: 25

Photo ID: 26

VEGETATION AREA 8	
AS 3959:2018 Vegetation Classification Applied:	Excluded as per Section 2.2.3.2 (f) Low Threat Vegetation
Vegetation Types Present:	Low Threat Vegetation
Description/Justification:	A combination of an established and developing residential areas. Grasses maintained to less than 50mm in height. Footpaths, hardstand areas and street scapes/verges cleared of unmanaged vegetation.
	
Photo ID: 27	

Figure 3.1

Vegetation Classification & Topography Map - (Pre-Development)

Lot 557 on Plan / Diagram: P003698 &
Lot 558 on Plan / Diagram: P003698
Dayton Primary School
Dayton
City of Swan

------ LEGEND ------

- Photos
- Hydrants
- Elevation (m)
- Subject Site
- Development Area

Proposal

- Admin
- Staff & Library
- Assembly, Canteen, Music, Stores
- TB1 - Kindy & PP Play
- TB2 - GLA
- TB3 - GLA
- TB4 - GLA
- TB5 - SP ED, Science, GLA
- Future Transportables
- FUTURE - Reserved for Educare
- Sports Courts
- Sporting Oval
- Carpark

Assessment Area

- 150m Buffer

Classified Vegetation

- Class A - Forest
- Class B - Woodland
- Class C - Shrubland
- Class G - Grassland
- Exclusion 2.2.3.2

0 25 50 75 100 125

Metres

AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Sarina Gorman 02-03-2021
SCALE (A3): 1 : 2150

BUSHFIRE PRONE PLANNING

3.1.3 Vegetation Separation Distance

The vegetation separation distance is the horizontal distance measured from the relevant parts of an existing building or a future building's planned location (within a lot), to the determined edge of an area of classified vegetation.

This separation distance applied to determining a Bushfire Attack Level (BAL) can be either:

- The *measured distance* – for which the location of the building relative to the edge of classified vegetation must be known. This will result in single determined BAL that will apply to a building. (The measured distance is a required calculation input); or
- A *calculated minimum and maximum distance (range)* that will correspond to each individual BAL. The calculated distances provide an indicative (or achievable) BAL for which the determined BAL will be dependent on the known location of the building relative to the edge of classified vegetation.

  The calculated range of distances corresponding to each BAL can be presented in different formats (tables or a BAL contour map), dependent on the form of information that is most appropriate for the proposed development/use. These distance ranges corresponding to BAL(s) will be presented in Section 3.2: 'Assessment Output".

For the proposed development/use, the applicable vegetation separation distances will be presented within the Bushfire Management Plan in this location:	In Section 3.2 'Assessment Output' as a table containing the calculated ranges of distance corresponding to each BAL and illustrated as a BAL Contour Map.

3.2 Assessment Output

UNDERSTANDING THE RESULTS OF THE BUSHFIRE IMPACT ASSESSMENT

Bushfire Attack Levels (BALs) – Their Application in the Building Environment is Different to the Planning Environment

In the building environment, a *determined BAL* is required for the proposed construction at the building application stage. This is to inform approval considerations and establish the bushfire construction standards that are to apply. An indicative BAL is not acceptable for a building application.

In the planning environment, through the application of SPP 3.7 and associated Guidelines, the deemed to satisfy requirement for a proposed 'development site' or sites (defined by the LPS Amendment Regulations 2015 as "that part of a lot on which a building that is the subject of development stands or is to be constructed"), is that a BAL-29 or lower rating can be achieved once all works associated with the proposal are completed. For planning approval purposes, an *indicative BAL* can provide the required information.

Determined Bushfire Attack Level

A determined BAL is to apply to an existing building or the 'development site' on which the building is to be constructed and not to a lot or building envelope. Its purpose is to state the potential radiant heat flux to which the building will be exposed, thereby determining the construction standard to be applied.

A determined BAL cannot be given for a future building whose design and position on the lot are unknown or the vegetation separation distance has not been established. It is not until these variables have been fixed that a determined BAL can be stated, and a BAL Certificate can be issued.

The one exception is when a building *of any dimension* can be *positioned anywhere* on a proposed lot (within R-Code building setbacks) or within a defined building envelope, and always remain subject to the same BAL, regardless of the retention of any existing classified vegetation either onsite or offsite.

Indicative Bushfire Attack Level

If a BAL is not able to achieve 'determined' status it will be an indicative BAL. It indicates the BAL that can be achieved by the proposed development/use. However, it is conditional upon an assessment variable(s) being confirmed at a later stage (e.g. the building location is established/changed, or vegetation is removed to establish the vegetation separation distance).

A BAL certificate cannot be issued for an indicative BAL – unless that BAL cannot vary (refer to 'Determined BAL' above).

In table form, a single or a range of indicative BAL(s) may be presented. If a single indicative BAL is stated for a defined area (i.e. the lot or building envelope), this will be the highest indicative BAL impacting the defined area.

In BAL contour map form (refer to Section 3.2.2), the illustrated BAL contours visually identify areas of land for which if any part of an existing or proposed building is located on that land and within the BAL contours, then the highest BAL affecting that building (or part of the land on which the building will be constructed), will be the indicative BAL that is to apply.

The BAL can only become a determined BAL once the actual location of that building on the land is known and/or the required minimum vegetation separation distance corresponding to the relevant BAL contour is established (refer to Table 3.x).

3.2.1 Bushfire Attack Level Results – Table Format

Table 3.2.1: Vegetation separation distances required to achieve the stated BAL rating.

INDICATIVE (ACHIEVABLE) BUSHFIRE ATTACK LEVELS FOR THE ORIGINAL LOT (A BAL rating is achievable if a separation distance range is known)							
Derived from the Application of Method 1 BAL Determination Methodology (AS 3959:2018 Section 2, Table 2.5)[1]							
Original Lot No.	Vegetation Area	Vegetation Classification	Effective Slope (degree range)	Indicative BAL's – Separation Distance (m) or Status			
				BAL-29	BAL-19	BAL12.5	BAL-LOW
557	1	Class G Grassland	upslope or flat	8-<12	12-<17	17-<50	Risk of Ember Attack
	2	Class A Forest	upslope or flat	21-<31	31-<42	42-<100	Risk of Ember Attack
	3	Class B Woodland	upslope or flat	14-<20	20-<29	29-<100	Risk of Ember Attack
	4	Class G Grassland	upslope or flat	8-<12	12-<17	17-<50	Risk of Ember Attack
	5	Class B Woodland	upslope or flat	14-<20	20-<29	29-<100	Risk of Ember Attack
	6	Class C Shrubland	upslope or flat	9-<13	13-<19	19-<100	Risk of Ember Attack
	7	Class G Grassland	upslope or flat	8-<12	12-<17	17-<50	Risk of Ember Attack
	8	Excluded AS3959:2018 2.2.3.2 (f)	N/A	-	-	-	Risk of Ember Attack

Table 3.2.2: Vegetation separation distances required to achieve the stated BAL rating.

INDICATIVE (ACHIEVABLE) BUSHFIRE ATTACK LEVELS FOR THE ORIGINAL LOT (A BAL rating is achievable if a separation distance range is known)							
Derived from the Application of Method 1 BAL Determination Methodology (AS 3959:2018 Section 2, Table 2.5)[1]							
Original Lot No.	Vegetation Area	Vegetation Classification	Effective Slope (degree range)	Indicative BAL's – Separation Distance (m) or Status			
				BAL-29	BAL-19	BAL12.5	BAL-LOW
558	1	Class G Grassland	upslope or flat	8-<12	12-<17	17-<50	Risk of Ember Attack
	2	Class A Forest	upslope or flat	21-<31	31-<42	42-<100	Risk of Ember Attack
	3	Class B Woodland	upslope or flat	14-<20	20-<29	29-<100	Risk of Ember Attack
	4	Class G Grassland	upslope or flat	8-<12	12-<17	17-<50	Risk of Ember Attack
	5	Class B Woodland	upslope or flat	14-<20	20-<29	29-<100	Risk of Ember Attack
	6	Class C Shrubland	upslope or flat	9-<13	13-<19	19-<100	Risk of Ember Attack
	7	Class G Grassland	upslope or flat	8-<12	12-<17	17-<50	Risk of Ember Attack
	8	Excluded AS3959:2018 2.2.3.2 (f)	N/A	-	-	-	Risk of Ember Attack

Table 3.2.3: Indicative BAL ratings (post development)

MINIMUM SEPARATION DISTANCES REQUIRED TO RETAIN INDICATIVE, MAXIMUM, ACCEPTABLE BAL RATING – POST DEVELOPMENT				
Vegetation Area	Vegetation Classification	Effective Slope (degrees)	Maximum Acceptable BAL Rating	Required Separation Distances (metres)
1	Class G Grassland	0	BAL-29	8
2	Class A Forest	0		21
3	Class B Woodland	0		14
*3	Excluded AS3959:2018 2.2.3.2 (f)	0		N/A
4	Class G Grassland	0		8
5	Class B Woodland	5		14
6	Class C Shrubland	0		9
7	Class G Grassland	0		8
*7	Excluded AS3959:2018 2.2.3.2 (f)	0		N/A
8	Excluded AS3959:2018 2.2.3.2 (f)	0		N/A

Note[1]: *3 and *7 indicates vegetation subject to changes post development of this site, with the area/s being reclassified to 'Excluded' AS3959-2018 (f)'. This is the result of the implementation of Asset Protection Zones around the proposed structures and landscaping within the development site. The development site is to be maintained to a low bushfire threat state in perpetuity in accordance with Schedule 1: Standards for Asset Protection Zones as stipulated in the Guidelines for Planning in Bushfire Prone Areas, AS3959-2018 s2.2.3.2 requirements and the City of Swan Fire Hazard Reduction Notice (Firebreak Notice).

Figure 3.2

Vegetation Classification & Topography Map - (Post-Development)

Lot 557 on Plan / Diagram: P003698 &
Lot 558 on Plan / Diagram: P003698
Dayton Primary School
Dayton
City of Swan

------ LEGEND ------

- Photos
- Hydrants
- Elevation (m)
- Subject Site
- Development Area

Proposal

201091_Proposal

- Admin
- Staff & Library
- Assembly, Canteen, Music, Stores
- TB1 - Kindy & PP Play
- TB2 - GLA
- TB3 - GLA
- TB4 - GLA
- TB5 - SP ED, Science, GLA
- Future Transportables
- FUTURE - Reserved for Educare
- Sports Courts
- Sporting Oval
- Carpark

Assessment Area

- 150m Buffer

Classified Vegetation

- Class A - Forest
- Class B - Woodland
- Class C - Shrubland
- Class G - Grassland
- Exclusion 2.2.3.2

0 25 50 75 100 125

Metres

AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Sarina Gorman 02-03-2021
SCALE (A3): 1 : 2150

BUSHFIRE PRONE PLANNING

3.2.2 Bushfire Attack Level Results - BAL Contour Map Format

INTERPRETATION OF THE BUSHFIRE ATTACK LEVEL (BAL) CONTOUR MAP

The contour map will present different coloured contour intervals extending from the areas of classified bushfire prone vegetation. These represent the different bushfire attack levels that will exist at varying distances away from the classified vegetation in the event of a bushfire in that vegetation.

The areas of classified vegetation are those that will remain as the intended end state of the subject development once earthworks, clearing and/or landscaping and re-vegetation have been completed (or each stage completed).

Each bushfire attack level corresponds to a set range of radiant heat flux that is generated by a bushfire. That range is defined by the AS 3959:2018 BAL determination methodology.

The width of each shaded BAL contour is a diagrammatic representation of the separation distances from the classified vegetation that correspond to each BAL for each separately identified area of classified vegetation. They have been calculated by the application of the unique site variables including vegetation types and structure, ground slope and applied fire weather.

(Refer to Section 3.2 'Understanding the Results of the Bushfire Impact Assessment' for the explanation of how BAL(s) for buildings will be assessed from the BAL Contour Map).

Construction of the BAL Contours

Table 3.2.2.1: Vegetation separation distances applied to construct the BAL contours.

BAL CONTOUR MAP – APPLIED VEGETATION SEPARATION DISTANCES								
Derived from the Application of Method 1 BAL Determination Methodology (AS 3959:2018 Section 2, Table 2.5)[1]								
Vegetation Area	Vegetation Classification	Effective Slope (degree range)	BAL and Corresponding Separation Distance (m)					
			BAL-FZ	BAL-40	BAL-29	BAL-19	BAL12.5	BAL-LOW
1	Class G Grassland	upslope or flat	<6	6-<8	8-<12	12-<17	17-<50	>50
2	Class A Forest	upslope or flat	<16	16-<21	21-<31	31-<42	42-<100	>100
3	Class B Woodland	upslope or flat	<10	10-<14	14-<20	20-<29	29-<100	>100
*3	Excluded AS3959:2018 2.2.3.2 (f)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	Class G Grassland	upslope or flat	<6	6-<8	8-<12	12-<17	17-<50	>50
5	Class B Woodland	upslope or flat	<10	10-<14	14-<20	20-<29	29-<100	>100
6	Class C Shrubland	upslope or flat	<7	7-<9	9-<13	13-<19	1-<100	>100
7	Class G Grassland	upslope or flat	<6	6-<8	8-<12	12-<17	17-<50	>50
*7	Excluded AS3959:2018 2.2.3.2 (f)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	Excluded AS3959:2018 2.2.3.2 (f)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Note[1]: All assessment inputs applied are presented in Section 3.1								
Note[2]: It is assumed for the purposes of assessment that Area 8 will continue to be managed in a low threat state in perpetuity. (Established and Developing Residential Area, maintained private gardens and buildings. Cleared bitumen/hardstand areas/roads.								
Note[1]: *3 and *7 indicates vegetation subject to changes post development of this site, with the area/s being reclassified to 'Excluded' AS3959-2018 (f)'. This is the result of the implementation of Asset Protection Zones around the proposed structures and landscaping within the development site. The development site is to be maintained to a low bushfire threat state in perpetuity in accordance with Schedule 1: Standards for Asset Protection Zones as stipulated in the Guidelines for Planning in Bushfire Prone Areas, AS3959-2018 s2.2.3.2 requirements and the City of Swan Fire Hazard Reduction Notice (Firebreak Notice).								

Figure 3.3

BAL Contour Map - (Post-Development)

Lot 557 on Plan / Diagram: P003698 &
Lot 558 on Plan / Diagram: P003698
Dayton Primary School
Dayton
City of Swan

PROSPER RD
ARTHUR ST
SPARKLE VSTA
BLUNDELL ST
SAPPHIRE RD
HAPPY LANE
GLOSS ST
SIENNA ST
AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
AREA 7
AREA 8
TB2 - GLA
Future Transportables
Kindy & PP Play
Future Transportables
Sporting Oval
Staff & Library
558
557
Admin
TB5 - SP, ED, Scienve, GLA
Assembly, Canteen, Music, Stores
TB3 - GLA
TB4 - GLA
Sports Courts
Future Transportables
FUTURE - Reserved for Educare
AURUM PDE
NOBLE LANE
ALABASTER RD
CRANLEIGH ST
SIBU CL
PRAVA LANE
CADENS LANE
GLOXINIA GLDE
GERBERA LANE
ST JOHN ARTHUR ST
TAMMIN LANE
KABIANA WAY
SYNANDRA WAY
SEMOTA LANE
FEATHERFLOWER AV
OLIVINA PWY
TENELLA RD
WUNANGA RD
SAM ROSA PL

------ LEGEND ------

- Subject Site
- Development Area

Proposal

- Admin
- Staff & Library
- Assembly, Canteen, Music, Stores
- TB1 - Kindy & PP Play
- TB2 - GLA
- TB3 - GLA
- TB4 - GLA
- TB5 - SP ED, Science, GLA
- Future Transportables
- FUTURE - Reserved for Educare
- Sports Courts
- Sporting Oval
- Carpark

Assessment Area

- 100m Buffer
- 150m Buffer

Bushfire Attack Levels

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5
- BAL-LOW

0 25 50 75 100 125

Metres

N

AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Sarina Gorman 02-03-2021
SCALE (A3): 1 : 2150

3.2.3 Bushfire Attack Level Results - Derived from The BAL Contour Map

DERIVING A BAL RATING FOR A FUTURE CONSTRUCTION SITE (BUILDING) FROM THE BAL CONTOUR MAP DATA

(Capacity to Issue a BAL Certificate)

Key Assumptions: The actual location of a building within a lot or envelope (an 'area') may not have been determined at this stage of planning; and the BAL ratings represent the BAL of an 'area' not a building.

The BAL Rating is Assessed as Indicative

If the assessed BAL for the 'area' is stated as being 'indicative', it is because that 'area' is impacted by more than one BAL contour interval and/or classifiable vegetation remains on the lot, or on adjacent lots, that can influence a future building's BAL rating (and this vegetation may have been omitted from being contoured for planning purposes e.g. Grassland or when the assumption is made that all onsite vegetation can be removed and/or modified).

In this report the indicative BAL is presented as either the highest BAL impacting the site or as a range of achievable BAL's within the site – whichever is the most appropriate.

The BAL rating that will apply to any future building within that 'area' will be dependent on:

1. vegetation management onsite; and/or
2. vegetation remaining on adjacent lots; and/or
3. the actual location of the future building within that 'area'.

A BAL Certificate cannot be provided for future buildings, within a lot or envelope with an indicative BAL, until the building location and in some instances building design (elevation), have been established and any required and approved vegetation modification/removal has been confirmed. Once this has occurred a report confirming the building location and BAL rating will be required to submit with the BAL certificate.

The required confirmation of the BAL rating must be done by a bushfire practitioner with the same level of accreditation as has been required to compile this BAL Contour report or subsequent Bushfire Management Plan. This is dependent on the type of calculations utilised (e.g. if performance-based solutions have been used in the Plan BPAD Level 3 accreditation is required).

The BAL Rating is Assessed as Determined

If the assessed BAL for the lot or envelope is stated as being 'determined' it is because that lot or envelope is impacted by a single BAL contour interval. This BAL has been determined by the existence (or non-existence) of classified vegetation outside the lot or envelope, and no classifiable vegetation currently exists on the lot or envelope (i.e. it has been cleared to a minimal fuel, low bushfire threat state). In the situation where the BAL Contour Map has been constructed around multiple lots, there also needs to no classifiable vegetation on an adjacent lot if this vegetation has not already been incorporated into the creation of the BAL Contour Map.

As a result, a determined BAL can be provided in this limited situation because:

1. No classified vegetation is required to be removed or modified to achieve the determined BAL, either within the lot/envelope or on adjacent lots (or if vegetation is excluded from classification, it is reasonable to assume it will be maintained in this state into the future); and
2. A future building can be located anywhere within the 'site' and be subject to the determined BAL rating; and
3. The degree of certainty is more than sufficient to allow for any small discrepancy that might occur in the mapping of the BAL contours.

For a determined BAL rating for a lot/envelope, A BAL Certificate (referring to the BMP) can be provided for a future building, if the BMP remains current.

Table 3.2.3.1: Indicative Bushfire Attack Levels for the Proposed Works

(Refer to Figure 3.3)

INDICATIVE BUSHFIRE ATTACK LEVELS FOR PROPOSED WORKS		
Relevant Fire Danger Index (AS 3959-2018 Table 2.1)		80
Derived from the Application of Method 1 BAL Determination Methodology (AS 3959:2018 Section 2, Table 2.5)[1]		
Building/Structures/Works	BAL Status	Indicative BAL Rating
Admin Block	Indicative	**BAL-12.5**
Staff & Library	Indicative	**BAL-12.5**
Assembly, Canteen, Music, Stores	Indicative	**BAL-12.5**
Teaching Block (TB1) Kindy & Pre-Primary Play	Indicative	**BAL-12.5**
Teaching Block (TB2) - GLA	Indicative	**BAL-12.5**
Teaching Block (TB3) - GLA	Indicative	**BAL-12.5**
Teaching Block (TB4) - GLA	Indicative	**BAL-12.5**
Teaching Block (TB5) - SP ED, Science, GLA	Indicative	**BAL-12.5**
FUTURE – 2x Transportables (Pre-Primary) – Lot 558	Indicative	**BAL-19**
FUTURE – 6x Transportables (2 Storey GLA) – Lot 558	Indicative	**BAL-12.5**
FUTURE – 4x Transportables – Lot 557	Indicative	**BAL-12.5**

4 IDENTIFICATION OF BUSHFIRE HAZARD ISSUES

The subject site currently lies in a bushfire prone area as defined by the OBRM Map of Bushfire Prone Areas. The bushfire hazards are likely to be reduced in the future as the development of the surrounding land is undertaken. The conditions stipulated in this BMP and the City of Swan Fire Hazard Reduction Notice (Firebreak Notice) will address the issue of onsite vegetation management, as the site is cleared and/or landscaped (if applicable) and will continue to be managed in a low bushfire threat state. Within 150 metres of the development site, the bushfire hazards consist of a mix of vegetation including Class A – Forest, Class B – Woodland, Class C - Shrub and Class G – Grassland.

Vegetation onsite is within the control of the subject site's landowner/s and therefore can potentially be removed or maintained to mitigate the bushfire risk subject to any Environmental Surveys and approval required by the Local Government.

Vegetation offsite that is not within the control of the subject site's landowner/s, cannot be removed or modified by the landowner/s and as a result the assessed BAL's determined by this vegetation indicate the appropriate BAL ratings across the site.

Future Development – Where any Landscaping or Revegetation areas are scheduled to occur as a result of ongoing development within the Subject Site, consideration must be given as to not increase the bushfire risk and does not alter the indicative BAL ratings indicated in this plan.

5 ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA ESTABLISHED BY THE GUIDELINES

For a development application that is not a 'Tourism Land Use' to be considered compliant with SPP 3.7, it must satisfy (achieve) the intent of each of the four elements of the bushfire protection criteria. These criteria are established by the *Guidelines for Planning in Bushfire Prone Areas WAPC 2017 v1.3*). Compliance can be achieved by either:

- Meeting all applicable acceptable solutions corresponding to each element (i.e. the minimum bushfire protection measures that are deemed to satisfy planning requirements); or
- Where an acceptable solution cannot be met, by developing a performance solution that satisfies the established requirements.

5.1 Local Government Variations to Apply

Local governments may add to or modify the acceptable solutions of the Bushfire Protection Criteria (BPC) and/or apply technical requirements that vary from those specified in the Guidelines for Planning in Bushfire Prone Areas (WAPC). In such instances, this Proposal will be assessed against these variations and/or any specific local government technical requirements for emergency access and water. Refer to Appendices 2 and 3 for relevant technical requirements.

Will local or regional variations (endorsed by WAPC / DFES) to the applicable acceptable solutions established by the *Guidelines* or the *Position Statement: Tourism land uses in bushfire prone areas WAPC October 2019,* apply to this Proposal?	No

5.2 Summary of Assessment Against the Bushfire Protection Criteria

SUMMARISED OUTCOME OF THE ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA					
Element of the Bushfire Protection Criteria	Basis for the Proposal Achieving Full Compliance with SPP 3.7			The Proposal Cannot Achieve Full Compliance with SPP 3.7	
	Acceptable Solutions Met		Achieves the Intent of the Element		
	All applicable solutions are fully met	All applicable solutions are not fully met. A merit based assessment and/or a bushfire performance comparison of the proposals residual risk with that of the residual risk of the acceptable solution is conducted (refer Note 4)	A performance principle-based solution is applied	Bushfire planning development type that may not require full compliance is applied	An improvement in bushfire performance compared to the existing development is detailed (refer Note 4)
1. Location	✓			N/A	
2. Siting and Design of Development	✓				
3. Vehicular Access	✓				
4. Water	✓				

Note: The development proposal has been assessed:

1. Against the requirements established in Appendix 4 of the *Guidelines for Planning in Bushfire Prone Areas, WAPC 2017 v1.3 (Guidelines)*. The Guidelines are found at https://www.planning.wa.gov.au/8194.aspx; and
2. Applying the interpretation guidance provided in *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019)*.
3. Applying any endorsed variations to the Guideline's acceptable solutions and associated technical requirements that have been established by the local government. If known and applicable these have been stated in Section 5.1 with the detail included as an appendix if required by the local government.
4. When non-compliant with SPP 3.7 and when appropriate, by utilising additional compliance pathways that include the application of merit-based assessment and comparative bushfire performance. The validity of this approach is derived from relevant decisions made by the responsible authorities (refer Appendix 2).

5.3 Assessment Detail

Element 1: Location	
Intent: To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.	
Compliance: How the proposed development achieves the intent of Element 1:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)

ASSESSMENT (COMPLIANCE) STATEMENTS

For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3)* and apply the interpretation guidance established by the *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019)*.

Acceptable Solution: A1.1: Development Location

Broader Landscape Context (Vegetation and Topography)

Onsite (areas within the subject site):

The proposal is for the construction of a new Primary School. The development site currently lies within a bushfire prone area as defined by the OBRM map of Bushfire Prone Areas. It exists within an established and developing residential area (in the suburb of Dayton). It is surrounded by laid out public roads and managed gardens associated with the dwellings in the area. Large paddock areas are also present to the north of the subject site. The removal or modification of classifiable vegetation will be required within the boundaries of the subject site.

The current, onsite vegetation (within the allotment boundary) consists of predominantly Class G – Grassland.

Post Development – No bushfire prone vegetation will remain within the subject site boundary. The proposed development, associated roads and parking (with the exception of Public Open Space areas) ensures the entire site will be built out.

Offsite (areas adjoining the subject site):

The current offsite areas of bushfire prone vegetation for this proposal consist of a mix of Class A – Forest, Class B – Woodland, Class C - Shrubland and Class G – Grassland. All areas of classified vegetation are located within 150 metres of this proposal.

This proposal is currently subject to a rating of BAL-FZ (Refer to Figures 3.1 and 3.3 of this plan). Should any future development be proposed on the subject site, it will be subject to potential radiant heat from a bushfire not exceeding 29KW/m² (i.e. a BAL-29 or less will apply) This can be achieved by using positioning, design and appropriate vegetation modification (if applicable); and

Managing the remaining bushfire risk to an acceptable level by the existence/implementation and ongoing maintenance measures as identified in this plan. These measures include the requirements for vegetation management, vehicular access and firefighting water supply.

Element 2: Siting and Design of Development

Intent: To ensure that the siting and design of development (note: not building/construction design) minimises the level of bushfire impact.

Compliance: How the proposed development achieves the intent of Element 2:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)

ASSESSMENT (COMPLIANCE) STATEMENTS

For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3)* and apply the interpretation guidance established by the *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019)*.

Acceptable Solution: A2.1: Asset Protection Zone

DEVELOPMENT SITING AND DESIGN:

The necessary outcome of bushfire planning for development siting and design, is to ensure that a building can be located within the developable portion of any lot (i.e. outside those parts of the lot that form the required R-Code building setbacks, or any other excluded area), and be subject to potential radiant heat from a bushfire not exceeding 29 kW/m^2 (i.e. a maximum BAL of BAL-29).

This will be achieved when the size of the "low fuel area immediately surrounding a building", the asset protection zone (APZ), is large enough. This requires a certain separation distance to exist between the building and areas of classified vegetation. These are the BAL-29 APZ dimensions and they will vary dependent on site specific parameters.

The APZ should be contained solely within the boundaries of each lot, except in instances where the neighbouring lot(s) or adjacent public land will be managed in a low-fuel state on an ongoing basis, in perpetuity.

Where possible, planning for siting and design should incorporate elements that include non-vegetated areas (e.g. roads/parking/drainage) and/or formally managed areas of vegetation (public open space/recreation areas/ services installed in a common section of land), as either part of the required APZ dimensions or to additionally increase separation distances to provide greater protection. These elements create robust and easier managed asset protection zones.

Future buildings on the development site can be surrounded by an APZ that will ensure the potential radiant heat impact of a bushfire does not exceed 29 kW/m^2 (BAL-29).

ASSET PROTECTION ZONE (APZ) – ATTRIBUTES TO SATISFY BUSHFIRE PLANNING REQUIREMENTS:

Width: The required APZ dimensions to ensure buildings are subject to a maximum BAL of BAL-29 (measured from any external wall or supporting post or column to the edge of the classified vegetation), has been determined in Section 3.2 of this BMP and are:

BAL-29 APZ Dimensions		
Proposed Primary School	Building to Vegetation Area *1	Minimum 8 metres
	Building to Vegetation Area *2	Minimum 21 metres
	Building to Vegetation Area *3	Minimum 14 metres
	Building to Vegetation Area **3	Excluded' AS3959-2018 (f)
	Building to Vegetation Area *4	Minimum 8 metres
	Building to Vegetation Area *5	Minimum 14 metres
	Building to Vegetation Area *6	Minimum 9 metres
	Building to Vegetation Area **7	Excluded' AS3959-2018 (f)

- * Indicates unmanaged vegetation that is located offsite. Vegetation that is onsite is within the control of the subject site's landowner/s and therefore can potentially be removed or maintained to mitigate the

bushfire risk, subject to any approval being required by a local government. Vegetation that is located offsite however, cannot be removed or modified for BAL reduction purposes as it is not within the control of the subject site landowner.

- ** Indicates vegetation subject to changes post development of this site, with the area/s being reclassified to 'Excluded' AS3959-2018 (f)'. This is the result of the implementation of Asset Protection Zones around the proposed structures and landscaping within the development site. The development site is to be maintained to a low bushfire threat state in perpetuity in accordance with Schedule 1: Standards for Asset Protection Zones as stipulated in the Guidelines for Planning in Bushfire Prone Areas, AS3959-2018 s2.2.3.2 requirements and the City of Swan Fire Hazard Reduction Notice (Firebreak Notice).

Location: The APZ will consist of areas of land both within and external to the subject site boundary. Within the subject site, it will consist of managed landscaping, driveways and parking areas. The balance of the required APZ will consist of established and maintained gardens associated with residential dwellings on the adjoining lots. Regular maintenance is required in accordance with AS3959-2018 in conjunction with the requirements stipulated in the City of Swan Fire Hazard Reduction Notice (Firebreak Notice).

Management: Where any part of the required APZ dimension is vegetated, it will be managed in accordance with the technical requirements established by the Schedule 1: 'Standards for Asset Protection Zones (Guidelines). The APZ specifications are also detailed in Appendix 1.

ASSET PROTECTION ZONE (APZ) – DIMENSIONS TO SATISFY BUILDING (AND OPERATION) REQUREMENTS

It is important for the landowner to be aware that the APZ dimensions that will be required to be physically established and maintained on each lot surrounding relevant buildings, may be different to those stated above for the BAL-29 APZ (which is the minimum size a planning proposal needs to show can be met to comply with SPP 3.7).

The actual APZ dimensions to be physically established and maintained, will be based on which of the following establishes the larger APZ dimension:

- The dimensions corresponding to the determined BAL of a building (refer to Section 3.2 for explanation of the 'planning' versus 'building' requirements and 'indicative' versus 'determined' BAL); or
- The APZ dimensions established by the City of Swan Fire Hazard Reduction Notice (Firebreak Notice).

Element 3: Vehicular Access

Intent: To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event.

Compliance: How the proposed development achieves the intent of Element 3:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)

ASSESSMENT (COMPLIANCE) STATEMENTS

For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3).*

Acceptable Solution: A3.1: Two Access Routes

The subject site is located on an existing road network within an existing and developing residential area. No new roads are proposed. Arthur Street, located immediately adjacent to the subject site, provides a minimum of two alternatives for emergency access/egress to two different destinations. The existing road network meets the requirements of the guidelines for public roads and is available to emergency and private vehicles, at all times and under all weather conditions. Refer to Figure 5.1 of this plan.

Acceptable Solution: A3.2: Public Road

N/A

Acceptable Solution: A3.3: Cul-de-sacs (including a dead-end road)

N/A

Acceptable Solution: A3.4: Battle-axe

N/A

Acceptable Solution: A3.5: Private Driveways

N/A

Acceptable Solution: A3.6: Emergency Access Way

N/A

Acceptable Solution: A3.7: Fire Service Access Routes

N/A

Acceptable Solution: A3.8: Firebreak Width

The subject site will comply with the requirements of the City of Swan Fire Hazard Reduction Notice (Firebreak Notice) issued under s33 of the Bush Fires Act 1954. Firebreaks and hazard reduction, as necessary, will be installed/maintained annually and in perpetuity.

Element 4: Water	
Intent: To ensure water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire.	
Compliance: How the proposed development achieves the intent of Element 4:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)
ASSESSMENT (COMPLIANCE) STATEMENTS For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3).*	
Acceptable Solution: A4.1: Reticulated Areas	
The subject site is located within a reticulated water supply area for fire-fighting operations. The closest external hydrant is located outside of the subject site on Cranleigh Street. Existing external hydrants are located at regular intervals along Cranleigh Street and the surrounding roads/streets. Refer to Figures 3.1 and 5.1 of this Plan.	
Acceptable Solution: A4.2: Non-Reticulated Areas	
N/A	
Acceptable Solution: A4.3: Non-Reticulated Areas – Individual Lots	
N/A	

5.4 Additional Bushfire Protection Measures

The following bushfire protection measures are to be implemented and maintained. They are additional to those established by the relevant acceptable solutions applied to the proposed subdivision, development or use.

The relevant acceptable solutions are those against which this planning proposal has been assessed in Section 5.3 of this Bushfire Management Plan.

As a Vulnerable Land Use in a Bushfire Prone Area, the proposed Primary School will be subject to a Bushfire Emergency Plan.

Buildings of Class 4 to Class 9 are not required by the Building Code of Australia (BCA) to be constructed to comply with bushfire performance requirements. Bushfire Prone Planning recommends however, that some degree of upgrading be considered to improve the protection for occupants and the building's survivability.

Figure 5.1

Bushfire Protection Measures

Lot 557 on Plan / Diagram: P003698 &
Lot 558 on Plan / Diagram: P003698
Dayton Primary School
Dayton
City of Swan

REQUIREMENTS:

1. Primary route providing a minimum of two alternatives for emergency access/egress to two different destinations. This forms part of the existing public road network and meets compliance with Element 3 of the Guidelines.

2. Classified vegetation in accordance with AS3959-2108 that is impacting the proposed development.

3. School grounds to be maintained in accordance with the criteria detailed in AS3959-2018 s2.2.3.2 (f), Schedule 1: Standards for Asset Protection Zones as stipulated in the Guidelines for Planning in Bushfire Prone Areas and the City of Swan Fire Hazard Reduction Notice.

4. The subject site is located within a reticulated water supply area for fire-fighting operations. The closest hydrants are located outside the subject lot on Cranleigh Street. Existing external hydrants are also located at regular intervals along Cranleigh Street and surrounding streets/ roads.

NOTES:
- Removal of any potentially classifiable, native vegetaston requires approval from the City of Swan.

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DATE OF AERIAL PHOTO: October 2020
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------ LEGEND ------

- Hydrants
- Evacuation Route
- Subject Site
- Development Area

Proposal

201091_Proposal

- Admin
- Staff & Library
- Assembly, Canteen, Music, Stores
- TB1 - Kindy & PP Play
- TB2 - GLA
- TB3 - GLA
- TB4 - GLA
- TB5 - SP ED, Science, GLA
- Future Transportables
- FUTURE - Reserved for Educare
- Sports Courts
- Sporting Oval
- Carpark

Assessment Area

- 150m Buffer

Classified Vegetation

- Class A - Forest
- Class B - Woodland
- Class C - Shrubland
- Class G - Grassland
- Exclusion 2.2.3.2

0 25 50 75 100 125

Metres

AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Sarina Gorman 02-03-2021
SCALE (A3): 1 : 2150

BUSHFIRE PRONE PLANNING

6 RESPONSIBILITIES FOR IMPLEMENTATION AND MANAGEMENT OF THE BUSHFIRE PROTECTION MEASURES

Table 6.1: BMP Implementation responsibilities prior to occupancy or building.

Landowner (Developer) - Prior to Occupancy	
No.	Implementation Actions
1	The local government may condition a development application approval with a requirement for the landowner/proponent to register a notification onto the certificate of title and deposited plan. This will be done pursuant to Section 70A *Transfer of Land Act 1893* as amended ('Factors affecting use and enjoyment of land, notification on title'). This is to give notice of the bushfire hazard and any restrictions and/or protective measures required to be maintained at the owner's cost. This condition ensures that: 1. Landowners/proponents are aware their lot is in a designated bushfire prone area and of their obligations to apply the stated bushfire risk management measures; and 2. Potential purchasers are alerted to the Bushfire Management Plan so that future landowners/proponents can continue to apply the bushfire risk management measures that have been established in the Plan.
2	Post planning approval, the entity responsible for having the BMP prepared should ensure that anyone listed as having responsibility under the Plan has endorsed it and is provided with a copy for their information and informed that it contains their responsibilities. This includes the landowners/proponents (including future landowners where the Plan was prepared as part of a subdivision approval), local government and any other authorities or referral agencies ('Guidelines' s4.6.3).
3	Prior to occupation of the proposed buildings, the subject site is to be compliant with the City of Swan Fire Hazard Reduction Notice (Firebreak Notice) issued under s33 of the Bushfires Act 1954.
4	Prior to occupancy, a copy of the Bushfire Emergency Plan must be provided to the landowner/occupier and they are to be informed that it contains responsibilities that must be actioned due to the subject Proposal's land use being defined as 'Vulnerable'. This Plan must be read, and the instructions contained in the Plan that require certain information to be displayed and available to all occupants, must be complied with.
5	Prior to occupancy, all actions contained within the Pre-Season Procedure established by the Bushfire Emergency Plan, must be completed.
6	Prior to any building work, inform the builder of the existence of this Bushfire Management Plan and the responsibilities it contains, regarding the required construction standards. This will be: • The standard corresponding to the determined BAL, as per the bushfire provisions of the Building Code of Australia (BCA); and/or • A higher standard because the BMP establishes that the construction standard is to correspond to a higher BAL as an additional bushfire protection measure.

Table 6.2: Ongoing management responsibilities for the Landowner/Occupier.

6.2 Landowner/Occupier - Ongoing	
No.	Ongoing Management Actions
1	Maintain the Asset Protection Zone (APZ) surrounding Clubroom and Workshop Facility to the largest dimension as determined by either: • The dimensions corresponding to the determined BAL of a building (refer to Section 3.2 for explanation of the 'planning' versus 'building' requirements and 'indicative' versus 'determined' BAL); or • The dimensions corresponding to the local government's Firebreak Notice. Maintain the APZ to the above dimensions and to the standards established by the Guidelines (refer to Appendix 1) or as varied by the local government through their Firebreak Notice (refer to the following responsibility).
2	Comply with the City of Swan Fire Hazard Reduction Notice (Firebreak Notice) issued under s33 of the Bush Fires Act 1954. This may include specifications for asset protection zones that differ from the Guideline's APZ Standards, with the intent to better satisfy local conditions. When these are more stringent than those created by the Guidelines, or less stringent and endorsed by the WAPC and DFES, they must be complied with. Refer to Appendix 1.
3	Ensure that any builders (of future structures on the lot) are aware of the existence of this Bushfire Management Plan and the responsibilities it contains regarding the application of construction standards corresponding to a determined BAL.
4	Ensure all future buildings the landowner has responsibility for, are designed and constructed in full compliance with: 1. the requirements of the WA Building Act 2011 and the bushfire provisions of the Building Code of Australia (BCA); and 2. with any identified additional requirements established by this BMP or the local government.
5	Annually review applicable Bushfire Emergency Plans and conduct the pre-season preparation procedure.

Table 6.3: Ongoing management responsibilities for the Local Government.

6.3 Local Government - Ongoing	
No.	Ongoing Management Actions
1	Monitor landowner compliance with the Bushfire Management Plan and the annual City of Swan Fire Hazard Reduction Notice (Firebreak Notice)

A1.1 Requirements Established by the Guidelines – Standards for Asset Protection Zones

(Source: Guidelines for Planning in Bushfire Prone Areas - WAPC 2017 v1.3 Appendix 4, Element 2, Schedule 1 and Explanatory Note E2.1)

DEFINING THE ASSET PROTECTION ZONE (APZ)

Description: An APZ is an area surrounding a building that is managed to reduce the bushfire hazard to an acceptable level (by reducing fuel loads). The width of the required APZ varies with slope and vegetation and varies corresponding to the BAL rating determined for a building (lower BAL = greater dimensioned APZ).

For planning applications, the minimum sized acceptable APZ is that which is of sufficient size to ensure the potential radiant heat impact of a fire does not exceed 29kW/m² (BAL-29). It will be site specific.

For subdivision planning, design elements and excluded/low threat vegetation adjacent to the lot(s) can be utilised to achieve the required vegetation separation distances and therefore reduce the required dimensions of the APZ within the lot(s).

Defendable Space: The APZ includes a defendable space which is an area adjoining the asset within which firefighting operations can be undertaken to defend the structure. Vegetation within the defendable space should be kept at an absolute minimum and the area should be free from combustible items and obstructions. The width of the defendable space is dependent on the space, which is available on the property, but as a minimum should be 3 metres.

Establishment: The APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity.

The APZ may include public roads, waterways, footpaths, buildings, rocky outcrops, golf courses, maintained parkland as well as cultivated gardens in an urban context, but does not include grassland or vegetation on a neighbouring rural lot, farmland, wetland reserves and unmanaged public reserves.

[Note: Regardless of whether an Asset Protection Zone exists in accordance with the acceptable solutions and is appropriately maintained, fire fighters are not obliged to protect an asset if they think the separation distance between the dwelling and vegetation that can be involved in a bushfire, is unsafe.]

Schedule 1: Standards for APZ

Fences: within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used.

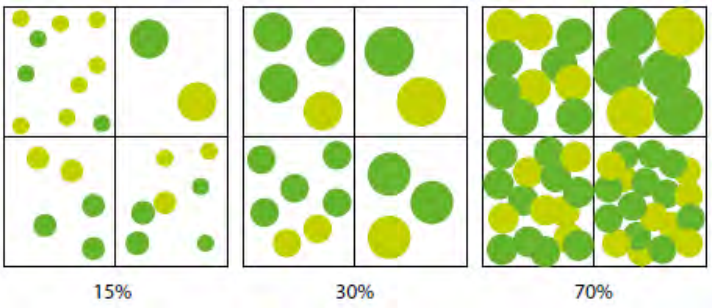
Objects: within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors.

Fine Fuel Load: combustible dead vegetation matter less than 6 mm in thickness reduced to and maintained at an average of two tonnes per hectare (example below).

Example: Fine fuel load of 2 t/ha
(Image source: Shire of Augusta Margaret River's Firebreak and Fuel Reduction Hazard Notice)

Trees (> 5 metres in height): trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy. Diagram below represents tree canopy cover at maturity.

Tree canopy cover – ranging from 15 to 70 per cent at maturity



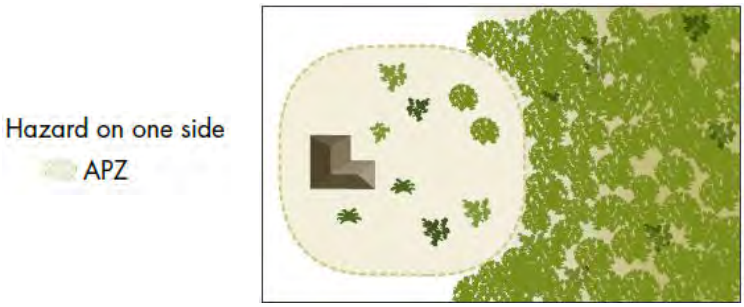
(Source: Guidelines for Planning in Bushfire Prone Areas 2017, Appendix 4)

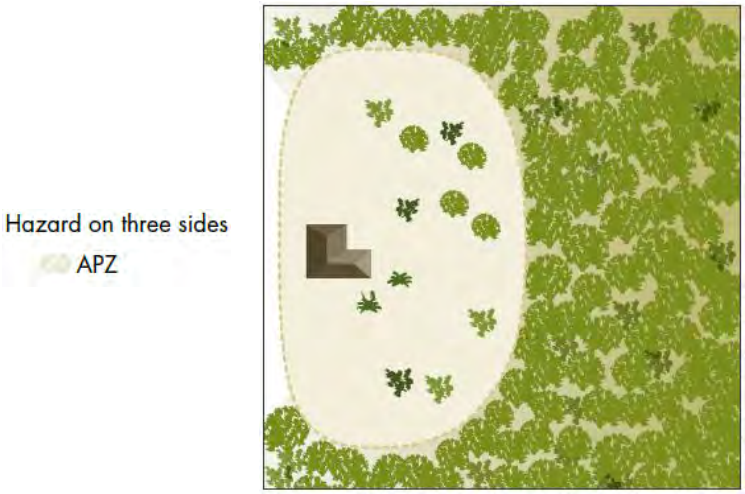
Shrubs (0.5 metres to 5 metres in height): should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m2 in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees.

Ground covers (<0.5 metres in height): can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 mm in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs.

Grass: should be managed to maintain a height of 100 mm or less.

The following example diagrams illustrate how the required dimensions of the APZ will be determined by the type and location of the vegetation.





A1.2 Requirements Established by the Local Government – the Firebreak Notice

The local government's current Firebreak Notice is available on their website, at their offices and is distributed as ratepayer's information. It must be complied with.

These requirements are established by the local government's Firebreak Notice created under s33 of the Bushfires Act 1954 and issued annually (potentially with revisions). The Firebreak Notice may include additional components directed at managing fuel loads, accessibility and general property management with respect to limiting potential bushfire impact.

If Asset Protection Zone (APZ) specifications are defined in the Firebreak Notice, these may differ from the Standards established by the Guideline's, with the intent to better satisfy local conditions. When these are more stringent than those created by the Guidelines, or less stringent and endorsed by the WAPC and DFES, they must be complied with.

The APZ dimensions to be physically established and maintained, will be based on which of the following establishes the larger APZ dimension:

- The dimensions corresponding to the determined BAL of a building (refer to Section 3.2 explanation of the 'planning' versus 'building' requirements and 'indicative' versus 'determined' BAL(s)); or
- The APZ dimensions established by the local government's Firebreak Notice.

A1.3 Requirements Recommended by DFES – Property Protection Checklists

Further guidance regarding ongoing/lasting property protection (from potential bushfire impact) is presented in the publication 'DFES – Fire Chat – Your Bushfire Protection Toolkit'. It is available from the Department of Fire and Emergency Services (DFES) website.

A1.4 Requirements Established by AS 3959:2018 – 'Minimal Fuel Condition'

This information is provided for reference purposes. This knowledge will assist the landowner to comply with Management Requirement No. 3 set out in the Guidance Panel at the start of this Appendix. It identifies what is required for an area of land to be excluded from classification as a potential bushfire threat.

"Australian Standard - AS 3959:2018 Section 2.2.3.2: Exclusions - Low threat vegetation and non-vegetated areas:

The Bushfire Attack Level shall be classified BAL-LOW where the vegetation is one or a combination of the following:

a) Vegetation of any type that is more than 100m from the site.

b) Single areas of vegetation less than 1ha in area and not within 100m of other areas of vegetation being classified vegetation.

c) Multiple area of vegetation less than 0.25ha in area and not within 20m of the site or each other or other areas of vegetation being classified vegetation.

d) Strips of vegetation less than 20m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20m of the site or each other, or other areas of vegetation being classified vegetation.

e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

f) *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, (means insufficient fuel available to significantly increase the severity of a bushfire attack – for example, recognisable as short cropped grass to a nominal height of 100mm), mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks (single row of trees)."*