Land Capability Assessment

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Wallan South and Wallan East Precinct Structure Plans
20 June 2022

Land Capability Assessment

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This Report makes no comment on the presence of hazardous materials, unless specifically requested.

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Acronyms and abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines
DELWP	Department of Environment, Land, Water and Planning
EAO	Environmental Audit Overlay
EPA	Environmental Protection Authority
ESA	Environmental Site Assessment
GDE	Groundwater Dependent Ecosystem
NEPM	National Environment Protection Measure
PSP	Precinct Structure Plan
PRSA	Preliminary Risk Screening Assessment
SMO	Salinity Management Overlay
TDS	Total Dissolved Solids
VPA	Victorian Planning Authority

1. Introduction

1.1. Background and objectives

Jacobs Group (Australia) Pty Ltd (Jacobs) was commissioned by Victorian Planning Authority (VPA) to undertake a Desktop Environmental, Hydrogeological and Geotechnical Site Assessment of the Wallan South and Wallan East Precinct Structure Plan (PSP) (request for quotation reference: D/19/4152), hereafter referred to as the "Wallan South PSP" and "Wallan East PSP" respectively.

The Wallan South PSP covers an area of approximately 806 hectares and is bounded by Old Sydney Road to the West, Hume Freeway to the east, Darraweit Road to the north and Wallan Township to the north/north-east. It is understood that the Wallan South PSP is expected to have a residential focus and supported by associated services and facilities such as town centres, schools, community centres, parks and employment land.

The Wallan East PSP covers an area of approximately 141 hectares and is bounded by Epping-Kilmore Road to the east, Wallan-Whittlesea Road to the South, the Wallan Station and railway corridor to the west and Kelby Lane to the north. It is understood that future land uses at the Wallan East PSP will be designed to support and complement the existing Wallan township through provision of residential and employment opportunities.

The aim of this assessment is to identify opportunities and constraints to the proposed land development within the Wallan South and Wallan East PSPs which may potentially be caused by existing or past land uses, and site and sub-surface conditions. The assessment comprised two stages; Stage 1 being a review of the history of land use at the site and a preliminary desktop review of information, with Stage 2 involving inspections of selected properties within the Wallan South and Wallan East PSPs identified as presenting a potential risk. Risk in this regard relates to potential contamination, hydrogeology and/or geotechnical issues. Intrusive site investigations were not conducted at this stage, although site inspections were conducted at selected properties, primarily for the purpose of assessing potential issues relating to contamination. This report includes the findings of both the Stage 1 and 2 assessments completed.

1.2. Scope of works

The following scope of work was undertaken at the site:

- **Stage 1 –** This desktop assessment stage comprised the gathering of relevant information (including the use of literature sources) for the purposes of identifying potential sources of contamination, hydrogeological, hydrological, geomorphological, and geotechnical on a regional scale; and

- **Stage 2 –** This assessment included inspecting selected properties within the two PSPs for potential sources of contamination and areas of geotechnical and hydrogeological significance (e.g., areas of water logging, existing groundwater bores, etc.) identified during the Stage 1 assessment.

The approach and findings of the assessment, together with supporting information, are documented within this report.

2. Regulatory framework

2.1. Relevant legislation and policies

2.1.1. Planning and Environment Act 1987

The *Planning and Environment Act 1987* sets out the requirements of planning authorities when preparing planning schemes or amendments to planning schemes. The Act requires planning authorities to "*take into account any significant effects which it considers the scheme or amendment might have on the environment or which it considers the environment might have on any use or development envisaged in the scheme or amendment*".

Under Section 12 (2) (a) of the *Planning and Environment Act 1987*, the *Ministerial Direction No. 1 – Potentially Contaminated Land* requires planning authorities to satisfy themselves that the environmental conditions of land proposed to be used for a sensitive use, agriculture or public open space are, or will be, suitable for that use. This is generally done through the completion of an environmental site assessment and audit process.

In addition, in accordance with s. 12(2)(b) and s. 60(1)(e) of the Planning and Environment Act 1987, planning and responsible authorities must consider: (1) "*any significant effects which it considers the scheme or amendment might have on the environment or which it considers the environment might have on any use or development envisaged in the scheme or amendment*"; and (2) "*any significant effects which the responsible authority considers the use or development may have on the environment or which the responsible authority considers the environment may have on the use or development*."

Planning authorities must satisfy themselves that the site is suitable for its proposed use. Adequate information must be provided by the applicant on the existing potential for contamination to have future adverse effects, to enable the planners to make an informed decision.

2.1.2. Ministerial Direction No. 1 – Potentially Contaminated Land

Where the land is to be rezoned, *Ministerial Direction No. 1 – Potentially Contaminated Land*, requires planning authorities when preparing planning scheme amendments, to satisfy themselves that the environmental conditions of land proposed to be used for a sensitive use, agriculture or public open space are, or will be suitable for that use.

If the land is potentially contaminated and a sensitive use is proposed, Direction No. 1 provides that a planning authority must satisfy itself that the land is suitable through an environmental audit.

Where approving a planning permit would allow potentially contaminated land to be used for a sensitive use (including a residential site or a children's service), the responsible authority must require a Certificate of Environmental Audit or a Statement of Environmental Audit, in order to satisfy itself that the land is suitable for the proposed use. The issuance by the auditor of a Certificate of Environmental Audit implies that the land is suitable for any use and that no restrictions are placed on the use of the site due to its environmental conditions. On the other hand, a Statement of Environmental Audit indicates the site is either not suitable for any use or it is suitable only for a nominated use subject to the conditions and/or limitations in its use.

2.1.3. Ministerial Direction No. 19

Ministerial Direction No. 19 came into effect on 18 October 2018. It requires planning authorities to seek early advice from EPA when undertaking strategic planning processes and preparing planning scheme amendments that may significantly impact Victoria's environment, amenity and/or human health due to pollution and waste. The explanatory report for an amendment must include a statement of how the proposed amendment addresses the views of EPA.

The Ministerial Requirement for information is issued under section 12(1)(f) of the *Planning and Environment Act 1987*. It requires planning authorities to give the Minister for Planning the following information when applying for authorisation to prepare an amendment under sections 8A or 8B of the *Planning and*

Environment Act 1987, or preparing an amendment under section 9 of the *Planning and Environment Act 1987*:

- *"the written views of EPA, including any supporting information and reports"; and*
- *"a written explanation of how the proposed amendment addresses any issues or matters raised by EPA".*

2.1.4. Planning Practice Note 30

Planning Practice Note 30 was published by Department of Environment, Land, Water and Planning (DELWP) in July 2021. The purpose of the practice note is to provide guidance for planners and applicants on:

- How to identify potentially contaminated land
- The appropriate level of assessment of contamination that should be conducted in different circumstances
- The appropriate provisions in planning scheme amendments
- Appropriate conditions on planning permits

A list of the land uses that have the potential to contaminate land (categorised as high or medium) are provided in Table 2 of PPN30. This is not an exhaustive list but does include several land uses / activities relevant to rural residential areas such as those associated with the Wallan South and Wallan East PSP areas.

The practice note also presents an assessment matrix in Table 3 that outlines recommended approaches towards assessing potentially contaminated land under different planning proposals. An extract from Table 3 is presented below.

Extract 2-1. Extract from Planning Practice Note 30 (DELWP, 2021)

Extract of Table 3 from Planning Practice Note 30

Planning Proposal		Potential for Contamination	
		High	Medium
Uses defined in *Ministerial Direction No. 1*, the EAO, and clause 13.04-1S			
• Sensitive uses: Residential use, childcare centre, kindergarten, pre-school centre, primary school, even if ancillary to another use. • Children's playground • Secondary school	New use, or buildings and works associated with a new use	A	B
	Buildings and works associated with an existing use	B	B
Other land use			
Open space Agriculture Retail or office Industry or warehouse	New use, or buildings and works associated with a new or existing use	C	D

	Planning Scheme Amendment	Planning Permit Application
A	PRSA or audit option applies Proceeding directly to an audit is recommended.	PRSA or audit option applies Proceeding directly to an audit is recommended.
B	PRSA or audit option applies PRSA to determine need for audit is recommended.	PRSA or audit option applies PRSA to determine need for audit is recommended.
C	PSI to inform need for audit is recommended	PSI to inform need for audit is recommended
D	Planning authority to document consideration of potential for contamination to impact proposal	Responsible authority to document consideration of potential for contamination to impact proposal

Note: Where land is used for more than one purpose, the most sensitive land use should be used to inform the approach to determining if an audit is required.

In some circumstances an Environmental Audit Overlay (EAO) may cover the land. The EAO indicates that a decision has been made that the land is potentially contaminated and is unlikely to be suitable for a sensitive use without further assessment and remediation. The EAO requires that an environmental audit or preliminary risk screening assessment be undertaken. All buildings and works associated with a sensitive use (irrespective of how minor) will trigger the need to undertake an environmental audit or preliminary risk screening assessment. Jacobs notes that no EAO has been identified to exist within the Wallan South and Wallan East PSP areas.

2.1.5. Environment Protection Act 2017

The Environment Protection Act 2017 (as amended by the Environment Protection Amendment Act 2018) and its subordinate legislation came into effect on 1 July 2021.

The legislation enhances the protection of Victoria's environment and human health through a more proportionate, risk-based environment protection framework that includes:

- A preventative approach through a general environmental duty.
- A tiered system of EPA permissions to support risk based and proportionate regulatory oversight.
- Significant reforms to contaminated land and waste management.
- Increased maximum penalties.
- Requirements for more environmental information to be publicly available.
- Modernising and strengthening EPA's compliance and enforcement powers

Similar to the (now repealed) Environment Protection Act 1970 that it replaces, the Environment Protection Act 2017 provides for environmental audits, which are used to provide an authoritative opinion on the suitability of potentially contaminated land for future use and forms an integral part of the land use planning and approval process. However, the Environment Protection Act 2017 also incorporates a new process – the Preliminary Risk Screening Assessment (PRSA), administered by EPA Victoria.

PRSAs do not replace Environmental Audits – they are used to establish whether there is a need for an Environmental Audit, and if so, the scope of the Environmental Audit. Importantly, the PRSA does not make a conclusion on the suitability of a site for its existing or proposed future use – this remains the outcome of an Environmental Audit. Only EPA-appointed Environmental Auditors can perform PRSAs. Environmental consultants may be involved in the PRSA process through preparing assessment reports that are considered by the Auditor in the PRSA. A PRSA is expected to follow an assessment process consistent with that of the Preliminary Site Investigation (PSI) outlined in the National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) and may include targeted / limited sampling.

The environmental audit system under the 2017 Act is also administered by EPA Victoria. An Environmental Audit of a site involves the appointment of an EPA accredited Environmental Auditor to undertake an independent assessment of the environmental condition of a site and provide an opinion regarding the site's suitability for feasible or proposed end uses. A range of information including a site history assessment and results of relevant soil and groundwater testing undertaken are evaluated by the Environmental Auditor when forming such an opinion. At the conclusion of the audit a certificate or statement of environmental audit may be issued. A certificate indicates that the use of the land is unrestricted, whereas a statement indicates that particular uses of the land or groundwater are either precluded or suitable only under specified conditions.

2.2. Guidelines and standards for assessment of contaminated land

2.2.1. National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)

The NEPM is the national guideline for assessing contaminated sites and was prepared by the National Environment Protection Council (NEPC). The NEPM document ensures there is a nationally consistent approach to the assessment of contamination. The NEPM provides guidance on the methods of site contamination assessment, environmental and health-based investigation levels for soil and groundwater contaminants, human and environmental health risk assessment and reporting requirements.

2.2.2. Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality published by Australian and New Zealand Governments and Australian State and Territory Governments, Canberra ACT (ANZG) in 2018 provide a nationally consistent framework for water quality management. The ANZG (2018) guidelines establish water quality trigger values for the protection of a range of environmental values for water resources, such as drinking water, recreation and ecological values.

The ANZG (2018) guidelines replaced the previous guidelines published in 2000 (commonly referred to as the ANZECC 2000 guidelines) and have been adopted as the most contemporary guidelines when considering the new Environment Reference Standard. However, it should be noted that in many cases the ANZG did not make substantial revision to what was in the ANZECC 2000 guidelines. This is particularly true for most toxicant guideline values and guidelines values for primary industries and aquaculture.

2.2.3. Environment Reference Standards

The Environment Reference Standard came into effect on 1st July 2021 (alongside the Environment Protection Act 2017) and sets out the environmental values of the ambient air, ambient sound, land and water environments that are sought to be achieved or maintained in Victoria and standards to support those values. Environmental values are the uses, attributes and functions of the environment that Victorians value.

Standards for the environmental values are comprised of objectives for supporting different uses of the environment and indicators that can be measured to determine whether those objectives are being met. The indicators and objectives provide a basis for assessment and reporting on environmental conditions in Victoria.

2.2.4. Australian Standard AS1726-2017: Geotechnical Site Investigations

Australian Standard AS1726 sets out minimum requirements for a geotechnical site investigation, as a component in the engineering design, construction, commissioning and operation of civil engineering and building works.

The standard specifies considerations affecting the design and construction of works which must be made in a geotechnical site investigation. Assessment of these factors enables the identification of field and laboratory work to obtain the geotechnical data required to facilitate the engineering design and construction of the works. The standard provides guidance on suitable field and laboratory examination and testing of geotechnical materials and outlines a system of material classification.

The applications of this Standard include assessment of natural or filled ground, new construction, maintenance of existing facilities, the evaluation of post construction performance and the assessment of failure.

2.2.5. Australian Standard AS4482.1-2005: Guide to the investigation and sampling of sites with potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds

Australian Standard 4482.1 provides guidance on the collection of sufficient and reliable information when assessing potentially contaminated sites. In particular this standard focuses on the assessment of sites potentially contaminated with non-volatile and semi-volatile compounds. The standard covers key elements of Preliminary Site Investigation (PSI), Detailed Site Investigation (DSI) methods, data quality objectives (DQO), developing sampling strategies, the collection of samples and quality assurance procedures.

2.2.6. Australian Standard AS4482.2-1999: Guide to the sampling and investigation potentially contaminated soil – Part 2: Volatile substances

This standard refers to AS4482.1 regarding the establishment of preliminary site information; and provides more specific guidance on field screening and sample collection techniques when assessing sites that are potentially contaminated with volatile compounds.

3. Methodology

3.1. General assessment approach

3.1.1. Stage 1 Assessment

A Stage 1 assessment (also referred to as a Phase 1 Environmental Site Assessment (ESA)) is typically undertaken to establish site conditions, historical site uses and practices. As part of this Stage 1 assessment the following sources of information have been reviewed:

- Previous reports;
- EPA Victoria information searches including:
  - Priority sites register;
  - Environmental Audit Reports Online Portal;
  - Groundwater Quality Restricted Use Zones Map;
  - EPA Licensed sites; and
  - EPA landfill register.
- Topographical maps;
- Current and historical certificates of title;
- State bore records on the DELWP Water Measurement Information System;
- Geological maps;
- Planning schemes;
- Historical aerial photographs;
- Hydrogeological maps;
- Potential acid sulfate soils (PASS) probability maps; and
- Energy Safe Victoria cathodic protection system database.

The Stage 1 assessment seeks to identify if possible:

- The potential source(s) of on and off site contamination;
- Pathways and receptors of contamination; and
- Areas of environmental concern (contamination, hydrogeological and geotechnical) which will form the basis of subsequent assessments at the site.

A qualitative risk assessment has been undertaken as part of the Stage 1 assessment using a traffic light system which uses colour-coding to classify each PSP area as low, medium or high risk from a contamination, hydrogeological and geotechnical perspective. The outcomes of the risk assessment are subsequently used to confirm the need for Stage 2 assessment for each PSP area (see below).

3.1.2. Stage 2 Assessment

For this particular investigation, the site inspection works are referred to as a Stage 2 assessment. The site inspections undertaken included an inspection of areas (where access is permitted) that have been identified during the Stage 1 assessment as presenting a low, medium or high risk from a contamination, hydrogeological and geotechnical perspective. Those properties identified during the Stage 1 assessment as presenting a very low risk were not inspected.

Based on the findings of the site inspections, the need for further works may be required for some PSP areas to assess the suitability for residential or more sensitive use.

While the completion of these further works does not form part of this scope of work, Section 3.1.3 and Section 3.1.4 below provide an overview of the typical objectives/outcomes of such works.

3.1.3. Stage 3 Assessment (not included in this scope of works)

The Stage 3 intrusive site investigation may be undertaken to characterise the site with respect to contamination, hydrogeology and geotechnical conditions. Note that this stage of site investigation is usually referred to as a Phase 2 ESA. With respect to each of the abovementioned disciplines, the following works may be undertaken as part of a Stage 3 assessment:

- **A contamination assessment** will typically assess the level (if any) of contamination present on site, establish the lateral and vertical distribution of contamination and identify the source(s) of on-site and off-site contamination. Prior to undertaking any intrusive soil and/or groundwater investigation, a Sampling and Analysis Plan (SAQP) is generally prepared. The SAQP defines the intended sampling locations and the contaminants which will be tested for, based on the site characteristics as determined in a Phase 1 ESA.
- **A geotechnical assessment** will typically seek to obtain information on the sub-surface conditions at the site through a geotechnical site investigation comprising a series of boreholes and/or test pits and laboratory testing. Field and laboratory test data is used to develop a site model describing the soil and/or rock profile and the variability across the site. A geotechnical assessment would generally include advice on site classification and allowable bearing capacity for shallow foundation design and comments regarding excavations, foundation systems, pavement design and other items relevant to the proposed development.
- **A hydrogeological assessment** will typically include determination of the groundwater elevation through the installation of groundwater observation bores. Assessment of aquifer permeability can be undertaken through slug or pumping tests to inform potential groundwater inflow rates for construction of below-ground infrastructure. Water quality samples can be collected to inform disposal options.

3.1.4. Remediation (not included in this scope of works)

If significant contamination is identified at a site, to a level where the beneficial uses of land, surface water or groundwater are at risk or precluded, remediation of the identified contamination may be required in order to allow for a particular land use to continue or commence in future.

4. Precinct description

General information relating to the Wallan South and Wallan East PSP areas is presented in Table 4-1 below. Refer to Figure 1 in Appendix A for a site location map and Figures 2A and 2B for a site layout plan.

Table 4-1. Overview of Wallan South and Wallan East

Summary of precinct description details

Item	Wallan South PSP	Wallan East PSP
Location / Address	The Wallan South PSP area comprises an irregularly shaped area of land and is bounded by Old Sydney Road to the West, Hume Freeway to the east, Darraweit Road to the north and Wallan Township to the north/north-east. There are no physical features that demarcate the southern extent of the PSP (except for field boundaries).	The Wallan East PSP area comprises an irregularly shaped area of land and is bounded by Epping-Kilmore Road to the east, Wallan-Whittlesea Road to the South, the Melbourne to Sydney rail line to the west and Kelby Lane to the north
Extent (Approximate)	Centre at 320,021mE; 5,855,253mN North-western extent at 318,761mE; 5,858,406mN South-western extent at 317,569mE; 5,854,864mN North-eastern extent at 322,027mE; 5,856,168mN South-eastern extent at 321,392mE; 5,853,747mN	Centre at 324,430mE; 5,857,239mN North-western extent at 324,067mE; 5,857,763mN South-western extent at 323,464mE; 5,856,754mN North-eastern extent at 324,759mE; 5,857,667mN South-eastern extent at 325,019mE; 5,856,574mN
Current Title Information	The Wallan South PSP area is divided into approximately 35 individual parcels of land (lots 1 – 35). Current title information for all parcels of land are depicted in Figures 2A and 2B and summarised in Appendix B.	The Wallan East PSP area is divided into approximately 22 individual parcels of land (lots 36 – 57). Current title information for all parcels of land are depicted in Figures 2A and 2B and summarised in Appendix B.
Site Area (ha)	806	141
Local Council	Mitchell Shire Council	Mitchell Shire Council
Current Land Zonings	Under the Mitchell Shire Planning Scheme, the majority of the Wallan South PSP area is zoned as Farming Zone (FZ) with the following notable exceptions: • An irregularly shaped area of land (lot 35) at the intersection of Northern Highway and Hume Freeway is zoned as Rural Conservation Zone (RCZ). This parcel is approximately 10.9 ha in size.	Under the Mitchell Shire Planning Scheme, the majority of the Wallan East PSP area is zoned as Farming Zone (FZ) with the following notable exception: • The railway corridor along the western boundary of the PSP area is zoned as Public Use Zone Transport (PUZ4).
Zoning of Surrounding Land	Under the Mitchell Shire Planning Scheme, the Wallan South PSP area is bounded variously by the following zones: • Road Zone 1 (RDZ1) • Road Zone 1 (RDZ2) • Low Density Residential Zone (LDRZ) • General Residential Zone 1 (GRZ1) • Public Park and Recreation Zone (PPRZ) • Rural Conservation Zone (RCZ) • Farming Zone (FZ)	Under the Mitchell Shire Planning Scheme, the Wallan East PSP area is bounded variously by the following zones: • Road Zone 1 (RDZ1) • Farming Zone (FZ) • Township Zone (TZ)
Environmental Audit Overlay	There are no sites with an environmental audit overlay within the Wallan South PSP area or within 200 m of the PSP.	There are no sites with an environmental audit overlay within the Wallan East PSP area or within 200 m of the PSP.
Site Layout	The Wallan South PSP is moderately undulating with an unnamed creek traversing the western portion in a north-west/south-east alignment which drains to Merri Creek to the east of the PSP. Duke Street Drain enters the northern boundary of	The Wallan East PSP is slightly sloped towards the south with Merri Creek traversing the western portion in a north/south alignment. The Wallan Station and rail corridor are located to the immediate west of the site. Apart from Hart Court and private tracks that provide access to

Item	Wallan South PSP	Wallan East PSP
	the PSP (Taylors Lane) in a north/south alignment and drains to the above unnamed creek. The high points of the PSP are generally towards the west/south-west while the low points are towards the east/north-east. To the south-east of the Wallan South PSP is the Hume Freeway which is joined by the Northern Highway crossing the eastern portion of the PSP. There are no other public roads crossing the PSP, however some private tracks are noted to be present to provide access to existing residential properties and farms.	existing residential properties and farms, there are no other public roads within the PSP area.
Current Land Uses	The site is primarily used for agricultural purposes with large areas of open farmland and associated infrastructure (farm buildings, water bores, farm dams etc.). However, there are also some rural residential properties. A battery egg farm is located in the north-western portion of the PSP.	The Wallan East PSP is primarily used for agricultural purposes with large areas of open farmland and associated infrastructure (farm buildings, water bores, farm dams etc.). However, there are also some rural residential properties. The Wallan East train station and rail corridor are located along the western boundary of the Wallan East PSP.
Proposed Land Uses	The proposed future use of the Wallan South PSP is as future land supply for various land uses including sensitive uses such as residential, schools, community centres, parks and employment land. At present, no specific land uses have been allocated to individual parcels of land.	The proposed future use of the Wallan East PSP is as future land supply for various land uses to support and complement the existing Wallan township through provision of residential and employment opportunities. At present, no specific land uses have been allocated to individual parcels of land.
Surrounding Land Uses	Wallan Township is located to the north and north-east of the Wallan South PSP. To the west and south of the PSP, as well as to the east beyond the Hume Freeway is predominantly agricultural land. A large retention basin owned by Yarra Valley Water is also located to the south of the PSP and used to irrigate some of the surrounding farmland.	To the north, east and south of the Wallan East PSP, as well as to the west beyond the railway corridor is predominantly agricultural land. The Wallan train station is located to the immediate west of the PSP. Beyond the train station is predominantly residential and commercial/industrial.

5. Environmental setting

Information on the general environmental setting of the Wallan South and Wallan East PSP areas is outlined in the following sections.

5.1. Regional geology

The Geological Survey of Victoria 1:250,000 Seamless Geology map (GSV, 2014) and 1:50 000 Kilmore geological map sheet (GSV, 1991) were reviewed to determine the geological conditions at the Wallan south and east areas.

The main geological unit to be encountered during future development of the Wallan South is likely to be alluvium and localised scoria of the Newer Volcanic Group (Neo and Neo2). However, towards the west the main geological units are likely to be Humevale Formation (Dxh) comprising siltstone with minor sandstone.

The main geological units identified in the study area are outlined below and their locations shown on Figure 5-1.

Alluvial trace deposits (Qa2)

Flood plain deposits are a transported material, and therefore may be variable in nature. General knowledge of the area indicates that the flood plain deposits are typically soft to stiff silty clay soils of medium to high plasticity. Due to the alluvial nature of the soils sand layers may also be encountered in this unit. These materials are Quaternary in age and typically the youngest soil deposit in the study area.

Newer Volcanic Group (Neo and Neo2)

The basalt expected to be encountered in this study area is typically a high strength volcanic rock derived from lava that has cooled as it flows over land. Quaternary aged Newer Volcanics basalt is often comprised multiple flows from multiple eruption events and therefore weathered zones appear in the rock profile between flows of high strength slightly weathered and fresh basalt.

Cooling of the lava results in sub-horizontal and sub-vertical joints in the basalt. Weathering within the basalt mass typically occurs spheroidally, influenced by the location of joints and passage of water through the joints. The deposition and weathering patterns result in a highly variable rock mass. Abrupt changes in fracturing, weathering, and strength are not uncommon within the rock mass.

Neo2 typically comprises basalt, basanite, youngest flows with little weathering or soil development. Weathering soil comprises high plasticity residual clay overlying weathered basalt rock.

Residual soil is derived from the complete weathering of the parent rock (basalt within the study area). The residual soil is typically stiff to very stiff high plasticity clay or clayey gravel.

Residual soil derived from Newer Volcanics basalt is typically sensitive volume changes associated with moisture change and can exhibit high shrink well properties and may be prone to fissuring.

Humevale Siltstone (Dxh)

The Humevale Formation generally comprises siltstone with interbedded sandstone (very fine to fine grained) where the siltstone predominates. Rare channel sandstone and slump deposits. Usually strongly bioturbated. The weathered siltstone and sandstone is typically overlain by residual clays.

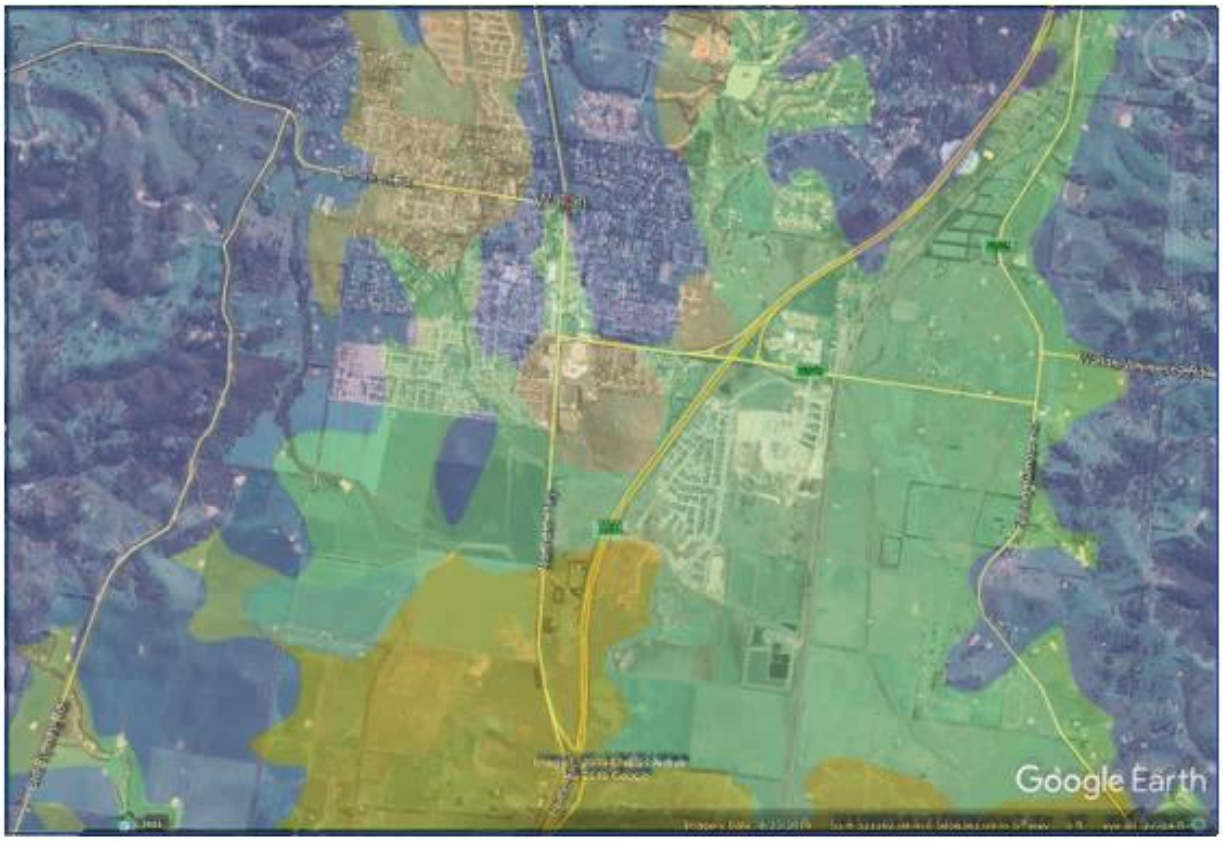


Figure 5-1. Regional Geology

Geology Geology Map extracted from 1:250000 Victoria - Seamless Geology , GSV, 2014 , Not to scale (Dxh = Humevale Siltstone, Neo = Newer Volcanic Group, Neo2 = Newer Volcanic Group - stony rises basalt, Qa2 = Alluvial terrace deposits)

The site inspection confirmed the above in part, with rock outcropping (siltstone) observed across the study area as well as alluvial deposits along creek. These are illustrated in the images Figure 5-2 and Figure 5-3.

Figure 5-2. Siltstone and residual soil along the Darraweit road

Figure 5-3. Alluvium deposit and basalt outcrops along the drainage channel in Wallan South

5.2. Soils and acid sulfate soils map review

A review of the Australian Soil Resources Information System (ASRIS) online map in November 2019 provided the details of soil classification and acid sulfate soil potential, the details of which are summarised in Table 5-1. Both sites have a low probability of acid sulfate soil potential.

Table 5-1. Soil Classification for both sites (ASRIS, 2019)

Soil classification	Wallan South PSP	Wallan East PSP
Clay	0 – 40%	20 – 40%
Silt	0 – 20%	0 – 20%
Sand	20 – 60%	20 – 40%
Probability of acid sulfate soil occurrence	Low	Extremely low

5.3. Regional hydrology

The Wallan South site (Figure 5-4) is dominated by Strathaird Creek, which flows south through the area, in a relatively well-defined channel which discharges to two engineered channels. The confluence of Strathaird Creek and Taylors Creek is immediately upstream of the Northern Highway. The confluence of these waterways is covered by a 1% AEP (1 in 100 year ARI) flood extent covering 57 hectares (DELWP, 2019b), while Taylors Creek itself is under a Floodway Overlay (FO). The Floodway Overlays indicate areas that present higher flood risks as they carry active flood flows i.e. waterways and open drainage systems (Melbourne Water, 2017b).

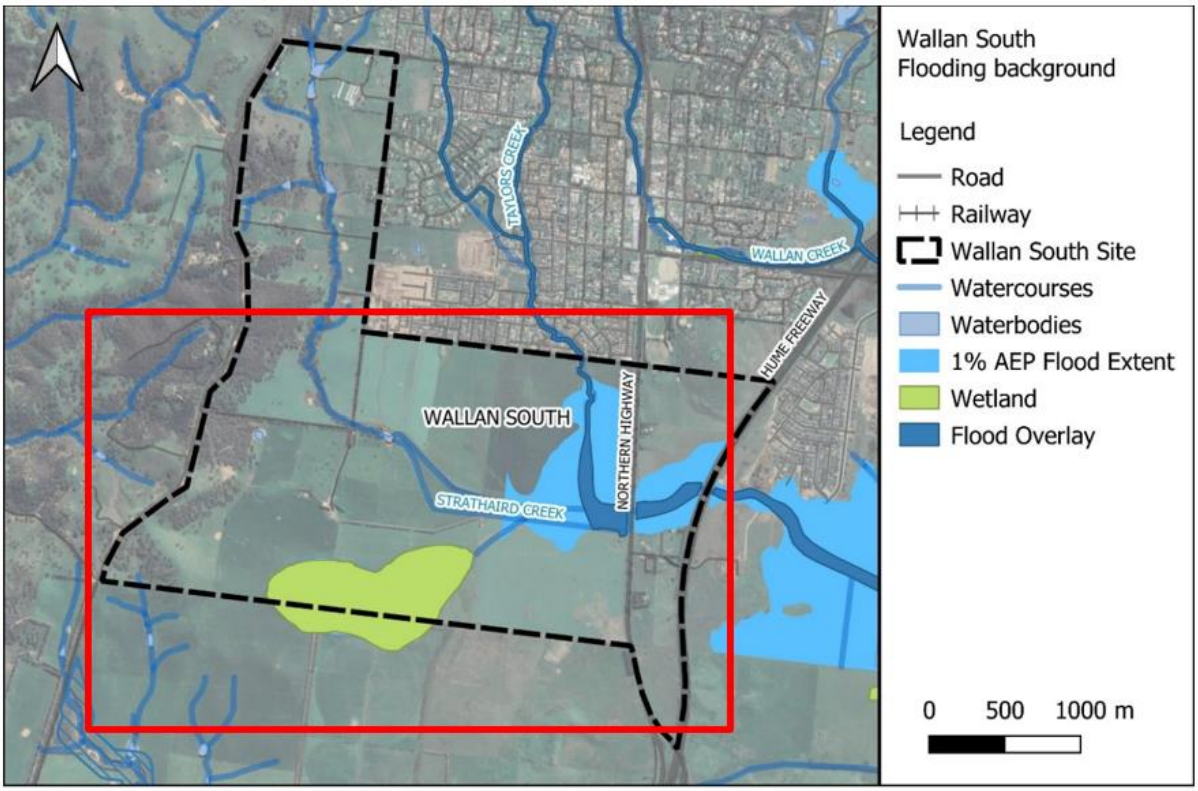


Figure 5-4. Flooding Information for the Propposed Wallan South Precinct (DELWP, 2019a)

The Northern Highway and Hume Freeway (on the eastern border of the site) act as hydraulic controls on Taylors Creek flowing eastward downstream towards Merri Creek. The extent of inundation widens to approximately 500m between the two roads and covers 20 hectares in the 1% AEP flood.

Melbourne Water's Drainage Scheme for Taylors Creek (Melbourne Water, 2017b) has earmarked a retarding basin of approximately 20 hectares at the junction of Northern Highway and Taylors Creek (Figure 5-5). A stormwater management strategy report for the development of Wallan South was prepared by Afflux Consulting in 2018 for Miller Merrigan Land Development Consultants that suggested this area could be reduced (Afflux Consulting, 2018). Melbourne Water has advised that it is currently undergoing a review of the hydrological and hydraulic modelling for Wallan South, so a revised drainage scheme is possible for

Taylors Creek, including potential changes to the retarding basin. Therefore, it is advised to wait upon the outcome of this review to determine whether the size of the retarding basin can be reduced.

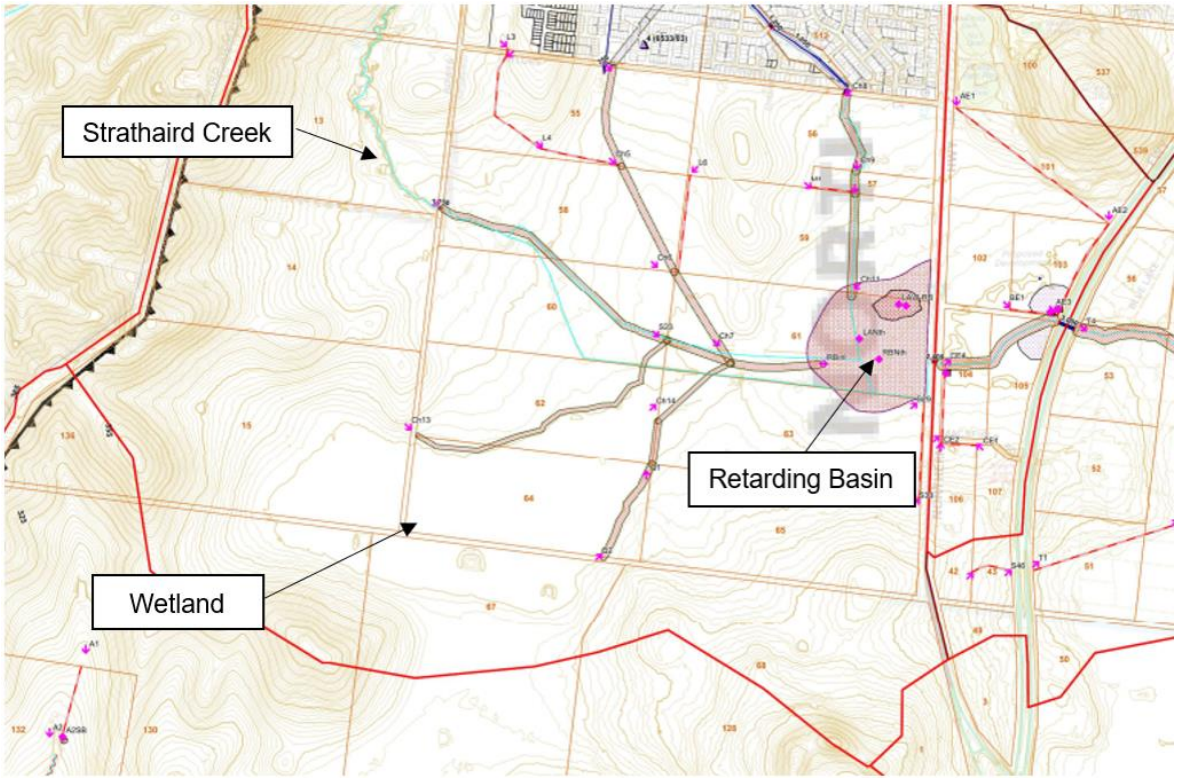


Figure 5-5. Flooding Information – Taylors Creek Drainage Scheme

Map illustrating the southern section of the Taylors Creek Drainage Scheme covering the Wallan South Precinct (Melbourne Water, 2017a)

There is a wetland to the south of the site of approximately 60 hectares (43 hectares within the precinct boundary) that drains northward to Strathaird Creek. It is classified in the Victorian Wetland Inventory dataset as a naturally occurring temporary freshwater marsh known to periodically inundate (DELWP, 2019c). The Corrick Classification System number for the wetland is 2: signifying a wetland with soils that may be waterlogged throughout the year, including inundation up to 0.5m deep for up to eight months (DELWP, 2016). The existing drains in this lower-central region of the site are flat and shallow, suggesting that there may be challenges in draining the area for proposed developments.

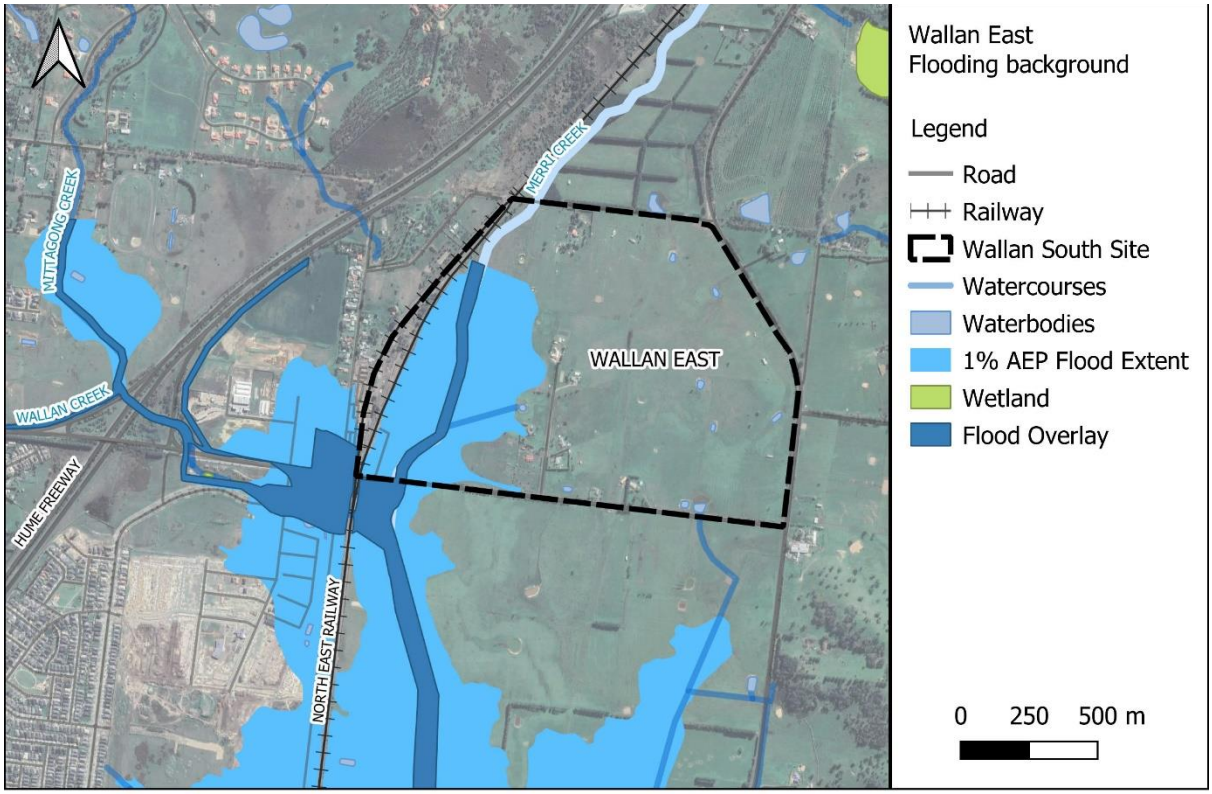


Figure 5-6. Flooding Information – Wallan East Precinct (DELWP, 2019a)

Merri Creek flows from north to south down through the western side of the Wallan East precinct area and is covered by the Floodway Overlay through most of the precinct before absorbing Mittagong Creek just south of the site beyond Wallan-Whittlesea Road (Figure 5-6). Merri Creek is covered by the 1% AEP flood extent over an area of 33 hectares within the precinct boundary, backing up against the railway embankment to the west. The flooding here appears to be driven by the confluence of the two creeks downstream, while it is probable that Wallan Creek influences water levels at the junction from the west.

There is no current Drainage Scheme covering the Wallan East precinct. Melbourne Water has advised that flood mapping is still to be conducted in the region for different development scenarios before a drainage scheme can be designed to properly inform the development potential of Wallan East.

5.4. Regional geomorphology

The morphology of the waterways depicted in Figure 5-4 and Figure 5-6 can be broadly described as headwater streams (Jacobs 2016), which prior to agricultural development are likely to have lacked a clearly defined channel (bed and banks), and may have been a series of depressions or chain of ponds where water was attenuated in the landscape following rainfall events. The exception to this is the upper part of Strathaird Creek, which appears to have a more clearly defined channel. With agricultural development, these headwater streams have largely been drained and replaced with engineered channels. There are also a number of farm dams located on these waterways.

No sites of geological or geomorphological significance are located in the precinct areas (Victorian Resources Online 2019). A desktop review indicated that the waterways do not appear to have any significant geomorphological values.

The two precinct areas appear to be located on soils that have formed from weathering of local New Volcanic Basalt rock. These geologies and associated soil types occur extensively in the north-west of Melbourne (Geological Survey of Victoria 1997).

Limited soil mapping exists at an appropriate scale for this area that can be relied upon, but it is considered most likely that the soils are Sodosols. These soils have a strong texture contrast, with sand to clay loamy

surface horizons and dense and coarsely structured subsoil horizons that are sodic. Sodosols are susceptible to problems of waterlogging and erosion as a result of the physical structure and chemical composition. Soil sodicity potentially leads to dispersion, degrading soil structure, which is more frequently a problem with subsoil horizons, that are often relatively impermeable and become prone to gullying and tunnel erosion. This erosion risk is increased in circumstances where the surface soil has been removed and the subsoils are then exposed (Jacobs 2019b).

There is increasing awareness, that urban development in areas that have these geologies and soil types in the Melbourne Region is an issue both through the construction phase and ongoing management of waterways. During the construction phase of development, vegetation is cleared and surface soils may be removed, exposing subsoils to rainfall. Erosion risks are potentially heightened along incised drains and connecting streams, as the amount of runoff to these waterways is increased as a result of increased stormwater runoff from impervious areas (roads, roofs). There is also more pressure on existing streams to drain water from their catchment areas (Jacobs 2016, 2019a, 2019b).

Figure 2-7 shows some selected photographs of erosion and damage to drains in the Merrifield development area following rainfall events, which is located approximately 20 km south of Wallan. These are shown here as examples of poor sodic soil management. Construction and drainage works have been undertaken without an adequate appreciation of the erodibility of the underlying sodic soils. The occurrence of this erosion and concerns expressed by Melbourne Water have led to further investigations into the stability of soils in this area and how they should be treated (Van de Graaf 2018). It has also prompted reconsideration of what scale of construction and waterway engineering works is necessary to mitigate erosion risks and what is considered an acceptable standard for the waterway design, given the erosion risks (Brizga & Seymour 2018, Jacobs 2019a).

Figure 5-7. Selected photographs of erosion and damage to drains at Merrifield following rainfall events (Brizga & Seymour 2018).

Figure 5-5 provides an overview of Melbourne Water's Drainage Scheme for Wallan South, showing a series of drainage channels and a retarding basin at the junction of Northern Highway and Taylors Creek. As previously discussed, it is understood that Melbourne Water are currently reviewing the hydrological and

hydraulic modelling, so revisions to this scheme are possible. Given the likely soil conditions expected in the area, erosion is considered a high risk along the proposed drains. No drainage scheme currently exists for the Wallan East precinct. Similar to Wallan South, erosion is also considered to be a high risk in Wallan East.

5.5. Regional hydrogeology

The Wallan South PSP area is characterised by three aquifer units:

- The Silurian Humevale Siltstone is the basement unit which forms a minor aquifer at the site. The aquifer is a fractured rock aquifer, with groundwater occurring within the joints and fractures of the rock mass. Groundwater yields from fractured rock aquifers are variable and largely a function of the degree of fracturing and extent of interconnection of fracture systems. The unit is saturated at depth, and hence the depth to watertable is large (20 – 50mBNS) where the unit outcrops. Typical salinity values are in the range of 3500 – 13,000 mg/L of TDS (DWELP, 2019). One well within the area (98234) is reported as screened within the unit (86 – 92 mBGL) with a recorded yield of 0.9 L/s;
- The Newer Volcanics aquifer is also a fractured rock aquifer and forms the major regional aquifer. Regionally, the Newer Volcanics produce can produce yields up to 6 L/s, with salinity ranging from 1500 – 5000 mg/L TDS. Locally, however, use of water from this aquifer is restricted to stock supplies with bores typically drawing less than 1 L/s. This unit is the primary watertable aquifer of the area, particularly where there is an absence of overlying alluvium. Thickness varies from 1 – 75m; and
- The Quaternary Alluvium forms a minor aquifer of variable thickness at the site. There is some discrepancy in available data regarding this unit: drilling logs from local wells indicate a weathered basaltic clay at the surface, rather than alluvial clay or sand, while geological mapping indicates widespread presence of an alluvial unit. If present, this aquifer is comprised of a porous medium aquifer, in which groundwater flows through the gaps and pore spaces between the sand particles making up the aquifer. This unit is likely to host the watertable if present at a thickness greater than 5m, which is likely along areas of surficial flow (e.g. the small area of Quaternary swamp and lake deposits in the southern areas of the site is also likely to host the watertable and is expected to be in direct hydraulic interaction with alluvial deposits). If the Alluvium is absent, the surficial unit across the site is expected to be either Newer Volcanics or Humevale Siltstone.

The Wallan East PSP area is characterised by three units:

- The Silurian Humevale Siltstone, as noted above, is a fractured rock aquifer pf low yield, present at depth and forming the basement unit. Three wells within the area (98215, 98216 and 141733) are reported as screened within this unit (at various intervals between 30 – 57 mBGL) with recorded yields of 0.5 – 0.8 L/s;
- The Newer Volcanics basalt aquifer, as noted above, has variable yield and is semi-confined by the overlying alluvial unit in this area (if present). Three wells within the area (98223, 98226 and 98229) are reported as screened within this unit (at various intervals between 16 – 36 mBGL) with recorded yields of 0.1 – 2.0 L/s. Thickness varies from 1 – 25m; and
- The Quaternary Alluvium, which (if present) forms the surficial, unconfined, watertable aquifer across the site. Local drilling logs do not indicate presence of this layer, while geological mapping indicates widespread presence of an alluvial unit. This unit is most likely to be present along Merri Creek and may form the watertable locally. If absent, the Newer Volcanics is expected to be the watertable unit.

Across both sites, depth to watertable is variable. State-wide depth to watertable mapping indicates groundwater within 5m of ground surface where the Quaternary Alluvium is the surficial unit. Areas where the Newer Volcanics and basement unit are at surface show a varied depth to water of 5 - 50 m below natural surface. Groundwater level data from local wells was not available.

The primary regional recharge mechanism is surface infiltration of rainfall. Regional groundwater flow is from north to south toward Port Phillip Bay (SKM, 2014).

A review of the Atlas of Groundwater Dependent Ecosystems (GDEs) (BoM, 2012) was undertaken to determine any GDEs within the PSP areas. The Atlas identifies that within the Wallan East PSP area:

- A ‘temporary freshwater wetland’ in the southern area of the PSP is rated as having low potential for groundwater interaction.

Within the Wallan East PSP area:

- Vegetation on the banks of the Merri Creek is listed as having a high potential for groundwater interaction; and
- The Merri Creek is noted as having a moderate potential for groundwater interaction.

5.6. Local groundwater quality

State-wide beneficial use[1] mapping (accessed from VVG November 2019) indicates that expected groundwater quality for the water table within the Wallan South PSP area is classified into Segment B2 (1,201 – 3,100 mg/L TDS) and within Wallan East PSP area groundwater is classified as Segment B and Segment C3 (3,201 – 5,400 mg/L TDS). This classification is based on mapping (DELWP, 2014) and data collected from local wells, a summary of which is provided in Table 5-1.

Table 5-1. Soil Summary of available water quality data across both PSPs (DELWP, accessed November 2019)

Parameter	Quaternary Alluvium	Newer Volcanics	Bedrock aquifer	Unknown [4]
	(mg/L unless otherwise specified)			
TDS	-	-	1,820 – 4,030	83 – 3,607
pH	-	-	-	-
Chloride (Cl)	-	-	680 – 1,846	430
Carbonate (CO3)	-	-	16	-
Bicarbonate (HCO3)	-	-	366 – 463	32 - 560
Total Alkalinity	-	-	300	460
Sulfate (SO4)	-	-	49 – 135	4 - 112
Nitrate (N)	-	-	0.226 – 0.451	0.226
Calcium (Ca)	-	-	26 – 146	5 – 1,660
Magnesium (Mg)	-	-	110 – 282	5 - 240
Sodium (Na)	-	-	360 - 768	14 - 705
Potassium (K)	-	-	12 – 14	2 - 24
Iron (Fe)	-	-	1 – 2.2	4.3 - 21

5.7. Local Groundwater use

Groundwater wells across both sites are primarily intended for stock and domestic use, which is consistent with expectations of the aquifer units present (typically low yield and salinity most suitable for stock watering). A summary of groundwater users is provided in Table 5-2. Additional information is provided in Appendix C.

[1] Beneficial use refers to a use of the environment, or any segment of the environment, which is conductive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges, emissions or deposits. Beneficial use may be existing or potential. For groundwater, beneficial use primarily refers to the groundwater quality and the aquifer yield.

[2] Segment B indicates use may be suitable for water dependent ecosystems and species, portable mineral water, irrigation, stock water, industry, water based recreation, traditional owner cultural values, cultural and spiritual values, buildings and structures, geothermal properties.

[3] Segment C indicates use may be suitable for water dependent ecosystems and species, portable mineral water, stock water, industry, water based recreation, traditional owner cultural values, cultural and spiritual values, buildings and structures, geothermal properties.

[4] Unknown denoted that drilling (logs) or construction information was unavailable for the well.

The Wallan East and Wallan South PSPs are not currently included within any Groundwater Management Area (GMA).

Table 5-2. Summary of Known Groundwater Users

Table summarising the known groundwater uses across the Wallan South and Wallan East PSP areas. Data obtained from DEWLP.

Unit	Number of bores	Uses	Bore depth range (m)	Bore yield (L/s)	Groundwater salinity (TDS mg/L)
Newer Volcanics	4	Stock and domestic	22 - 36	0.1 - 2	n/a
Bedrock	4	Stock and domestic	42 - 92	0.5 – 0.9	1,820 – 4,030
Unknown	11	Stock and domestic	10 - 117	0.3 - 2	1,560 - 3607
Unknown	1	Non-groundwater	37	n/a	83 (expected to be anomalous)

6. Information review

This section summarises the various sources of information, records and reports reviewed as part of the Stage 1 desktop assessment.

6.1. Certificate of Title information

Certificates of title were reviewed to ascertain information on the current and historical land uses within the Wallan South and Wallan PSP areas. A summary of the title information and certificates of title are provided in Appendix B. A review of the titles revealed the following information:

- The majority of historical title documents suggest that the Wallan South and Wallan East PSP areas were used for agricultural purposes and rural residential use, as anticipated;
- Lots 1 and 5 within Wallan South PSP were likely used for poultry farming and Lots 2 – 4 were formerly occupied by a battery egg farm;
- A large proportion of the Wallan East PSP area (Lots 36 – 42, 7 parcels) along the eastern side of the existing railway corridor is owned by VicTrack and occupied by a rail siding; and
- Current title documents suggest the remainder of the Wallan South and Wallan East PSP areas is predominantly used for agricultural purposes or rural residences.

6.2. Historical aerial imagery

Aerial photographs from 1946 to 2018 were reviewed for land use changes. Observations are summarised in table below. Copies of aerial photographs are provided in Appendix B.

Table 6-1. Summary of Review of Historical Aerial Imagery

Table presenting a summary of observations based on the review of available current and historical aerial imagery across the PSP area.

Year	Description	Source
1946	On-site: While some farm properties can be seen within the Wallan South and Wallan East PSP areas, the vast majority of the PSP areas appears to be agricultural land. There is no evidence of Hume Freeway or Northern Highway. The railway corridor and Wallan East station are visible to the west of the Wallan East PSP, with a rail siding noted to have been established within Lots 36 – 42 potentially used for laydown of railway materials. Strathaird Creek can be seen flowing south through the Wallan South PSP area before joining Taylors Creek (Duke Street Drain) just upstream of what is now the Northern Highway. The wetland area defined in the Victorian Wetlands Inventory (DELWP, 2019c) is visible along the southern edge of the Wallan South PSP area. Merri Creek can be seen flowing south along the western side of the Wallan East PSP site. Off-site: The surrounding land uses appear to predominantly consist of agricultural lands and rural residences. The Wallan township is visible to the north/north-east of the Wallan South PSP. Some rural residences have been established to the immediate west of the Wallan East station.	Vicmap
1968	On-site: The Old Hume Freeway (now Northern Highway) has been established and traverses in a north-south alignment through the eastern portion of the Wallan South PSP. The egg farm (Lot 3) is visible in the north-western portion of the Wallan South PSP. Strathaird Creek now splits into a second engineered channel running west-to-east across the Wallan South PSP area up to the Northern Highway. Little has changed within the remainder of the PSP areas which continue to be used as agricultural land. Off-site: The area to the west of the Wallan East station has undergone further development (likely rural residences and commercial). Few changes are notable elsewhere around the site perimeter.	Vicmap
1977	On-site: The Hume Freeway has been established and traverses in a northeast-southwest alignment along the eastern boundary of the Wallan South PSP. The egg farm (Lot 3) has undergone further expansion with additional buildings being constructed within the adjacent	Vicmap

Year	Description	Source
	Lots 2 and 4. Buildings and structures have been established within Lots 1 and 5 which are likely used for poultry farming. The major land use is still predominantly agricultural land. Additional farm storages have been constructed just south of the Wallan South PSP within the wetland area, and an engineered channel to facilitate drainage out to Strathaird Creek. Off-site: Little has changed at the surrounding lands which continue to be used as agricultural land and rural residences.	
1989	On-site: Several farm homesteads and rural residences have been established within the PSP areas. The major land use is still predominantly agricultural land. Off-site: Wallan Township has undergone significant development to the north/north-east of the Wallan South PSP. Limited development (likely farm homesteads) is noted to the east of Hume Freeway. Few changes are notable elsewhere around the site perimeter.	Vicmap
1993	On-site: No significant changes have occurred on-site. Off-site: No significant changes have occurred off-site.	Vicmap
2004	On-site: Little appears to have changed between 1993 and 2004, with the exception of the appearance of additional farm homesteads and rural residences within the PSP areas. Off-site: There is evidence in increased development in the Wallan Township. The Wallan Sewage Treatment Plan is visible to the east of Hume Freeway.	Vicmap
2010	On-site: No significant changes have occurred on-site. Off-site: Construction of residential development to the east of Hume Freeway and commercial/industrial development to the west of the Wallan East station is underway.	Vicmap
2015	On-site: No significant changes have occurred on-site. Off-site: Further residential development is underway to the east of Hume Freeway. Two circular irrigation systems associated with the Yarra Valley Water's reclaimed water re-use scheme are visible to the south of the Wallan South PSP.	Vicmap
2018	On-site: No significant changes have occurred on-site. Off-site: No significant changes have occurred off-site.	Vicmap

Review of the historical aerial photographs identifies the majority of the land forming the Wallan South and East PSP areas has been used for agricultural purposes for an extended period of time. Several potential sources of contamination have been identified within the PSP areas which include the poultry/egg farms (Lots 1 – 5), rail siding (Lots 36 – 42) and farm homesteads (at various lots).

Potential off-site sources of contamination include the railway corridor, the Wallan Sewage Treatment System and Yarra Valley Water's reclaimed water re-use scheme, located in the vicinity of the PSP areas.

6.3. EPA Victoria Records

6.3.1. EPA Priority sites register

A search of the EPA's Priority Sites Register (PSR), which lists those sites for which EPA has requirements for active management of land and groundwater contamination, was conducted by Jacobs on 31st October 2019. Sites within the Wallan South and Wallan East PSPs were not listed on the Register. However, one priority site was located within 5 km radius and the details are summarised in the table below.

Table 6-2. Summary of EPA Victoria Priority Sites (5 km radius)

Table presenting a summary of EPA Victoria Priority Sites located within 1km of the Wallan South and Wallan East PSP boundary.

EPA Priority Site	Notice Number	Description	Distance
LOT Z PS 818938 Newbridge Subdivision	90009466	Industrial waste has been dumped at the site. Requires assessment and/or clean up	850 m east of the Wallan South PSP 910 m south-west of the Wallan East PSP

However, the potential for the above priority site to impact upon the Wallan South and Wallan East PSPs is considered to be low given the considerable distance to the site. A copy of the reviewed PSR (dated 31st October 2019) is provided in Appendix B.

6.3.2. EPA Licenced Sites

A search of the EPA's Victoria Unearthed website https://www.environment.vic.gov.au/sustainability/victoria-unearthed) was conducted by Jacobs on 28 October 2019 which did not identify any licensed sites within the Wallan South and Wallan East PSPs. However, one licensed site was identified to be located within 5 km radius and the details are summarised in the table below.

Table 6-3. Summary of Surrounding Licensed Sites (5 km radius)

EPA Licensed Site	License Holder	Licence Number	Description	Distance
Wallan Sewage Treatment Plant, 200 South Station Street, Wallan (Premise Ref. no.: 71425)	Yarra Valley Water (YVW)	74181	The EPA discharge licence allows Yarra Valley Water to discharge treated wastewater into local waterways and reuse treated wastewater by irrigation to land. The licence covers seven treatment systems which includes the Wallan Sewage Treatment Plant located at 200 South Station Street, Wallan (Premise Ref. No.: 71425). A copy of the EPA licence is provided in Appendix B.	1.3 km east of the Wallan South PSP 1.5 km south of the Wallan East PSP

A search of the Victorian EPA audit reports online portal (https://www.epa.vic.gov.au/our-work/environmental-auditing/environmental-audit-reports-online) identified an environmental audit pursuant to Section 53V of the *Environment Protection Act 1970* was recently completed in May 2019 on the recycled water scheme at the Wallan Sewage Treatment Plant. The above audit report has been reviewed by Jacobs to assess the potential for the Wallan Sewage Treatment Plant to realise any significant health and ecological risk to the subject site. The key findings of the audit are summarised in Section 6.3.3.

6.3.3. Environmental audit sites

A Section 53V environmental audit[5] was recently completed on the recycled water scheme at the Wallan Sewage Treatment Plant. The objective of the audit was to assess the compliance of the requirements of the Health and Environment Management Plan (HEMP) and Recycled Water Scheme Recycled Water Quality

[5] Telford Environmental Consulting Services (2019). Environmental Audit of Use of Reclaimed Water, Wallan Recycled Water Scheme, Yarra Valley Water, CARMs no.: 77745-1, SON: 8006119, dated 28 May 2019.

Management Plan (RWQMP) relating to management of the recycled water scheme operated by Yarra Valley Water.

Whilst Jacobs notes that the audit concluded that "*water treatment, soil and groundwater, and water usage requirements of the publication have all been met through implementation of the HEMP*", limited information is available in the audit report relating to the scope and results of the monitoring program for our verification.

With the exception of the reclaimed water re-use scheme operated by Yarra Valley Water at Lots 8 and 9, Camerons Lane, Beveridge (refer to Section 6.7), Jacobs is not aware of any other re-use scheme in the vicinity of the project area that potentially receives the recycled water from the Wallan Sewage Treatment Plant.

6.4. Groundwater quality restricted use zones (GQRUZ)

Jacobs reviewed the Victorian EPA GQRUZ map on the 28 October 2019 and identified no GQRUZ sites exist within 5 km radius of the boundary of the Wallan South and Wallan East PSPs.

6.5. Cathodic Protection Records

On 18 November 2019, a Cathodic Protection Database Search request was made to Energy Safe Victoria for the properties within the Wallan South and Wallan East PSPs. The search did not identify current or former registered cathodic protection systems within the Wallan South and Wallan East PSP areas. A copy of the Energy Safe Victoria's database search is provided in Appendix B.

6.6. Landfills

Jacobs conducted an independent review of Appendix I of EPA Victoria Publication 1270 (2009) *Assessment of Potential for Methane Gas Movement from Victorian Landfills* and did not identify the presence of operating and former landfills within 5 km radius of the boundary of the Wallan South and Wallan East PSPs.

Jacobs also conducted a search on the Victorian Landfill Register (https://nationalmap.gov.au) No landfills were identified within 5 km radius of the boundary of the Wallan South and Wallan East PSPs.

6.7. Other reviewed reports

Jacobs was provided with the following report relating to the environmental site assessment works conducted at Lots 2, 3 and 4 within the Wallan South PSP:

- LRM Global Pty Ltd (LRM 2018). Environmental Site Assessment, 30 Rowes Lane, Wallan. Prepared for: Darraweit Property Trust Pty Ltd. October 2018.

The Yarra Valley Water operates a reclaimed water re-use scheme located at Lots 8 and 9, Camerons Lane, Beveridge. The scheme includes two adjacent fields, a storage reservoir and two circular irrigation systems that receive and use recycled water from the nearby Wallan Sewage Treatment System for irrigation purposes. Given its proximity to the Wallan South PSP, the potential exists for the scheme to impact upon groundwater quality that may result in restriction of future beneficial uses of groundwater at the Wallan South PSP. Three reports relating to assessment works previously conducted for the scheme were also reviewed. These reports are entitled:

- Yarra Valley Water, (YVW, 2008). Wallan Reclaimed Water Re-Use Scheme: Camerons Lane Lots 8 & 9 – Preliminary Assessment of Groundwater Monitoring Results. May 2008;
- Arris Pty Ltd (Arris, 2008). Lots 8 & 9 Camerons Lane Reuse Scheme – Assessment of Soil Monitoring Data for 2006 to 2007. May 2008; and
- Jacobs (2014). Beveridge North West PSP – Groundwater Quality Assessment. June 2014.

Key findings of the above reports are presented in the following sections and the reports are provided in Appendix B.

6.7.1. LRM Global Pty Ltd (LRM 2018). Environmental Site Assessment, 30 Rowes Lane, Wallan. Prepared for: Darraweit Property Trust Pty Ltd. October 2018

In September 2018, LRM Global (LRM) was commissioned by Darraweit Property Trust to undertake an environmental site assessment (ESA) of the former battery egg farm located at 30 Rowes Lane, Wallan for the purposes of pre-sale due diligence assessment.

The ESA included 41 (grid based) sample locations across the site and 8 targeted investigation locations within the footprint of former and current structures (two aboveground fuel tanks and electrical substation). Surficial soil samples were collected at shallow depths ranging from 0.1 – 0.3 metre below ground level (mbgl), with 49 samples collected in total for analysis. Soil samples were tested for a range of contaminants of potential concern (COPC) associated with current and historical site activities including herbicides, pesticides, total recoverable hydrocarbons (TRHs), monocyclic aromatic hydrocarbons (MAHs), nutrients, polychlorinated biphenyls (PCBs) and heavy metals.

Key findings of the ESA are summarised below:

- LRM indicated that all soil samples were collected within the natural soil profile as fill material was not identified during the assessment;
- An isolated exceedance of arsenic (105 mg/kg) marginally above the adopted health-based criterion (100 mg/kg) for low-density residential land use setting was reported in surficial soil within the eastern portion of the site, however it was interpreted to be associated with background concentration. Statistical analysis conducted indicates the 95% upper confidence limit of the arithmetic mean concentration of arsenic was below the adopted health-based criterion;
- Measurable concentrations of nutrients including ammonia (up to 37 mg/kg), nitrate (up to 7.7 mg/kg) and total Kjeldahl Nitrogen (TKN) were reported in select surface soil samples (where analysed);
- Exceedances of EPA IWRG 621 Fill Material thresholds for arsenic, nickel and zinc were reported in surficial soil at several locations. LRM concluded the elevated metals concentrations are associated with background concentrations and classified the site soils as “Fill Material”;
- Asbestos containing material was not identified at any soil investigation locations; and
- The remaining analytes were either below the laboratory limit of reporting or adopted health-based criteria.

Jacobs notes that limited site history information is available in the LRM report, hence it is unclear whether all potential source/s of contamination have been identified and investigated during the ESA. In addition, groundwater investigation was not undertaken as part of the ESA, hence the contamination status of groundwater is unknown. It is likely that further assessment and potentially a statutory audit will be required in the event that this area is proposed for residential or more sensitive use.

6.7.2. Yarra Valley Water, 2008: Wallan Reclaimed Water Re-Use Scheme: Camerons Lane Lots 8 & 9 – Preliminary Assessment of Groundwater Monitoring Results

In 2008 Yarra Valley Water undertook groundwater monitoring across a network of 18 groundwater monitoring bores and windmills. The purpose of the assessment was to confirm that the irrigation of the site using recycled water was not having a detrimental impact upon groundwater quality and the relevant beneficial use segments as defined in the SEPP. Laboratory results were compared against background results obtained in 2005 prior to commencement of irrigation in order to assess groundwater quality trends. These results were also compared against the ANZECC & ARMCANZ (2000) assessment criteria for the relevant protected beneficial uses.

Yarra Valley Water concluded that the majority of parameters generally reported stable concentrations trends between pre and post irrigation monitoring. Where exceedances of the relevant criteria were observed, these were either:

- For analytes that also reported exceedances prior to irrigation commencing and were therefore deemed unlikely to have resulted from the irrigation itself (i.e. total dissolved solid); and
- For analytes that were not tested for during pre-irrigation monitoring and therefore results could not be attributed to irrigation (i.e. sodium, chloride and pH).

The report also provides a summary of the water quality parameters for the recycled irrigation water, which was derived from the Wallan Sewage Treatment Plant. The discharged water is rated as Class C recycled water, which can be used for the following uses (as described by Yarra Valley Water):

'*Class C may be used for a number of uses including for cooked or processed human food crops including wine grapes and olives. It can also be used for livestock grazing and fodder and for human food crops grown over a meter above the ground and eaten raw such as apples, pears, table grapes and cherries. It can be used by councils for specific purposes but there are restrictions around human contact*'

While nutrient concentrations (nitrate, nitrite and ammonia) as well as e.coli are generally raised, concentration of metals, selected solvents, volatile organics and monocyclic aromatic hydrocarbons (MAHs) were generally reported below laboratory limits of detection. As such, irrigation is unlikely to result in contamination of the soil or groundwater by these analytes.

6.7.3. Arris Pty Ltd, 2008: Lots 8 & 9 Camerons Lane Reuse Scheme – Assessment of Soil Monitoring Data for 2006 to 2007

In May 2008, Arris Pty Ltd (Arris) was commissioned by Yarra Valley Water to undertake an assessment of impacts on soils at Lots 8 and 9 Camerons Lane as a result of irrigation using recycled water. This assessment focussed predominantly on agronomic impacts, rather than impacts to ecological or human health.

The investigation involved the collection of soil samples from 8 separate locations across the area to the south of the recycled water reservoir, where the lateral irrigation systems operate. Samples were collected at two depth intervals (namely 0.0 – 0.1mbgl and 0.2 – 0.3mbgl) in 2006 and 2007, with 32 samples collected in total. Soil samples were tested for a range of analytes used to measure soil health (predominantly from an agronomic perspective).

The report concluded that the irrigation of the site with recycled water 'has generally improved many indicators of soil health over the monitoring period. Notable trends included:

- Increased pH;
- Decreased total aluminium; and
- Increased cation exchange capacity.

While minimal laboratory analysis was undertaken for contaminants of concern relevant to the protection of human health, it is noted that the reported analysis of the irrigation water indicated concentrations of metals, selected solvents, volatile organics and monocyclic aromatic hydrocarbons (MAHs) generally below the laboratory limits of detection or at low concentration. While this does not rule out the presence of such contaminants in the soil as a result of other anthropogenic sources (or in the case of metals in particular from naturally derived sources), it is highly unlikely that irrigation would result in the accumulation of such contaminants in the soil.

6.7.4. Jacobs, 2014: Beveridge North West PSP – Groundwater Quality Assessment

A groundwater quality assessment was undertaken by Jacobs (2014) as part of the land suitability assessment for the Beveridge North West PSP.

Groundwater samples were obtained from 13 targeted locations at Lots 8 and 9 Camerons Lane, Beveridge and submitted for analysis of dissolved phase metals, nutrients, inorganics and TDS. 12 of these locations were groundwater sampling locations while a further treated effluent / recycled water sample was collected from the winter storage facility (sample EFF). The treated effluent contained in the winter storage facility is used to irrigate the site.

The assessment reported concentrations of heavy metals and nutrients such as ammonia, nitrite and nitrate were likely reflective of background / regional groundwater conditions. No beneficial uses of groundwater were found to be precluded.

Elevated nitrite and cyanide were reported in the surface water sample collected from the winter storage facility. However, no contaminant concentrations of these contaminants were reported above adopted assessment guidelines as part of the actual groundwater sampling program.

7. Site characterisation

7.1. Site contamination assessment

Based on the available information and consistent with the historic land use in the PSP areas, potential sources of contamination were identified during the regional desktop site history review (Stage 1 assessment) of the Wallan South and Wallan East PSP areas. The potential sources of on-site contamination were assigned a qualitative level of risk based on the likelihood of the contamination representing a potential constraint to future development at the site. A site inspection (Stage 2 assessment) was then undertaken on select PSP areas, where access was permitted to verify the risk ranking. While the site inspection focussed more on those areas identified as presenting the greatest potential for contamination, Jacobs also assessed the wider site extent to confirm land uses, where possible.

Off-site potential sources of contamination were also inspected during the site inspections (where possible). These too were assigned a qualitative risk level based on the likelihood of the contamination representing a potential constraint to future development of the Wallan South and Wallan East PSP areas.

While each identified property is slightly different with respect to the potential for contamination, there are some land uses which recur across the PSP areas and are typical of rural areas such as Wallan. The potential sources of contamination observed within the PSP areas include general agricultural land use, rural septic tank systems, farm residences and associated sheds, imported fill (including tipped waste and miscellaneous stockpiles), former poultry/egg farms and rail siding. While Appendix D identifies potential contaminants of concern relevant to each parcel assessed, the presence of other contaminants of concern cannot be ruled out at this stage owing to the limited assessment of each individual property. These common land uses are discussed below as well as general comments relating to the PSP areas and surrounding land use.

Each parcel of land within the boundary of the Wallan South and East PSP areas was evaluated as part of the desktop study (Stage 1 assessment). The purpose of this evaluation was to establish current and historical land uses, and then make a determination as to the potential for those activities to contaminate land. This evaluation was guided by comparing the current and / or historic land uses with those presented in Table 2 of Planning Practice Note 30 (PPN30) (DELWLP, 2021). Table 2 of PPN30 defines the potential for different land uses to contaminate land as either 'high' or 'medium'. Jacobs has applied professional judgement when evaluating land uses and the resultant contamination potential. For the purposes of this assessment, Jacobs has determined that any land uses that are not clearly defined as either a 'high' or 'medium' potential for contamination in PPN30 is considered either (unless determined otherwise based on professional judgement):

- Land use with a 'low' potential for contamination. This would apply to properties where highly localised areas of interest are identified (i.e. septic tanks, or farm buildings with only minor (small volume) chemical storage).

A site inspection (Stage 2 assessment) was then undertaken at selected properties to verify the assigned potential for contamination. While the site inspection focused more on specific areas of interest, Jacobs also assessed the wider site extent to confirm land uses, where practicable.

The outcomes of the Stage 1 and Stage 2 assessment are presented in:

- Table 7-1, which presents a summary of the overall number of parcels within the PSP that were characterised as either presenting a 'high', 'medium' or 'low' potential to contaminate land
- Appendix D which presents the evaluation outcome for each of the parcels of land within the Wallan South and East PSP areas.
- Figure 3 in Appendix A, which spatially represents the evaluation outcomes

Off-site potential sources of contamination were also inspected during the Stage 2 assessment (where possible). These too were assigned a qualitative contamination potential rating based on the likelihood of the contamination representing a potential constraint to future development of the Wallan South and East PSP areas.

While each identified property is slightly different with respect to the potential for contamination, there are some land uses that are commonly present across the PSP areas. The potential sources of contamination observed within the Wallan South and Wallan East PSP area include general agricultural land use, rural septic

tank systems, farm residences and associated sheds, imported fill (including tipped waste and miscellaneous stockpiles), former poultry/egg farms and rail siding. While the evaluation completed has sought to identify potential contaminants of concern relevant to each parcel assessed, the presence of other contaminants of concern cannot be ruled out at this stage owing to the limited assessment of each individual property (i.e. generally targeted observations, with no intrusive sampling conducted).

Common land uses are discussed below as well as general comments relating to the Wallan South and East areas and surrounding land use.

7.1.1. General precinct-wide observations

7.1.1.1. General agricultural land use and rural septic tank systems

Majority of the land forming the Wallan South and East PSP areas has been used for agricultural purposes for an extended period of time. As such, there is likely to be a long history of general agricultural processes within the PSP areas. The most notable of these is crop spraying and grazing. Contaminants of concern associated with this process typically include metals, pesticides, herbicides and fungicides as well as potentially nutrients (from manure, slurry application and other fertilizers) and biological contaminants (from buried animals).

Since rural residences can be relatively isolated, the use of septic tanks for sewerage purposes rather than mains sewerage is common. Since these septic tank systems are underground, they can be difficult to identify during the site inspection. However, conversations with landowners suggest septic tank systems appear to be common in the PSP areas. Contaminants of concern can also include biological contaminants and nutrients associated with leakages from septic tank systems.

General agricultural use and rural septic tank systems have not been explicitly identified in Appendix D owing to their site-wide relevance. These activities are generally considered to present a low risk of widespread contamination that could be considered restrictive to future site use (it is anticipated that any impacts would be highly localised, and relatively minor in nature). Further discussion on this topic is provided in Section 8.

7.1.1.2. Farm residences and associated sheds

Farm residences and associated sheds are the most common potential source of contamination across the PSP areas. These areas are typically used for storage of farm machinery (both operational and non-operational), materials, vehicles and many other miscellaneous items. These sheds may also include fuel storage areas for refuelling farm machinery (typically in above-ground storage tanks) as well as storage areas for items such as agricultural chemicals (pesticides, herbicides etc.), oils, lubricants and solvents for machinery maintenance – typically in very small volumes.

Based on the above, the most likely sources of contamination include spillages of fuels and chemicals on soils from general machinery/equipment storage and maintenance of farm vehicles. However, spillages of other agricultural chemicals may also impact upon soils. Given that such chemicals are typically stored in small volumes impacts are therefore likely to be localised in extent.

Asbestos was also commonly used as a building material with a number of applications in Australia as early as the 1880s (although more frequently in the mid to late 1900s). While asbestos presents a limited risk while it remains in a bonded matrix (i.e. as bonded asbestos cement sheeting), free fibres can present a greater potential risk. Mobilisation can occur through a number of processes including (but not limited to) abrasion, sanding and cutting that can result in the release of fibres. Asbestos is also likely to be encountered in building materials during demolition of old buildings and sites where buried or imported waste has been reported.

7.1.1.3. Imported fill, fly tipped waste and stockpiled material

The presence of imported fill can be difficult to identify without undertaking intrusive investigations, particularly in areas that are heavily vegetated. Fill material is most likely to be found in locations where previous construction/development works have been undertaken.

Wastes can also be generated and deposited on-site, the type and volume of wastes are contingent on the activities and processes being performed. In addition, illegal dumping of wastes and importation of wastes (albeit the latter is less common as it typically requires EPA approval) may also occur.

Potential contaminants of concern associated with fill material, fly-tipped waste and stockpiled materials can vary significantly depending on their source and time at which they were deposited. Since such information is rarely available specific contaminants of concern often cannot be adequately identified without laboratory analysis (although visual and olfactory observations can provide limited information). However, the most encountered contaminant groups include total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs) and metals. However, asbestos is also a contaminant of concern, particularly in building-derived waste.

7.1.1.4. Poultry/egg farms

Based on the available information, Lots 2 – 4 within the Wallan South PSP were historically occupied by a battery egg farm and Lots 1 and 5 were likely used for poultry farming.

On-site disposal of waste (including manure and dead poultry) could result in pollution of soil and groundwater with nutrients, pathogens and heavy metals.

Poultry and egg farms can also be accompanied by an abattoir which can pose significant contamination to the environment due to nutrients from animal manure and process wastewater leading to eutrophication in wetlands and waterways, and toxic concentrations of nitrogen compounds; depletion of oxygen levels in surface waters due to the breakdown of organic matter; pathogens such as salmonella bacteria from any diseased stock held at the site; increased salinity derived from waste stabilisation pond effluent evaporation; increased turbidity due to solids transfer to waterways and wetlands; and alkalinity and surfactants derived from equipment cleaning[6].

7.1.1.5. Rail siding

A rail siding has existed within Lots 36 – 42 of the Wallan East PSP adjacent to the existing railway corridor since at least 1946 and potentially used for laydown of railway materials.

The specificity of rail infrastructure can cause some typical organic and inorganic contamination, resulting mostly from used lubricate oils and condenser fluids, transportation of oil derivatives, metal ores, fertilizers and different chemicals, as well as from application of herbicides[7]. The most common types of pollutants connected with railway transport are TRH, PAH, metals, pesticides and herbicides.

7.1.1.6. Surrounding land uses

Sites located immediately outside of the Wallan South and Wallan East PSP boundaries were also considered during the Stage 1 assessment in order to identify any potentially contaminating land uses that may impact upon the future uses of land within the PSP areas. Off-site sources identified in the vicinity of the PSP areas are summarised in Table 7-2. Sites listed in this table were inspected from the closest publicly accessible areas during the site visits.

The site located outside of the PSP areas with the highest risk ranking was the existing rail corridor located to the west of the Wallan East PSP area which has been allocated a risk ranking of medium to high. Consistently with the rail siding, the rail corridor has the potential to cause subsurface contamination.

As indicated in Section 6.7, previous soil and groundwater assessments conducted for the Yarra Valley Water's reclaimed water re-use scheme have reported contaminant concentrations below the adopted assessment criteria. On that basis, the potential for the scheme to impact upon the project area is likely to be low.

[6] Department of Water, Government of Western Australia, Water Quality Protection Note, Rural Abattoirs, WQPN98, May 2007.

[7] B. Wilkomirski et al (2010) Railway Transportation as a Serious Source of Organic and Inorganic Pollution, dated 8 October 2010.

The remaining off-site properties generally comprised small farms, rural residences and small-scale commercial properties. Based on their proximity to the Wallan South and Wallan East PSP areas as well as the nature of the operations observed, the potential for contamination of the PSP areas was perceived to be either low or very low.

7.1.2. Site characterisation

The potential on-site sources of contamination were selectively assessed (where access was permitted) during the site inspection of the Wallan South and Wallan East PSP areas on 22 November 2019. Several properties were also inspected from the closest publicly accessible areas due to access restrictions (or other practical reasons).

The potential sources of on-site contamination identified during the Stage 1 and 2 assessments are presented in Appendix D and depicted in Figures 3A and 3B in Appendix A. The overall summary of numbers of 'low', 'medium' and 'high' ranked sites are also presented in Table 7-1.

General farm homesteads were the most frequently observed potential contamination sources within the Wallan South and East PSP areas. As described previously, these typically included fuel storage as well as storage of other miscellaneous chemicals albeit typically in small volumes - impacts are likely to be localised. On this basis, these properties were generally allocated a low potential for contamination, unless otherwise noted in Appendix D.

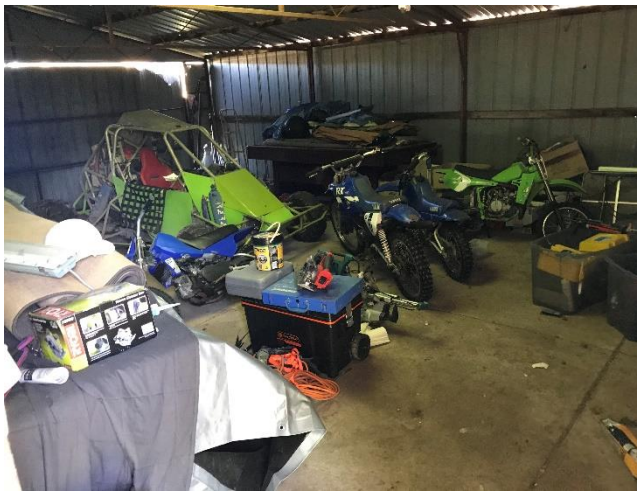
Access consent was not granted for Lots 1 and 5, hence these properties were excluded from the site inspection. Based on the site history information, these properties were likely used for poultry farming. For the purpose of this assessment, Jacobs has conservatively allocated a medium potential of contamination for these properties.

The former battery egg farm at Lots 2 – 4 (Wallan South PSP) are currently used for dwelling, storage of plant and equipment, and sheep grazing. Stockpiling of soils was also noted at the former egg farm and in some cases building rubble was also identified.

Site Inspection – Selected Photographs

Picture 7-1. Storage of farm machinery (Lot 43)

Picture 7-2. Storage of farm machinery (Lot 51)



Picture 7-3. Machinery shed (Lots 2-4)

Picture 7-4. Storage of oils and lubricants (Lots 2-4)

Picture 7-5. Sheep grazing (Lots 2-4)

Picture 7-6. Former chicken sheds (Lots 2-4)

Site Inspection – Selected Photographs

Picture 7-7. Soil stockpiles (Lots 2-4)

Picture 7-8. Building rubble observed within soil stockpiles (Lots 2-4)

Picture 7-9. Rail siding, looking south-west (Lots 36-42)

Picture 7-10. Rail siding, looking north-west (Lots 36-42)

Table 7-1. Summary of On-Site Characterisation – Potential for Contamination

Table summarising the contamination potential for sites within the Wallan South and Wallan East PSP, based on the land uses with potential to contaminate land presented in Table 2 of Planning Practice Note 30 (DELWP, 2021). Proposed further assessment is based on the approach presented in Table 3 of PPN30, assuming sensitive future use and a new use.

No Sites	Contamination Potential	Recommended Further Action
12	Medium	PRSA to determine the need for an Environmental Audit
45	Low	No further action required – General Environmental Duty applies

Table 7-2. Summary of Off-Site Characterisation – Potential for Contamination

Table summarising the contamination potential for sites within the vicinity of the Wallan South and Wallan East PSP, based on the land uses with potential to contaminate land presented in Table 2 of Planning Practice Note 30 (DELWP, 2021). This includes a qualitative evaluation of the potential impact on sites within the Wallan South and Wallan East PSP area.

Land Use	Contamination Potential	Potential Impact on Properties within Wallan South and Wallan East PSP
Rail corridor	Medium	Existing rail corridor adjacent to the Wallan station. Upgrade work for the station carpark is currently underway.

7.2. Geotechnical assessment

7.2.1. Variation in ground model

Variable ground conditions are expected at the proposed sites specifically Wallan south area, which comprise three regional geological formations such as Newer Volcanics Group, Humevale formation and alluvium. The depth of the alluvial profile at the project area is not known. Devonian profile typically comprises residual soil and extremely weathered siltstone/sandstone characterised by silty clay of medium to high plasticity with occasional gravel. This material occurs both as a layer overlying, and within the moderately weathered to fresh siltstone/sandstone. Newer Volcanics Basalt typically comprises residual soil and extremely weathered to fresh basalt characterised by clay of high plasticity with occasional gravel. The High plasticity clay usually subjected to high shrinkage and swell by absorbing water.

The depth to weathered rock specially in newer Volcanics group can be highly variable over short horizontal distances. Weathering within the basalt profile is generally extremely weathered to slightly weathered and fresh rock. The strength of the rock encountered at the rock head is generally medium to extremely high depends on weathering degree.

The depth to weathered rock can be highly variable over short horizontal distances. Weathering within the Devonian (Humevale Siltstone) profile is generally moderately weathered at the rock head with zones of highly weathered material, the degree and extent of which is dependent on the environmental conditions the formation has been subject to. The weathering generally becomes moderately and less weathered with depth. The strength of the rock encountered at the rock head is generally low to high. Moderately to slightly weathered rock at depth is generally encountered as high to very high strength.

7.2.2. Soil reactivity

The residual soil of the Newer Volcanic Group is typically highly reactivity and prone to shrinkage and swelling due to the seasonal changes to the moisture content of the soil. Australian Standard AS2870-2011 "Residential Slabs and Footings - Construction" indicates that Wallan is in a Climatic Zone 3 with respect to shrink swell movements. The depth of design suction changes in Climatic Zone 3 can be up to 2.3m below ground level.

Based on the Melbourne climatic zones indicators and the classification system presented in Table D1 of AS2870-2011, an indicative site classification of Class "H2 to E" (Highly reactive to extremely reactive clay site) could be adopted for design purposes, where the depth of clay over massive rock is larger than 1.5 m . Although this classification would depend on the depth, thickness and reactivity of the clay material in this area, a characteristic surface movements (y_s) of between 60 mm to large than 75 mm could be expected as per Table 2.3 of AS2870-2011.

The thickness of the residual soil profile in the Newer Volcanics is likely to be highly variable, and it is our experience in this area and with this geological unit that the depth to basalt can vary significantly over relatively short horizontal distances.

The above site classification is based on regional geological information and is intended for preliminary consideration only. Site specific geotechnical site investigations which may include soil sampling and laboratory testing should be undertaken prior to the design and construction of any footing systems, pavements and associated civil infrastructure as part of any future building permit application.

7.2.3. Geotechnical risk assessment

A preliminary assessment of the geotechnical risks associated with the land suitability assessment has been undertaken. A risk assessment matrix considering the likelihood and consequence as shown below has been used to characterise risks. The risk ranking presented in Table 7-3 below has been undertaken based on the available desktop information to date.

Table 7-3. Design Geotechnical Risk Summary

Summary of the geotechnical risk associated with the Wallan South and Wallan East PSP, including the relevant risk matrix

Risk	Risk Rating	Risk Description	Potential Mitigation Measures	Mitigated Risk Rating
Uncertainty of ground conditions	**H (HLxME)**	• Lack of information leading to incorrect ground models. • Unduly conservative design • Potential construction delays to revise design	• Carry out site specific additional ground investigation and laboratory testing	**L (LLxMI)**
Instability of excavation	**M (LLxME)**	• Potential instability of soils • Collapse of excavation • Excessive inflow of perched water	• Open cut excavations up to 1.5m height shall be battered to a minimum slope of 1V:1H • Dewatering to be designed, installed and managed properly	**L (LLxMI)**
Surface movement of shallow foundations due to shrinkage and swelling of expansive soil	**M (LxME)**	• Excessive surface movement due to shrinkage and swelling of the potential expansive soil subjected to seasonal changes in moisture content.	• Excavate the expansive soil and replace with blinding concrete to base of concrete. • If shallow rock is expected, remove all expansive soil and found the structure on weathered rock.	**L (LLxMI)**
Bearing capacity of shallow foundations	**M (LLxME)**	• Bearing capacity failure of shallow foundations, excessive settlement and damage to structures/equipment	• Ensure that weight of structures does not exceed the bearing capacity of the soil • If bearing capacity of soil is not adequate, remove any soft ground and replace with either blinding concrete or selected cohesive and non-porous fill	**L (LLxMI)**

Risk	Risk Rating	Risk Description	Potential Mitigation Measures	Mitigated Risk Rating
Damage to adjacent properties	**L (LLxMI)**	• Ensure existing utilities have been cleared and diverted from excavation location • Excavation may incur in excessive vibration and induce structural damage to the adjacent properties.	• Undertake pre-construction survey of adjacent properties • Contractor to undertake vibration assessment and select appropriate machinery for excavation. • Contractor to monitor vibration level during excavation and minimise damage.	**VL (ULxMI)**

Risk Matrix		Consequence (CO)			
		S	Me	MI	M
Probability (PR)	HL	VH	H	M	M
	L	H	M	M	L
	LL	M	M	L	VL
	UL	M	L	VL	VL

Legend and Risk Matrix

PR - Probability	CO - Consequence	RI - Risk
HL – Highly Likely	S - Severe	VH – Very high risk
L - Likely	ME - Medium	H – High Risk
LL – Low likelihood	MI - Mild	M – Moderate risk
UL - Unlikely	M - Minor	L – Low risk
		VL – very low risk

7.3. Hydrogeological assessment

Based on the available hydrogeological information and bore data in the vicinity of the site, a summary of the conceptual hydrogeological model for both Wallan South and Wallan East PSPs is detailed below:

- The local hydrogeology is defined by three units – the outcropping bedrock of the Humevale Siltstone, the overlying basalt of the Newer Volcanics and the Quaternary Alluvium that is predominately associated with Merri Creek;
- The Newer Volcanics forms the major aquifer at the site, given its extensive presence, quality and yield (compared to the Humevale Siltstone). It is likely the Quaternary alluvial units are thin and localised, despite being noted as widespread on geological maps;
- Groundwater is likely to be intersected within 10 m of the surface, but may be as shallow as 5 m in some areas (notably the wetland area in southern Wallan South PSP and in vicinity to Merri Creek in Wallan East PSP) or as deep at 50m (notably where the bedrock outcrops in Wallan South PSP);
- Groundwater quality is likely to vary from 1,000 – 5,400 mg/L TDS but most likely to be in the range of 1,000 to 4,000 mg/L TDS across the sites;
- Local aquifers are recharged by direct infiltration of rainfall through the soil. As such, all areas of the site are potential groundwater recharge areas. Locally, flooding around the creek and the swamp deposits at times of high surface water flow will most likely also contribute to groundwater recharge; and
- The Atlas of Groundwater Dependent Ecosystems (BoM, 2012) identifies Merri Creek in Wallan East PSP as having moderate potential for groundwater interaction, whilst the vegetation on the bank of the Creek has high potential. Therefore, it is likely that the depth to groundwater in vicinity of the Creek will be shallow. The 'temporary freshwater wetland' in the southern area of Wallan South PSP is rated as having low potential for groundwater interaction.
- A site walkover for both PSPs was undertaken by Jacobs on 22 November 2019 to determine or confirm hydrogeological features. The outcomes of the site walkover are as follows:
- An attempt was made to access and measure water level in local wells 145715, 98238, 98240 and 98225.
- 98225 (Wallan East PSP) was found but was equipped with pump equipment which prevented the measurement of a water level.
- All other wells could not be found or accessed.

- Merri Creek was inspected to determine whether surface flows were present. Water was not found to be flowing in the Creek, however denser vegetation was found along the course of the Creek compared to the neighbouring fields, indicating the presence of a shallow water source;
- A large channel runs through Wallan South PSP that is filled with water. The nature of this channel is unknown (whether is concrete or clay lined, whether it is natural and interacts with groundwater). Several dams are filled from this channel;
- Drainage channels and dams (potentially spring fed) are scattered across both sites; and
- An effort to observe the potential wetland on the southern boundary of Wallan South PSP was made but no access was possible.

In summary, the site walkover confirmed that depth to groundwater across the site is expected to be shallow due to the presence of surface water features. While many of the local wells could not be accessed or found at the time of the site walkover, it is possible they are still present and could be made available for groundwater monitoring in the future.

8. Development opportunities & constraints

8.1. Land contamination

The following issues require consideration in the planning and design of any development and may be assessed through further contamination investigation:

- Based on the information described in this report, there do not appear to be any significant constraints from a site contamination perspective which would render the land unsuitable for any feasible land use. However, there are specific areas which have been identified where current and / or former uses present a 'medium' for contamination of land (refer to Appendix D and depicted in Figure 3 in Appendix A) and for these properties further assessment will be required to better characterise the nature of contamination (if any) present.
- In accordance with Planning Practice Note 30 (PPN30), and assuming that all areas within the Wallan South and Wallan East PSP are to be assessed on the assumption that they may be used in the future for a sensitive use:
  - Those sites that have been identified where current and / or former uses present a 'medium' potential for contamination of land should be assessed further through a Preliminary Risk Screening Assessment (PRSA). The PRSA process will determine whether an Environmental Audit is required, and if so, the scope of that audit.

  If the PRSA and / or Environmental Audit process were to be conducted as part of the planning scheme amendment for the Wallan South and Wallan East PSP conducted by VPA (rather than representing a requirement of the developer of the site in the future) this may be considered a potential constraint due to the time and costs required to complete this assessment process. However, our understanding is that this would not be the case.
- It is likely that identified areas of concern will comprise discrete or localised areas of contamination that can be cost-effectively managed or remediated as part of the site development process (unless the additional assessments recommended for 'medium' contamination potential site above establish otherwise). For example:
  - Septic tank systems associated with the rural residences are likely to be present within the Wallan South and Wallan East PSP areas which have the potential to cause localised subsurface contamination. As such, it is recommended that any septic tank system should be identified, excavated and validated as part of future site development activities.
  - Miscellaneous small stockpiles and areas of discarded material / equipment on the ground surface were observed as some properties. These stockpiles / materials may not be suitable to remain on site under the future land use scenario, in which case they should be identified and removed to a suitably licenced disposal facility, and the areas that they were located appropriately validated. This may be undertaken as part of future site development activities.

  It is anticipated that minor management activities such as the above could be adequately controlled during development through the implementation of a robust Construction Environmental Management Plan (CEMP) with suitable provisions for the management of unexpected finds. Where necessary, the advice of a suitably qualified environmental professional should be sought by the developer.

8.2. Geotechnical

The following issues require consideration in the planning and design of any development and should be assessed through a geotechnical site investigation.

Variable ground conditions

- The depth and reactivity of the Newer Volcanics residual clay which forms the surface geology across southeast and north part of the Wallan South site are unknown. Alluvium depth and reactivity which form the surface geology of Wallan east and the majority part of Wallan south are not identified. Residual soil and alluvium would govern both sites (Wallan east and Wallan south) classification for foundation design in this area. It is expected that the site would be considered highly reactive (Class "H2 to E"). A more favourable site classification may be applicable to the western half of the Wallan south site, which is mapped as Humevale Formation. It is noted that a geotechnical site investigation is recommended to characterise the site classification across the site; and

- The variable thickness of the soil horizon over relatively short horizontal distances can lead to differential settlement of structures. As such, a geotechnical investigation is required to assess the depth to rock across the site.

Excavatability & stability of temporary excavations

- The variable geological conditions across the site can lead sudden change ground conditions for excavation. Excavation in sand, gravel and fill or excavations extending below the water table will be unstable and should be battered or shored. This will need to be assessed at the time of construction; however, a conservative approach should be adopted when considering stability of short term batter slopes;
- The excavation of the surficial fill, alluvium and natural soils is expected to be possible with standard bucket excavation method utilising a traditional excavator of suitable capacity;
- Excavation within granular Alluvium will post a risk of caving and collapse. Alternative ground collapse control measures during excavation (e.g. benching / battering, shoring, shielding, etc.) shall be considered to ensure that sidewall and overall integrity of the excavation is maintained;
- Excavations in Newer Volcanics and can vary between relatively easy excavations in residual soils to difficult excavation in weathered rock. It is expected that the existing natural soils may be excavated using conventional excavation equipment such as tracked excavators. Excavators equipped with ripper attachments or hydraulic impact breakers may be required to loosen any weathered basalt that is encountered, prior to excavation. Blasting may be required for excavation in very high strength basalt rock;
- Construction adjacent or near the crest of river bank (Merri Creek) will post a number of risks including slope failure, overturning of machinery. Ground Investigation and river bank inspection are recommended to confirm the strength of soil and stability of the river bank during construction and serviceability. The bearing capacity of footing constructed at top of slope would also require to assess, ensuring sufficient bearing capacity is available to the foundation soil;
- Temporary open cut trenches less than 1.5 m depth maybe constructed by battering the side of the excavation. Temporary batter slopes should not be steeper than 1V:2H in the cohesive alluvial deposits. High plasticity clays may be fissured and have weak shear planes, where soil block failures can happen. As such, appropriate benching and temporary slopes (e.g. 1V:2H or flatter) should be considered for trench and foundation excavations; and
- Dispersive soils may be encountered at the vicinity of the creek. Dispersive soils are easily revelled, and are susceptible to erosion and washing away. Theses soils may not be suitable for use as fill material as part of an engineered fill to support foundations or pavements.

Foundation design

- Construction of shallow footing above Alluvium will post a risk of structural damage due to insufficient bearing capacity and settlement. Ground Investigation is recommended to confirm the ground conditions, and assess the composition, thickness, strength and compressibility characteristics of the underlying soil;
- Shallow footings of private and residential development constructing above residual basaltic soil may be subjected to large seasonal surface movement due to shrinkage and swelling of expansive clay. Care should be during the foundation design to minimise the impact of soil shrinkage and swelling and limit the change in moisture content of the reactive soil;
- Design of roads, drainage works and underground assets would require consideration of the highly reactive nature of the clays to ensure serviceable performance and minimise on-going maintenance requirements; and
- Fill material, which may be present on site, is expected to be uncontrolled and may not be suitable as a founding material in its current state.

Groundwater Management

- Construction in low lying areas may be difficult during wet months. Where saturated conditions occur during construction/investigation then the site soils may become boggy and difficult to traverse.
- Dewatering during construction will be required if excavations interact with the water table. It is possible that sand lenses (within alluvium deposits), that offer a higher permeability compared to fine grained soils, may provide an additional ingress for water into the excavation. The recharge, direction and magnitudes of flow are unknown; however, it is considered that a sump and pump type arrangement could provide satisfactory management of ground water locally. This shall need to be assessed prior and during

any excavation. Based on the presence of Clay and Silt within the Alluvium, consideration should be made to the filtration and capture of sediment;
- In addition to groundwater management, events such as heavy rainfall and flooding are required to be considered in the design of a sump and pump arrangement. The capacity of the discharge point is required to be adequate to meet current capacity and the addition of any groundwater. Discharge of groundwater should be in accordance with the relevant authorities and conditions on permits obtained.
- Areas subject to poor drainage may comprise soft material which provides low bearing capacity for foundations.

8.3. Hydrogeology

A small area within the boundaries of both the Wallan South and Wallan East PSP is covered by a Salinity Management Overlay (SMO). The objectives of SMOs include the following:

- To implement the Municipal Planning Strategy and the Planning Policy Framework;
- To identify areas subject to saline groundwater discharge or high ground water recharge;
- To facilitate the stabilisation of areas affected by salinity;
- To encourage revegetation of areas which contribute to salinity;
- To encourage development to be undertaken in a manner which brings about a reduction in salinity recharge;
- To ensure development is compatible with site capability and the retention of vegetation, and complies with the objectives of any salinity management plan for the area; and
- To prevent damage to buildings and infrastructure from saline discharge and high watertable.

Under the applicable Schedule to the SMO (27/05/2019 C141mith), there are no specific salinity management objectives to be achieved, and no specific statement of risk. Under the SMO, a planning permit will be required to subdivide land. This application will include information such as regional geology, soil types, high groundwater recharge areas, groundwater levels, sources of water, vegetation proposed to be removed and recommendations for land management practices. The areas covered by the overlay are small in size and likely to be associated with areas of poor drainage.

Given the areas covered by the SMO in Wallan South and Wallan East PSP are small in size, it is expected they will not pose a barrier to development. Should further investigation be required, the drilling of groundwater wells will allow for the assessment of conditions. It is worth noting that there are local examples where developers were successful in having a SMO removed from their site areas (Mitchell Planning Scheme Amendment C93 and C71[8]), however this process may not be required at Wallan PSPs, given the limited area affected.

Across both PSP areas, there does not appear to be any significant hydrogeological constraints which would render the land unsuitable for development. However, shallow depth to groundwater is likely to exist in some areas of the site and the presence of the SMO indicates that there is potential for activities such as irrigation or other high recharge uses to cause local salinisation. Considerations should be given to the location of any such activities.

The following issues require consideration in the planning and design of any development:

- Shallow watertable may cause groundwater inflow to excavations and may impact on site drainage (i.e. cause waterlogging);
- The brackish nature of the groundwater may require careful monitoring if dewatering or extraction is required, particularly for the consideration of the disposal of water;
- Decreased local groundwater recharge in winter and early spring as the result of dewatering or extraction associated with development has the potential to reduce discharge to nearby surface water features, which could potentially have a negative impact on the ecological health of local waterways (specifically Merri Creek in Wallan East PSP, and the potential wetland and the water channel in Wallan South PSP);

[8] C93: August 2013, SMOs were deleted from Springridge Estate, Northern Highway, Wallan and Newbridge Estate, Station Street, Wallan.

C71: July 2011, SMOs were deleted from stage 1 of the Wallara Waters residential estate, Wallan East.

- There may be additional land management requirements imposed by council or other regulatory body (relating to the SMO), as part of any proposed subdivision for the site; and
- There may be areas that have poor sub-soil drainage and are susceptible to water-logging.

Opportunities for potential use of extracted groundwater include dust suppression during construction, and garden watering and irrigation of parks and ovals following development. However, depending on the salinity of the groundwater, it may need to be shandied with potable water to improve the quality for the intended purpose.

Groundwater field investigations are expected to become high priority where excavations are likely to exceed 5m in depth. For large or deep excavations, groundwater investigations can be used to inform the quantity, quality and impact of dewatering.

8.4. Hydrology

Melbourne Water is in the process of reviewing the current hydraulic and hydrological modelling for the Wallan South and East precincts. As such, flooding information for the region – including the drainage schemes and planning overlays referred to in this report – may change in the near future.

The current Drainage Scheme for Taylors Creek currently has a retarding basin of approximately 20 hectares specified at the junction of Northern Highway and Taylors Creek. A report prepared by Afflux Consulting in 2018 for Miller Merrigan Land Development Consultants suggested that this area could be reduced. However, it is advised to wait upon the outcome of the current Melbourne Water review to determine whether this is possible.

The majority of the two precinct areas are free from hydrological constraints significant enough to constrain development, however there are flood hazards present at both sites. The Land Subject to Inundation Overlay (LSIO) extends across both Wallan South and Wallan East, impacting development in this area. Under the LSIO, a permit is required to construct a building or carry out works, and to subdivide land. Furthermore, both sites contain the Floodway Overlay (around Taylors Creek through Wallan South and Merri Creek through Wallan East) which add further caveats for land subdivision, namely: that no new lots entirely within the FO are created (other than by agreement with Melbourne Water); and that any subdivision is the re-subdivision of existing lots, with no additional lots being created.

8.5. Geomorphology

The Wallan South and Wallan East Precinct areas appear to be located on soils that have formed from weathering of local New Volcanic Basalt rock. They are likely to be similar in characteristics to that which have previously been assessed by Van de Graaf (2018) at a nearby locality Merrifield.

Topsoils have better structural stability but subsoils are highly dispersive/strongly sodic and susceptible to erosion, particularly in instances where the topsoil is removed or if there are drainage works, which then result in rainfall and runoff making contact with and eroding these soils. Development in these areas will require very careful planning, staging of works to minimise disturbance and possible remediation of soils to enhance their stability (application of gypsum).

With proposed urban development there will be a significant change in runoff to waterways – which in turn will heighten erosion risks. It is expected that with development of drainage services scheme Melbourne Water will want further advice as to how future development and the drainage services scheme can be prepared so as manage erosion risks and provide appropriate protection to waterways, including Hernes Swamp.

8.6. Future Quarrying

Jacobs understands that a Work Authority Application (reference no.: WA1473) is being considered for a proposed basalt and scoria quarry by Conundrum Holdings at the western half of 175 Northern Highway, Wallan (property plan number 2/LP6746). The proposed quarry is located to the south of Lot 25 within the Wallan South PSP.

It is anticipated that Council planning approval will be required by Conundrum Holdings in order to allow commencement of activities at the proposed quarry site. It is likely that this will include the re-zoning of the proposed quarry site to Special Use Zone (SUZ) which will also likely include the application of a buffer zone around the proposed quarry.

In accordance with EPA Victoria publication 1518 *Recommended Separation Distances for Industrial Residual Air Emissions* (EPA, 2013) a buffer distance of 500m (assuming blasting would be necessary) would be required between the proposed quarry and the nearest sensitive land uses. Future potential quarrying activities that would not require blasting may allow the buffer distance to be reduced to 250m. The potential implications of buffer distance to future sensitive land use development within the Wallan South PSP areas, specifically Lots 22, 25 and 26 located in close proximity to the proposed quarry should be considered by VPA and/or Council prior to finalising the future land use zones.

9. Conclusions

9.1. Contamination

Based on the information gathered during the Stage 1 and Stage 2 assessments, the following conclusions can be made in relation to the Wallan South and Wallan East PSP:

- The site history assessment found that the site has a long history of agricultural land uses, with much of the areas remaining under cultivation to the present day.
- Septic tank systems associated with rural residences are likely to be present within the PSP areas;
- Based on the available information, including a site walkover and site history assessment, properties can be categorised as follows:
  - Medium potential for contamination is associated with the potential poultry farms (Lots 1 and 5), former egg farm (Lots 2 – 4), and rail siding (Lots 36 – 42).
  - Highly localised areas of potential contamination associated with stockpiles and general dumped materials were observed at the former egg farms (Lots 2 – 4). However, any contamination is likely to be localised to stockpiles themselves and in some instances in shallow underlying soils which can be easily removed;
  - Lots associated with the farm homesteads located at Lots 8, 9 10, 22, 29, 31, 32, 33 and 34 (within Wallan South PSP), as well as Lots 43, 44, 46, 47, 48, 49, 50, 51, 52, 55, 56, and 57 (within Wallan East PSP) were assessed to present a low potential for contamination.
  - Current and / or former activities at the remaining properties present a low potential for contamination. Such properties typically represented locations where no evidence of current or former potentially contaminative activities were identified (i.e. paddocks with no evidence of buildings or structures and no evidence of intensive agricultural land use that may be indicative of widespread and intensive commercial use of pesticides).
- A number of off-site sources of potential contamination have been identified in the vicinity of the PSP areas. Based on the nature of the site uses, the greatest risk to the PSP areas is likely to be presented by the existing rail corridor located to the west of the Wallan East PSP. The remaining properties were deemed to present low or very low potential for contamination of the PSP area.

Based on the information obtained from the sources described in this report, with the exception of the identified localised areas of potential contamination associated with current and/or former land uses identified above, there do not appear to be any significant risks from a site contamination perspective which would render the land unsuitable for residential or other sensitive land uses. Any areas of localised contamination are likely to be able to be effectively managed or remediated during any future site development.

9.2. Geotechnical

Based on the available geological information, a part of north and the south east half of the Wallan South PSP site are likely to be underlain by highly reactive residual basaltic clay overlying basalt rock. Alluvium covered the majority parts of Wallan South PSP and entire Wallan East PSP overlying weathered siltstone/sandstone and Newer Volcanics. An indicative site classification of Class “H2 to E” has been assessed in accordance with Table D1, AS2870-2011.

Key geotechnical issues associated with development of the site include the depth and reactivity of the basaltic clay and alluvium in terms of its influence on site classification, change and interface of variable ground conditions, foundation selection, differential settlement, subgrade performance, excavations and site accessibility. Fill material, if present, is expected to be uncontrolled and may not be suitable for development in its present state. Areas subject to poor drainage may comprise soft material which provides low bearing capacity for foundations.

Subsurface conditions may present a critical issue for design of the structures and foundations, and therefore there is be a cost-benefit in obtaining geotechnical data at targeted locations.

The results of the geotechnical investigation would form the basis of the geotechnical model for the site, which would be used to assess subgrade conditions, confirm the site classes, foundation design parameters, excavations and recommendations on earthworks.

9.3. Hydrogeology

Based on the regional hydrogeological information and bore data in the vicinity of the site, the Newer Volcanics forms the major aquifer at the site, given the likely yield, quality and depth to water (when compared to the Humevale Siltstone). It is likely the Quaternary alluvial units are thin and localised, despite being noted as widespread on geological maps.

Both PSPs currently have small areas within a Salinity Management Overlay (SMO). Under the SMO, a planning permit will be required as part of the subdivision process, which will detail recommendations for land management practices.

Across both PSP areas, there does not appear to be any significant hydrogeological constraints which would render the land unsuitable for development. However, shallow depth to groundwater is likely to exist in some areas of the site and the presence of the SMO indicates that there is potential for activities such as irrigation or other high recharge uses to cause local salinisation. Considerations should be given to the location of any such activities. The following issues require consideration in the planning and design of any development:

- Shallow watertable may cause groundwater inflow to excavations and may impact on site drainage (i.e. cause waterlogging);
- The brackish nature of the groundwater may require careful monitoring if dewatering or extraction is required, particularly for the consideration of the disposal of water;
- Decreased local groundwater recharge in winter and early spring as the result of dewatering or extraction associated with development has the potential to reduce discharge to nearby surface water features, which could potentially have a negative impact on the ecological health of local waterways (specifically Merri Creek in Wallan East PSP, and the potential wetland and the water channel in Wallan South PSP);
- There may be additional land management requirements imposed by council or other regulatory body (relating to the SMO), as part of any proposed subdivision for the site; and
- There may be areas that have poor sub-soil drainage and are susceptible to water-logging.

Opportunities for potential use of extracted groundwater include dust suppression during construction, and garden watering and irrigation of parks and ovals following development. However, depending on the salinity of the groundwater, it may need to be shandied with potable water to improve the quality for the intended purpose.

Groundwater conditions may present a critical issue for design where excavations are likely to exceed 5m in depth. For large or deep excavations, groundwater investigations can be used to inform the quantity, quality and impact of dewatering.

9.4. Hydrology

The 1% AEP flood extent impacts upon both the Wallan South and Wallan East precincts, covering 77 hectares and 33 hectares of the sites respectively. This flooding stems from the confluences of Strathaird Creek and Taylors Creek in Wallan South and Merri Creek with Mittagong Creek in Wallan East. Wallan South contains a wetland of approximately 43 hectares which is known to inundate episodically according to the DELWP Victorian Wetlands Inventory and may present drainage challenges.

Melbourne Water is in the process of reviewing the current hydraulic and hydrological modelling for the Wallan South and East precincts. As such, flooding information for the region – including the drainage schemes and planning overlays referred to in this report – are likely to change in the near future. Once completed this information will be the best available flooding information for these sites and it is recommended that these are adopted.

9.5. Geomorphology

The Wallan South and Wallan East Precinct areas appear to be located on soils that have formed from weathering of local New Volcanic Basalt rock. Limited soil mapping exists but it is considered likely that the soils are Sodosols. Sodosols are susceptible to problems of waterlogging and erosion as a result of the physical structure and chemical composition. Soil sodicity potentially leads to dispersion, degrading soil structure, which is more frequently a problem with subsoil horizons, that are often relatively impermeable and become prone to gullying and tunnel erosion. This erosion risk is increased in circumstances where the

surface soil has been removed or if there are drainage works, which then result in rainfall and runoff making contact with and eroding these soils.

There is increasing awareness, that urban development in areas that have these geologies and soil types in the Melbourne Region is an issue both through the construction phase and ongoing management of waterways. During the construction phase of development, vegetation is cleared and surface soils may be removed, exposing subsoils to rainfall. Erosion risks are potentially heightened along incised drains and connecting streams, as the amount of runoff to these waterways is increased as a result of increased stormwater runoff from impervious areas (roads, roofs). There is also more pressure on existing streams to drain water from their catchment areas. Further assessments into the characteristics of these soils and their erosion risks is recommended to inform future development in both PSPs.

10. Recommendations

We understand that the proposed future use of the Wallan South and Wallan East PSPs is as a broad ranging urban development and is likely thus to include sensitive uses such as residential, schools and community centres in addition to open space, retail and business uses. However, since specific future land uses within the PSP boundary are yet to be confirmed, this assessment has been completed based on the assumption that residential or other sensitive uses will be the probable land future uses across the PSP areas.

The following further works are recommended, including recommended timings:

- Completion of Preliminary Risk Screening Assessments at all properties where current and / or former land uses were assessed as presenting a 'medium' potential for contamination. These PRSAs will determine whether an Environmental Audit is required at the property, and the scope of the Environmental Audit (if deemed necessary). This recommendation would apply to 12 properties, specifically 1, 2, 3, 4, 5, 36, 37, 38, 39, 40, 41, and 42. These assessments may include the completion of targeted / limited sampling and should be completed in accordance with EPA Victoria publication 2021 *Guidelines for Conducting Preliminary Risk Screening Assessments* and EPA Victoria publication 2022 *Environmental Auditor Guidelines – Provision of Statements and Reports for Environmental Audits and Preliminary Risk Screen Assessments*. The PRSA may only be conducted by an Environmental Auditor. *Timing: These additional assessments may either be conducted as part of the planning process, or deferred until future development of the land occurs through the application of an Environmental Audit Overlay.*
- Completion of a hazardous materials assessment for existing properties to confirm the potential presence of asbestos containing materials and lead based paints and to identify controls that should be implemented during future development to prevent exposure by site workers or future users of the site. *Timing: It is recommended that this task be undertaken prior to the commencement of site demolition works on a site-by-site basis.*
- Removal of existing septic tanks followed by soil validation. Should the soil impacts indicate the septic tank is likely to impact groundwater, intrusive groundwater investigation should also be considered. *Timing: This task should be undertaken on a site-by-site basis during future site development*.
- Classification and appropriate removal (if required) of various stockpiles and dumped materials observed at the former egg farm (Lots 2 – 4) and present at any sites across the PSP areas. This includes subsequent validation following removal. It is noted that sampling of some stockpiles of soil observed may indicate that the material is suitable for re-use as part of future development and as such removal may not be required in all instances. *Timing: This task should be undertaken on a site-by-site basis during future site development.*
- It is recommended that a geotechnical investigation comprising soil and rock sampling, and geotechnical laboratory testing is undertaken. This will lead to the determination of the ground conditions, design constraints and geotechnical design parameters for temporary excavation, building foundation and road design. *Timing: This task should be undertaken on a site-by-site basis during future development as part of the building permit application process.*
- Groundwater level and quality monitoring on existing groundwater bores can be conducted to confirm groundwater conditions based on the risk of the proposed land use affecting groundwater. Groundwater hydraulic testing (slug tests) may also be undertaken to determine aquifer properties. This assumes existing wells are in a suitable condition for such an assessment. *Timing: This task should be undertaken on a site-by-site basis during design to inform risk to groundwater. Alternatively, groundwater investigations can be undertaken concurrently with geotechnical investigations by installing observation bores to measure groundwater level, quality and aquifer permeability.*
- It is recommended that the local registered bores identified in this assessment is confirmed with Southern Rural Water to understand whether they have active licences for groundwater use or whether they have been or should be decommissioned to prevent contamination of the aquifer.
- It is recommended that further site investigation, sampling, laboratory analysis and characterisation of soils is undertaken to confirm their erodibility and develop a plan to stabilise the soils (options include chemical treatment of soils, careful staging of works). The scope of this work would be similar to the Sodic Soils Assessment previously completed by Jacobs for Beveridge North-West, Shenstone Park, Wallan South and Wallan East (Part 1). *Timing: This task should be undertaken across the precinct area as part of the planning stage for the PSP. The outcomes of this work will assist in providing strategic advice on issues relating to sodic soils and how to manage these with future development.*
- A field geomorphology assessment of waterways is recommended to assess their current condition and how this is likely to change with changes in hydrology and hydraulics for future development scenarios.

The scope of this geomorphology assessment should be agreed with Melbourne Water. Jacobs have recently completed such investigations for the Werribee Junction Precinct Structure Plan (Jacobs 2019). *Timing: This task should be undertaken across the precinct area as part of the planning stage for the PSP. The outcomes of this work will assist in providing strategic advice on issues relating to the stability of waterways and how to manage these with future development.*

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Appendix A – Figures

The following figures are presented below:

- Figure 1 – Site Location
- Figure 2 – Site Layout
- Figure 3 – Site Characterisation – Potential for Contamination of Land

Appendix B – Reviewed Information

B1. Summary of Title information

Refer to **Figure 2A and 2B** for land parcel locations.

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
Wallan South PSP						
Lot 1	1/LP114173	V.9070 F.882	1630 Old Sydney Road, Wallan	Brenda & Michael Scherf	04.06.2012	Current
				Heather & Leonard Cozens	09.01.1996	History
				Celia & Clifford Thomas	23.08.1984	History
				Hilda Rowland	14.01.1982	History
				Hilda & Leonard Rowland (Poultry Farmer)	24.08.1976	History
				Keith, Irene, Derek, Beverley, Leonard & Hilda Rowland (Poultry Farmers)	30.05.1975	History
				Mary & William Hards (Poultryman)	25.02.1975	History
Lot 2	3/LP149223	V.9618 F.850	30 Rowes Lane, Wallan	Mansito Candace Nominees P/L	16.07.2001	Current
				Gabriele, Giovanna, Nicola & Nancy Salvatore	04.12.1985	History
				Irene, Keith, Derek, Beverley & Hilda Rowland	04.07.1985	History
Lot 3	1/LP149223	V.9618 F.848	185 Darraweit Road, Wallan	Mansito Candace Nominees P/L	16.07.2001	Current
				Camillo, Maelda, Domenico, Dino & Elisa Salvatore, Antonio & Bambina Petrocco & Rosa Massaro	04.12.1985	History
				Irene, Keith, Derek, Beverley & Hilda Rowland	04.07.1985	History
Lot 4	2/LP149223	V.9618 F.849	185 Darraweit Road, Wallan	Mansito Candace Nominees P/L	16.07.2001	Current
				Camillo, Maelda, Domenico, Dino & Elisa Salvatore, Antonio & Bambina Petrocco & Rosa Massaro	04.12.1985	History
				Irene, Keith, Derek, Beverley & Hilda Rowland	04.07.1985	History
Lot 5	CP152451	V.9477 F.353	1610 Old Sydney Road, Wallan	Denise & Robin Laidlaw	08.10.1987	Current
				Beverley & Derek Rowland (Poultry Farmer)	11.08.1982	History

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
Lot 6	1/TP950064	V.11516 F.863	70 Rowes Lane, Wallan	Michael Mathwin	27.08.2014	Current
		V.11357 F.684		Michael Mathwin	05.06.2012	History
		Bk. 801 No. 61		William & Mary Hards	22.12.1980	History
Lot 7	2/LP93763	V.8994 F.182	1500 Old Sydney Road, Wallan	Donna & Robert Green	06.07.2001	Current
				Valma Barrington	12.07.1995	History
				Valma & Edward Barrington (Manager)	01.10.1979	History
				John De Jong (Company Director)	20.12.1978	History
				Rosemary & Rodney Hay (Boat Dealer)	15.10.1973	History
Lot 8	1/LP93763	V.8994 F.181	90 Rowes Lane, Wallan	90 Rowes P/L	01.10.2018	Current
				888 Wallan P/L	03.09.2018	History
				Mega Group P/L & Slattery P/L	09.11.2006	History
				Liercol Nominees P/L	02.02.2004	History
				Jonathan & Josephine McDowell	29.04.1999	History
				Michael Mathwin	21.03.1978	History
				Rosemary & Rodney Hay (Boat Dealer)	15.10.1973	History
Lot 9	1\TP825	V.10129 F.428	1470 Old Sydney Road, Wallan	Graeme Cliff	29.11.2011	Current
		Bk.838 No.168		Ailsa & Graeme Cliff	07.07.1993	History
				Scott & Leanne Cochrane	18.07.1985	History
Lot 10	1\TP559653	V.1147 F.208	1450 Old Sydney Road, Wallan	Graham Whelan & Andriena Stroud	28.08.2018	Current
				Andriena Stroud	20.08.2018	History
				Christopher & Andriena Stroud	11.05.1994	History
				Kenneth Jones & Christopher Stroud	07.11.1988	History
				James Sinclair (Cartage Contractor)	16.01.1976	History

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
				Margaret & Jan De Jongh (Engineer)	18.12.1970	History
				Joyce & Irwin Parsons (Farmer)	14.08.1950	History
				Malcolm Ballantyne (Grazier)	20.01.1950	History
				Margaret Melvin	05.12.1949	History
				Margaret Sinclair	25.11.1879	History
Lot 11	2/TP817291	V.10685 F.321	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lots 12 & 13	1 & 2/TP823023	V.2448 F.498	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	17.01.2003	History
				Dorothea Connors	17.01.2003	History
				Dora & James Laffan (Grazier)	21.03.1974	History
				Dora, John & Leo Laffan (Graziers)	02.12.1932	History
				John Laffan (Farmer)	08.08.1907	History
				Esther & John Laffan (Farmer)	13.08.1901	History
				John Laffan (Farmer)	06.10.1892	History
Lot 14	20\PP3707	V.10685 F.323	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 15	1\TP817291	V.10685 F.320	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 16	3\TP817291	V.10685 F.322	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
Lot 17	23\PP3707	V.10685 F.324	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 18	24\PP3707	V.10685 F.325	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 19	79A\PP3707	V.5643 F.568	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	17.01.2003	History
				Dorothea Connors	17.01.2003	History
				Dora & James Laffan (Grazier)	21.03.1974	History
				Dora, John & Leo Laffan (Graziers)	02.12.1932	History
				John Laffan (Farmer)	20.02.1930	History
Lot 20	28\PP3707	V.10685 F.326	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 21	29\PP3707	V.10685 F.327	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 22	80\PP3707	V.10685 F.332	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 23	31\PP3707	V.10685 F.328	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 24	32\PP3707	V.30685 F.329	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 25	33A\PP3707	V.10685 F.331	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 26	34\PP3707	V.10685 F.330	175 Northern Highway, Wallan	Crystal Creek Properties P/L	21.01.2004	Current
				Dorothea Connors, Margaret Hollien & Gerard & Francis Laffan	24.10.2002	History
Lot 27	1\TP826276	V.10722 F.606	295 Norther Highway, Wallan	Slattey P/L	13.01.2009	Current
				Kalinju Park Estate P/L	28.05.2005	History
				John Laffan (Farmer)	02.05.2003	History
Lot 28	1\TP950066	V.11826 F.743	300 Northern Highway, Wallan	Mitchell Shire Council	11.05.2017	Current
				Dorothy Pyke	14.02.2017	History
				Lindsay Dean & Dorothy Pyke	14.10.2016	History
Lot 29	1\LP126928	V.9671 F.125	260 Northern Highway, Wallan	Havenmead P/L	24.05.2007	Current
				Christos & Freda Alvanos	11.11.1992	History
				Barry & Mary Hill	21.05.1985	History
Lot 30	2\LP126928	V.9671 F.126	260 Northern Highway, Wallan	Havenmead P/L	24.05.2007	Current
				Steven Alvanos	29.06.1999	History
				Santo Ferraro	30.05.1988	History
				Lychu, Mayly, Lymay & Sourivan Tong Pao	06.08.1985	History
Lot 31	3/LP149106	V.9617 F.956	5 Macsfield Road, Wallan	Cyari P/L	29.06.2005	Current
				Bridgeworks Australia P/L	26.08.1996	History
				Henry & Irene Dobson	14.08.1985	History

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
				Ivo & Alison Righetti	01.07.1985	History
Lot 32	4/LP149106	V.9617 F.957	25 Macsfield Road, Wallan	Jungu Investments P/L	27.07.2018	Current
				Danielle Oliver	10.01.2015	History
				Stephen & Danielle Thomas	16.01.2009	History
				Shane & Debbie Buck	01.12.2000	History
				Maria & Rosario Ferraro	05.07.1985	History
				Ivo & Alison Righetti	01.07.1985	History
Lot 33	5\LP149105	V.9617 F.954	20 Northern Highway, Wallan	Wenjun Investment P/L	07.08.2018	Current
				Giuseppe & Francesca Timpani	14.04.1986	History
				Ivo & Alison Righetti	01.07.1985	History
Lot 34	6\LP149105	V.9617 F.955	30 Macsfield Road, Wallan	Macsfield Projects P/L	26.10.2018	Current
				Kerrie-Anne McPhee	06.11.2014	History
				David Evans & Kerri-Anne McPhee	04.01.2000	History
				John & Christina Wighton	06.06.1986	History
				Ivo & Alison Righetti	01.07.1985	History
Lot 35	1\PS639576	V.11394 F.371	500 Old Hume Highway, Beveridge	Deloraine Rural P/L	05.02.2013	Current
				William Laffan	11.12.2012	History
Wallan East PSP						
Lot 36	1\TP904487	V.6419 F.715	Kelby Lane, Wallan	Victorian Rail Track	03.11.2016	Current
				The Victorian Railways Commissioners	01.08.1960	History
				Elizabeth Kendall	11.04.1957	History
				Elizabeth Coghill	11.10.1940	History
Lot 37	1\TP680375	V.3643 F.580	Kelby Lane, Wallan	Victorian Rail Track	02.11.2016	Current

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
				The Victorian Railways Commissioners	19.09.1912	History
Lot 38	1\TP391208	V.3624 F.685	Kelby Lane, Wallan	Victorian Rail Track	02.11.2016	Current
				The Victorian Railways Commissioners	14.08.1912	History
Lot 39	1\TP372654	V.3236 F.116	Kelby Lane, Wallan	Victorian Rail Track	02.11.2016	Current
				The Victorian Railways Commissioners	04.11.1907	History
Lot 40	1\TP956698	V.11553 F.498	2-32 Station Street, Wallan	Victorian Rail Track	30.01.2015	Current
		Bk. 223 No. 548		The Board of Land and Works	18.09.1872	History
Lot 41	2005\PP3707	V.11778 F.978	Not available	Government Road	06.08.2016	Current
				Crown Land vested in Victorian Rail Track	-	History
Lot 42	1\TP956768	V.11551 F.473	2-32 Station Street, Wallan	Victorian Rail Track	05.02.2015	Current
		Bk. 463 No. 277		The Victorian Railways Commissioners	19.09.1912	History
Lot 43	1\LP99336	V.9015 F.696	55 Kelby Lane, Wallan	Rodney De Vos	16.08.1999	Current
				Anthony & Mary Sultana	26.01.1984	History
				Carmela & Mario Palermo (Builder)	15.05.1979	History
				Pedro Textile Industries P/L	09.01.1974	History
				Anthony Barber (Grazier)	03.04.1974	History
Lot 44	2\LP99336	V.9015 F.697	25 Kelby Lane, Wallan	MRG Equities P/L	06.06.2007	Current
				DPB Group P/l	25.07.2005	History
				Richard Dalton	25.02.1997	History
				Bruce & Paulette Chamberlain	27.06.1988	History
				Rosa & Giuseppe cianciarulo (Bread Salesman)	29.10.1982	History
				Lucia & Antonio Faletti (Farmer)	29.10.1982	History
				Pedro Textile Industries P/L	09.01.1974	History

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
				Anthony Barber (Grazier)	03.04.1974	History
Lot 45	1\PS432563	V.10514 F.646	265 Wallan-Whittlesea Road, Wallan	Jim & Stan Kostakis	17.08.2000	Current
				Wallan East Farming P/L	04.05.2000	History
Lot 46	4\PS432563	V.10529 F.630	30 Hart Court, Wallan	Lorena Schrader	26.03.2018	Current
				Alan Nicholls & Lorena Schrader	04.08.2000	History
				Christopher Tilbrook & Lorena Schrader	04.08.2000	History
				Wallan East Farming P/L	30.06.2000	History
Lot 47	5\PS432563	V.10529 F.631	40 Hart Court, Wallan	Gavin & Melissa Langborne	25.07.2011	Current
				Frank & Sharon Suban	19.01.2001	History
				Wallan East Farming P/L	30.06.2000	History
Lot 48	3\LP99336	V.10360 F.935	2595 Epping-Kilmore Road, Wallan	Tony & David Italia	05.01.2018	Current
				Sudmo Australia P/L	10.07.2001	History
				Sudmo Installation P/L	10.11.1997	History
Lot 49	3\PS432563	V.10529 F.629	20 Hart Court, Wallan	Maneesha Chauhan & Anurag Chawla	01.11.2018	History
				Graham & Kimberly Staniforth	24.08.2001	History
				Graham & Kim Staniforth	24.08.2001	History
				Wallan East Farming P/L	30.06.2000	History
Lot 50	6\PS432563	V.10529 F.632	50 Hart Court, Wallan	Nicolaos & Valerie Minos	14.05.2002	Current
				Eileen Streatfield	06.08.2001	History
				Wallan East Farming P/L	30.06.2000	History
Lot 51	5\LP99336	V.9015 F.700	345 Wallan-Whittlesea Road, Wallan	Hayden Langborne & Catherine Mele	23.09.1999	Current
				James D, James J & Catherine Ross	26.09.1995	History
				Concetta Mele	09.12.1994	History

Parcel	Current Title	Volume Folio	Site Address	Registered Proprietors	Date	Status
				Concetta Mele & Giuseppe & Vincent Mele (Butchers)	23.03.1978	History
				Pedro Textile Industries P/L	09.01.1974	History
				Anthony Barber (Grazier)	03.04.1974	History
Lot 52	4\LP99336	V.9015 F.699	2539 Epping-Kilmore Road, Wallan	Angelo & Steven Minos	01.12.1998	Current
				Terrarent P/L	18.02.1986	History
				Vasilios, Polyvios & Andreas Michael	27.02.1980	History
				Pedro Textile Industries P/L	09.01.1974	History
				Anthony Barber (Grazier)	03.04.1974	History
Lot 53	Lot CM2 PS432563	V.10529 F.635	Wallan-Whittlesea Road, Wallan	Body Corporate No. 2 Plan No. 432563T	30.06.2000	Current
		V.10514 F.647		Wallan East Farming P/L	04.05.2000	History
Lot 54	Lot CM1 PS432563	V.10529 F.634	Wallan-Whittlesea Road, Wallan	Body Corporate No. plan No. 432563T	30.06.2000	Current
		V.10514 F.647		Wallan East Farming P/L	04.05.2000	History
Lot 55	2\PS432563	V.10529 F.628	10 Hart Court, Wallan	Ya-Yen tsai	06.09.2017	Current
				Malcolm & Heather Hunter	05.11.2010	History
				Joyce Grech & Jimmy Gatt	01.05.2006	History
				Andrew & Carola Hullin	09.11.2001	History
				Wallan East Farming P/L	30.06.2000	History
Lot 56	7\PS432563	V.10529 F.633	60 Hart Court, Wallan	John & Athena Tsoutsoulis	22.06.2010	Current
				Phillip & Janine Pace	14.08.2001	History
				Wallan East Farming P/L	30.06.2000	History
Lot 57	PC351617	V.10171 F.941	315 Wallan-Whittlesea Road, Wallan	Leeanne Ellis & Matthew Mason	25.01.2003	Current
				Kenneth Hart	31.05.1994	History

B2. Copies of current and historical title documents

B3. Aerial Photographs

B4. Priority Site Register

B5. EPA License

B6. Energy Safe Victoria Cathodic Protection System Search

B7. Previous Reports

Appendix C – Groundwater bores

Table 0-1. Summary of registered groundwater bores

Summary of registered groundwater bores within the Wallan South and Wallan East PSP areas

Bore ID	PSP area	Easting z55	Northing z55	Date completed	Use	Total depth (m)	Elevation top of casing (mAHD)	Screen top (m)	Screen bottom (m)	Yield (L/s)	TDS (mg/L)	Intersected aquifer (interpretation from drilling logs)
98215	Wallan East	324854.2	5857288	25/06/1980	Stock/ domestic	57	301.28	50	57	0.51	4030	Bedrock
98216	Wallan East	324627.2	5856995	15/05/1980	Stock/ domestic	42	299.18	30	42	0.51	3900	Bedrock
141733	Wallan East	324453.2	5856934	11/12/1999	Stock/ domestic	42	299.02	36	42	0.76	-	Bedrock
98220	Wallan East	324613.2	5857584	23/11/1981	Stock/ domestic	73	301.24	28	30	-	-	Full log says clay, which is anomalous.
98218	Wallan East	324263.2	5857284	20/04/1982	Stock/ domestic	50	299.4	20	26	1.8	3607.5	n/a
98219	Wallan East	324013.2	5856884	28/11/1981	Stock/ domestic	36.5	298.08	16	36.5	0.32	2990	n/a
98224	Wallan East	323713.2	5856984	29/09/1982	Stock/ domestic	297.9	12	34	0.63	-	n/a	
98225	Wallan East	324173.2	5856984	27/09/1982	Stock/ domestic	23	298.83	17	23	2	-	n/a
98223	Wallan East	323983.2	5857024	24/09/1982	Stock/ domestic	22	297.96	19	22	0.13	-	Newer Volcanics
98226	Wallan East	324963.2	5856884	8/10/1982	Stock/ domestic	36	299.61	30	36	2	-	Newer Volcanics
98229	Wallan East	324613.2	5857384	25/09/1982	Stock/ domestic	31	300.5	16	28	0.38	-	Newer Volcanics
98213	Wallan East	323981.2	5857652	1/10/1979	Stock/ domestic	10.66	300.74	-	-	#N/A	-	n/a
98221	Outside Wallan South	318613.2	5858384	11/09/1982	Stock/ domestic	94.4	383.94	48	60	#N/A	-	n/a
145714	Outside Wallan South	319781.2	5854267	1/03/2002	Investigation	20.6	310.29	-	-	#N/A	-	n/a
98234	Wallan South	321163.2	5855634	7/10/1985	Stock/ domestic	92	301.12	86	-	0.88	1820	bedrock
98217	Wallan South	318733.2	5858304	4/04/1981	Stock/ domestic	63	394.86	53	63	#N/A	-	n/a
98238	Wallan South	319403.2	5858084	22/10/1988	Stock/ domestic	66	372.62	4.5	66	#N/A	-	n/a
98240	Wallan South	319433.2	5857924	1/03/1991	Stock/ domestic	109	357.05	3	109	#N/A	-	n/a
145715	Wallan South	319001.2	5854668	1/03/2002	Investigation	18.2	304.39	14.2	17.2	#N/A	-	n/a
98201	Wallan South	321433.2	5855519	16/03/1971	Stock/ domestic	43.89	299.5	2.74	-	1.14	-	Newer Volcanics
98230	Wallan South	321513.2	5855984	27/03/1983	Stock/ domestic	117	308.01	-	-	0.63	1560	n/a
330483	Wallan South	321190.2	5854946	10/05/1974	Non-groundwater	37.49	304.18	-	-	#N/A	83.2	n/a

Appendix D - Summary of Potential for Contamination

Table 0-2. Summary of Site Characterisation – Potential for Contamination

Table summarising the contamination potential for each site within the Wallan South and Wallan East PSP, based on the land uses with potential to contaminate land presented in Table 2 of Planning Practice Note 30 (DELWP, 2021). Proposed further assessment is based on the approach presented in Table 3 of PPN30, assuming sensitive future use and a new use

Property No.	Site Use / Activity	Description / Findings	Site Inspection[1]	Potential for Contamination	Recommended Further Action
1	Likely poultry farming	Whilst this property could not be accessed, the imagery on Google Map appears to indicate a rural residence with adjoining shed in the north-eastern portion of the property.	No	Medium	Proceed to Preliminary Risk Screening Assessment
2, 3, and 4	Former battery egg farm	Three elongated buildings were located in the central portion of the site which were formerly used as chicken sheds. A machinery shed was located adjacent to the chicken shed which housed the plant and equipment. Various oils and chemicals were also observed in the machinery shed including two 205 litre drums containing diesel. Sheep grazing was noted during the site inspection. Animal manure was observed on the site surface across the property as well as within the former chicken sheds. Numerous stockpiles of soils were located to the west of the chicken sheds with building rubble noted in some stockpiles. Residences were located in the northern and south-eastern portion of the property. Two dams were located in the western portion of the property which potentially receive surface water from an unnamed creek entering from the northern site boundary.	Yes	Medium	Proceed to Preliminary Risk Screening Assessment
5	Likely poultry farming	Whilst this property could not be accessed, the imagery on Google Map appears to indicate a rural residence in the northern portion of the property. Two large buildings are located in the southern portion of the property however it is difficult to deduce the potential use from the imagery.	No	Medium	Proceed to Preliminary Risk Screening Assessment
6 - 7	Vacant lands	No features evident on the site	No	Low	No further action required - General Environmental Duty Applies
8, and 9	Farm building and residence	Whilst these properties could not be accessed, the imagery on Google Map appear to indicate farm residence with various outbuildings, although likely used for domestic use rather than agricultural use.	No	Low	No further action required - General Environmental Duty Applies
10	Farm building and residence	Farm residence with a horse stable.	Yes	Low	No further action required - General Environmental Duty Applies
11 -21	Vacant lands	No features evident on the site	No	Low	No further action required - General Environmental Duty Applies
22	Farm building and residence	Whilst this property could not be accessed, the imagery on Google Map appear to indicate farm residence with various outbuildings, although likely used for domestic use rather than agricultural use.	No	Low	No further action required - General Environmental Duty Applies
23-28	Vacant lands	No features evident on the site	No	Low	No further action required - General Environmental Duty Applies
29	Farm building and residence	Whilst this property could not be accessed, the imagery on Google Map appear to indicate farm residence with various outbuildings, although likely used for domestic use rather than agricultural use.	No	Low	No further action required - General Environmental Duty Applies
30	Vacant land	No features evident on the site	No	Low	No further action required - General Environmental Duty Applies
31, 32, 33, and 34	Farm building and residence	Whilst these properties could not be accessed, the imagery on Google Map appear to indicate farm residence with various outbuildings, although likely used for domestic use rather than agricultural use.	No	Low	No further action required - General Environmental Duty Applies
35	Vacant land	No features evident on the site	No	Low	No further action required - General Environmental Duty Applies
36, 37, 38, 329,	Rail siding	These properties were viewed from the closest publicly accessible areas. The rail sidings were located adjacent to the	No	Medium	Proceed to Preliminary Risk Screening Assessment

Property No.	Site Use / Activity	Description / Findings	Site Inspection[1]	Potential for Contamination	Recommended Further Action
40, 41, and 42		main running line. No notable features were observed along the rail siding.			
43	Farm building and residence	Farm residence with various outbuildings, although likely used for domestic use rather than agricultural use. Various oils and chemicals in small quantity were also observed in the machinery shed. A horse stable was located at the rear of the property.	Yes	Low	No further action required - General Environmental Duty Applies
44	Farm building and residence	Whilst this property could not be accessed, the imagery on Google Map appear to indicate farm residence with various outbuildings, although likely used for domestic use rather than agricultural use.	No	Low	No further action required - General Environmental Duty Applies
45	Vacant land??	No features evident on the site	No	Low	No further action required - General Environmental Duty Applies
46, 47, 48, 429, 520, 51, and 52	Farm building and residence	Whilst these properties could not be accessed, the imagery on Google Map appear to indicate farm residence with various outbuildings, although likely used for domestic use rather than agricultural use.	No	Low	No further action required - General Environmental Duty Applies
53, and 54	Vacant lands	No features evident on the site	No	Low	No further action required - General Environmental Duty Applies
55, 56, and 57	Farm building and residence	Whilst these properties could not be accessed, the imagery on Google Map appear to indicate farm residence with various outbuildings, although likely used for domestic use rather than agricultural use.	No	Low	No further action required - General Environmental Duty Applies

NOTES:

Yes – denotes properties that were accessed for the purposes of completing a site inspection (with landowner permission)

No – denotes properties that were not directly accesses for the purposes of completing a site inspection, but where observations may have been made via publicly accessible areas