Knox Hockey Club Inc. | PO Box 5181, Studfield, VIC, 3152
www.knoxhockeyclub.com.au | info@knoxhockeyclub.com.au | ABN: 16 997 740 936

1 April 2021

By email
Tanya Scicluna
Director – Connected Communities
Knox City Council

Dear Tanya

Knox Hockey Club – New Facility

The Knox Hockey Club is pleased to provide this further letter of support in relation to the ongoing efforts of Knox City Council to come to a final resolution in relation to the future siting of a home for the Club, and the construction of a facility commencing in the FY 2021-22.

Work undertaken by the Club

Over recent years, working together with Council officers on this project, the Knox Hockey Club has:

- Maintained a strong working relationship with The Knox School to extend the Club's tenancy as long as possible;
- Maintained active communications with Hockey Victoria in relation to the prospect of requiring a new location, to facilitate engagement from HV and assistance in relation to any transitional issues which might arise;
- Maintained a strong financial position in difficult circumstances in order to ensure the Club is able to provide their financial contribution to a new hockey pitch development, including membership expansion and other engagement with multiple State and Council-based grant opportunities;
- Worked in co-operation with officers in relation to each site option that has been brought forward for consideration, including providing practical and operational feedback at each opportunity;
- Engaged with other local stakeholders around proposed pitch locations where appropriate (e.g., Maroondah City Council, Scoresby Secondary College) to build relationships; and
- Reached out to other hockey Clubs in Melbourne which share direct residential interfaces with their hockey ground to obtain information and precedents on community management arrangements.

Proposed sites and further investigation

At this point in particular, the Knox Hockey Club would like to provide support for the proposal for further investigation of potential sites to be completed by Council, including sites at Wantirna Reserve (Wantirna), Gilbert Park (Knoxfield), and JW Manson Reserve (Wantirna).

The Club is prepared to provide whatever reasonable support and resources are required in order to ensure such investigation is progressed as immediately as possible. This is consistent with correspondence that the Club provided to Council in March 2021 confirming the continued need for a new facility and the Club's desire to focus on the use of Wantirna Reserve as their preferred outcome.

Knox Hockey Club believes that each of these sites should be investigated with priority given their potential significant upside in comparison to Benedikt Reserve. The current proposal of Benedikt Reserve is of concern to our Club given that the minimum operational requirements of a hockey club operating on a single pitch involve on-field activity extending to 10pm on weeknights to facilitate training and mid-week competitions, and 8pm on weekends to facilitate weekend competition when the Club is playing at home. Whilst competition hours change from week to week during the season (April – October), protection of these hours are critical to ensure that the Club remains viable with a single pitch solution. These hours, together with the significant change involved with developing the existing open space are

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likely to impose substantial change upon local residents that has to date attracted substantial grassroots community opposition.

Notwithstanding this, Knox Hockey Club will support Benedikt Reserve for the delivery of a single hockey pitch should it be the only option available for delivering a pitch during 2022.

Knox Hockey Club appreciates the work being undertaken by Council in relation to this project, and is committed to continuing to work and engage with Knox City Council, Knox Councillors, Hockey Victoria, local resident groups and local MPs in order to progress successful relocation in 2022.

Impact of delays – temporary solution

The Club notes that delays as a result of ongoing consultation, whilst potentially necessary, do place the future of the Club and hockey in Knox at risk in 2022. With the Club's existing home at The Knox School becoming unavailable from November 2021 onwards, without certainty in relation to siting and construction timelines there is now substantial risk of the Club starting the 2022 season without a home pitch to facilitate training and competition.

To mitigate against the risk of being without a home during 2022, the Club is actively exploring temporary alterative venues in conjunction with Hockey Victoria, which would allow the Club to continue operating in the short term. Any alternative location will need to be carefully chosen in order to provide a level of certainty to and consistency for our members, noting that it cannot be located within any suburb in the Knox municipality.

In absence of a plan to open a new pitch during 2022, the Club is liable to lose a significant number of playing members. The members the Club is at highest risk of losing include:

- Highly skilled young developing players with regional and state level experience who are looking for a hockey Club with a certain future (players in this category have already started to be lost in recent months), and
- Junior and lower grade senior players who are not prepared to travel significant distances to train and play.

Whilst membership for Knox Hockey Club increased marginally ahead of the 2020 season, membership numbers remain below trend because of:

- Limited and deteriorating facilities at the Knox School (including no pavilion access and poor standard of playing surface; and
- lack of certainty about the Club's future due to the planned closure of the school pitch.

As such, it is essential that this project remains a priority for Council and for the Club in coming weeks and months to ensure the most appropriate outcome is achieved within the delivery timelines required.

We look forward to continuing to engage with Council in relation to this matter and working collaboratively to identify and progress a satisfactory solution for hockey in the Knox municipality.

Kind regards

Stephanie Mann

Stephanie Mann
President – Knox Hockey Club
0458 602 860 (M)
president@knoxhockeyclub.com.au

MELBOURNE OUTER EAST HOCKEY FEASIBILITY STUDY

Maroondah City Council
Knox City Council
Yarra Ranges Council
City of Monash

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SECTION 1 -
EXECUTIVE
SUMMARY

INTRODUCTION

The Outer East Region includes four of the seven LGA's that make up the broader Melbourne East Region. The Cities of Maroondah, Knox and Monash, along with the Shire of Yarra Ranges, have partnered on this project to understand the current and future needs for hockey in the Outer East.

The broader Melbourne East Region provides a strong market for hockey with over 3,000 registered participants contributing approximately 15% of the total number of players across the state. High participation rates combined with gaps in facility provision and an additional 100,000 people expected in Melbourne's East over the next 10 years, supports a more strategic regional solution to address the future needs of hockey.

Hockey in the Outer East consists of four clubs (one premier league), four synthetic pitches across four venue and a total of 1,263 players connected to clubs within the study area. To guide the future planning and development of hockey in the Outer East this report delivers the following outcomes:

- A comprehensive participation analysis to understand the existing hockey climate in Melbourne's Outer East.
- An overview of current issues and challenges facing hockey participation and sustainability.
- Key findings from stakeholder consultation and priorities for the future hockey provision development.
- Existing facility access analysis including travel times for participants.
- An overview of existing and future programming.
- Investigation of proposed future sites for the development of new facilities.
- A prioritised implementation plan for the next 10 years, aligned with stakeholder responsibilities.
- An overview of development cost, viability and preferred management models.

A catalyst for this project (although not the sole driver) is the pending closure of the Knox Hockey Club pitch, currently located at the Knox School, until October 2021. Knox Council will use the findings from this study to inform decision making to support the Knox Hockey Club in finding a new home.

The model of community hockey facilities being located within schools and universities is a key issue in the Outer East that will need to be addressed to support club sustainability. In addition to the Knox issue mentioned above, two of the remaining three hockey venues are located on land not owned by local government. Yarra Valley Grammar and Monash University (Clayton Campus) provide facilities for the Croydon Hockey Club and Monash University Hockey Club respectively. There is uncertainty around the long term future for hockey at both of these sites.

Consultation with clubs within the study area and across the broader Melbourne East Region identified the following key themes:

- Lack of hockey infrastructure to support the future growth of hockey.
- Limited access and development opportunities at existing facilities.
- Replacement pitch required for Knox and additional pitches required to meet current and future demand.

The continued growth of Hookin2hockey and junior hockey, and the emergence of new social and modified programs such as Hockey Sixers and J-Ball, will drive future facility development opportunities. The delivery of new hockey facilities in the Outer East should be guided by the principle of shared use to accommodate the trends in unstructured participation being offered at flexible times.

This report provides information on existing facility classification levels identified by Hockey Victoria which have been used to inform future facility recommendations that are applicable to the Outer East Region.

DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviated terms are used within this document.

ABBREVIATION	DEFINITION
LGA	Local Government Authority. May also be referred to as Council.
Melbourne East Region	Refers the seven LGAs that make up the Melbourne East Region - The Cities of Boroondara, Manningham, Whitehorse, Maroondah, Knox and Monash and the Shire of Yarra Ranges.
Melbourne Outer East Region	The study area. Refers to the four LGAs that make up the Melbourne Outer East Region - The Cities of Maroondah, Knox and Monash and the Shire of Yarra Ranges.
Regional Hockey Facility	For this project the term 'Regional Hockey Facility' is used in the context of providing a regional solution for hockey within the study area and does not align with the true definition of a regional facility. For reference only, page 28 of this document provides the range of hockey facility classification levels from State to Club level as prescribed by Hockey Victoria.
Single or purpose built hockey pitch	For this project the term 'single or purpose built hockey pitch' refers to a pitch that is used for hockey only.
Multiuse / multipurpose hockey pitch	For this project the term 'multiuse' or 'multipurpose' hockey pitch refers to a pitch that is being used or will be used for other activities by compatible sports such as soccer, tennis, touch, lacrosse etc. These pitches are generally multi-lined but can still host competition games and events/tournaments.
Local club venue	For this project the term 'local club venue' refers to existing venues where local clubs are based or are using for training purposes.
Competition venue	For this project the term 'competition venue' refers to full size compliant hockey pitches that are being used for competition purposes.

HOCKEY IN THE OUTER EAST

Hockey is a popular sport in Victoria with 21,913 players (19,273 playing members and 2,640 Hookin2hockey players). With 1,263 registered players the Melbourne's Outer East Region contributes approximately 6% of total participants across the state.

Hockey Victoria is projecting significant growth within the sport in the next 5-10 years through the continued increase in junior player numbers and the success of social formats. Hockey Victoria is aiming for 25,000 members by 2023.

Over the past three years club hockey members based in Melbourne's Outer East has increased by 9% from 1,155 in 2015 to 1,263 in 2017. All clubs, with the exception of Monash University Hockey Club, have increased their membership numbers since 2014/15. The Croydon Hockey Club has experienced the greatest increase growing by over 200% to 179 players in 2017. In 2014 the club only had 3 senior teams and they now field senior women's and mixed junior teams.

Three clubs (Monash, Knox and Waverley) are located within Hockey Victoria's East Metropolitan Zone. Croydon Hockey Club is in the North East Metropolitan Zone. Hockey Victoria's 2015 Strategic Facilities Master Plan identified the following recommendations for the Outer East Region. It is important to note that the loss of the Knox Hockey pitch was unknown at the time these recommendations were developed.

- Development of a second pitch at Ashwood Reserve, Monash
- Renewal of the Monash University pitch.

Based on a population of 635,0019 the current pitch to population ratio for the Outer East Region is 1:158,755. This easily exceeds the industry pitch to population ratio guideline of 1:100,000 and indicates that additional pitches are required. The current pitch to player ratio is 1:316.

In comparison hockey in the G21 (Geelong) Region has a pitch to population ratio of 1:46,653. The G21 Region has a similar number of players but far less population and a greater number of pitches.

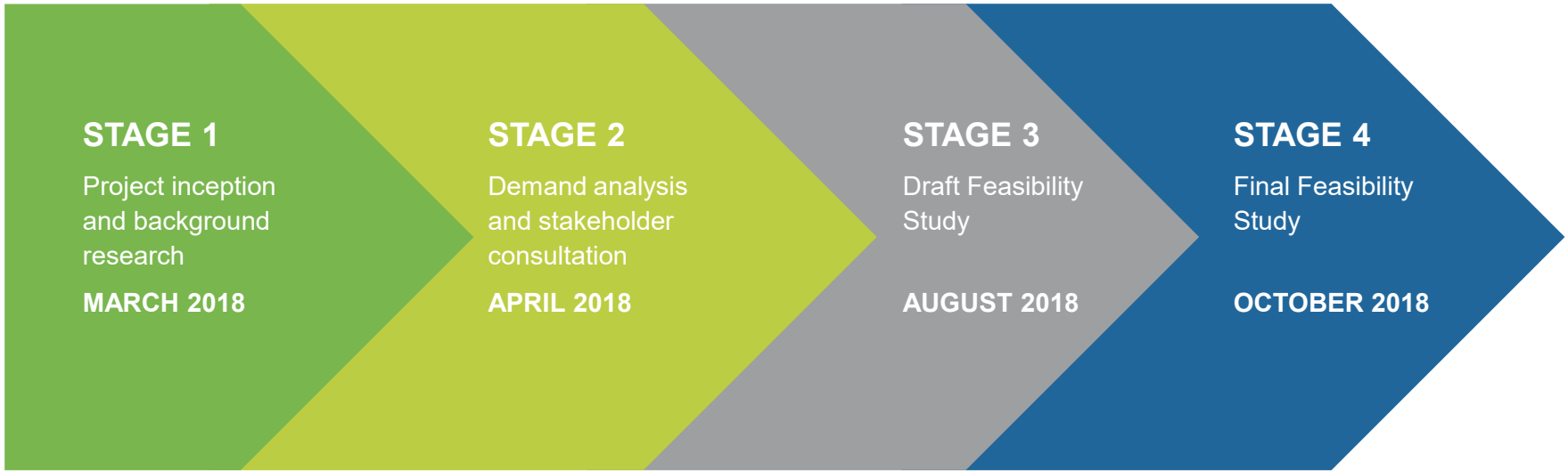
Map of the study area

Hockey players in the Outer East

- 9% increase in club membership from 2015 – 2017
- 620 registered adult participants (49%)
- 460 junior participants (36%)
- 183 Hookin2Hockey participants (14%)
- 40% female / 60% male gender breakdown
- Average player age is 22 years

PROJECT DEVELOPMENT

The Melbourne Outer East Hockey Feasibility Study has been delivered in four key stages and is due to be finalised and adopted by project partners by the end of 2018. The diagram below outlines project timelines and associated key tasks delivered during each stage in accordance with the project scope. The project is currently in Stage 3 with the draft report being considered by the Project Control Group.



- ✓ Project management
- ✓ Information and data collection
- ✓ Background document review
- ✓ Information review
- ✓ Participation analysis
- ✓ Demographic analysis
- ✓ Consultation with key stakeholders
- ✓ Demand assessment
- ✓ Facility mapping and gap analysis
- ✓ Shared use models
- ✓ Future recommendations
- ✓ Draft Feasibility Study
- ✓ Implementation plan
- ✓ Funding opportunities
- ✓ Final Melbourne Outer East Regional Hockey Feasibility Study

SECTION 2 – STATE OF PLAY

STRATEGIC PLANNING FOR HOCKEY

Following is a summary of key strategic documents that will impact the future planning and development of hockey facilities in the Outer East Region.

HOCKEY VICTORIA PLAYER AND STAKEHOLDER RESEARCH (2018)

State-wide hockey research undertaken by Latrobe University in February 2018. Key highlights include:

- 95% of active players reported that they are likely to be still playing hockey in 12 months time and 86% in 3 years time.
- 84% of current players indicated that they would be very interested in playing at least one new format of hockey.
- 77% of all Victorian players play in metropolitan areas (23% regional).
- 77% of inactive players reported interest in playing a new format of hockey.
- Average age of the current Victorian hockey player is 38 years.
- On average, the Victorian hockey player has been playing the game for 25 years.
- 59% of current players have other family members playing hockey.
- 53% of respondents plays multiple times per week, and 39% train multiple times per week.
- 40% of participants identified a need for more localised hockey competitions (decreasing travel time).
- 34% of participants highlighted the need for hockey to be offered at different times of the year.
- 30% identified a desire to play a mixed gender format of the game.
- The top 3 reasons for inactive players ceasing hockey participation included - family commitments, work / school commitments and travel for match play was too far.

HOCKEY VICTORIA STRATEGIC FACILITIES MASTER PLAN (2014)

A plan developed by Hockey Victoria to address Facilities needs.

Recommendations relevant to Melbourne's Outer East Region included in this Plan are provided below.

It is important to note that the loss of the Knox Hockey pitch was unknown at the time these recommendations were developed.

- Development of a second pitch at Ashwood Reserve.
- Development at a second pitch at Elgar Park.
- Renewal of the Monash University pitch.
- Since 2014, the Monash University pitch upgrade has been completed, and concept designs have been developed for the second pitch at Ashwood Reserve, with further planning required before further project development.

MELBOURNE EAST SPORT AND RECREATION STRATEGY (2016)

No hockey specific recommendations were outlined in this Strategy, although demand for hockey was identified as a high priority.

The Strategy highlighted the important role regional sporting facilities play in contributing to the health and well being of communities as they generally serve a broad catchment and cater for a diverse range of activities.

The Strategy investigated the issues and opportunities impacting the planning and provision of regional level facilities and is a key resource that should be considered to guide the future planning and development of regional level facilities.

PARTICIPATION ASSESSMENT

The table below provides an overview of Melbourne Outer East Hockey Club membership trends for the previous three years (2015 - 2017).

- Overall, hockey player numbers in Melbourne's Outer East Region experienced an increase of +108 participants (9%) from 2015 to 2017.
- After the reformation of Croydon Hockey Club in 2015, their membership growth has experienced growth of over 200% (+121 members).
- Knox Hockey Club and Waverley Hockey Club membership has remained relatively steady across the three year period with modest participation increases.

CLUB	2015	2016	2017	TOTAL	Member Change (+ / -)	% growth
Croydon Hockey Club	58	109	179	346	+121	209%
Knox Hockey Club	314	338	328	980	+14	4%
Monash University Hockey Club	258	265	216	739	- 42	-16%
Waverley Hockey Club	525	556	540	1621	+15	3%
TOTAL	**1155**	**1268**	**1263**	**3686**	**+108**	**9%**

Hockey members at clubs within the study area.

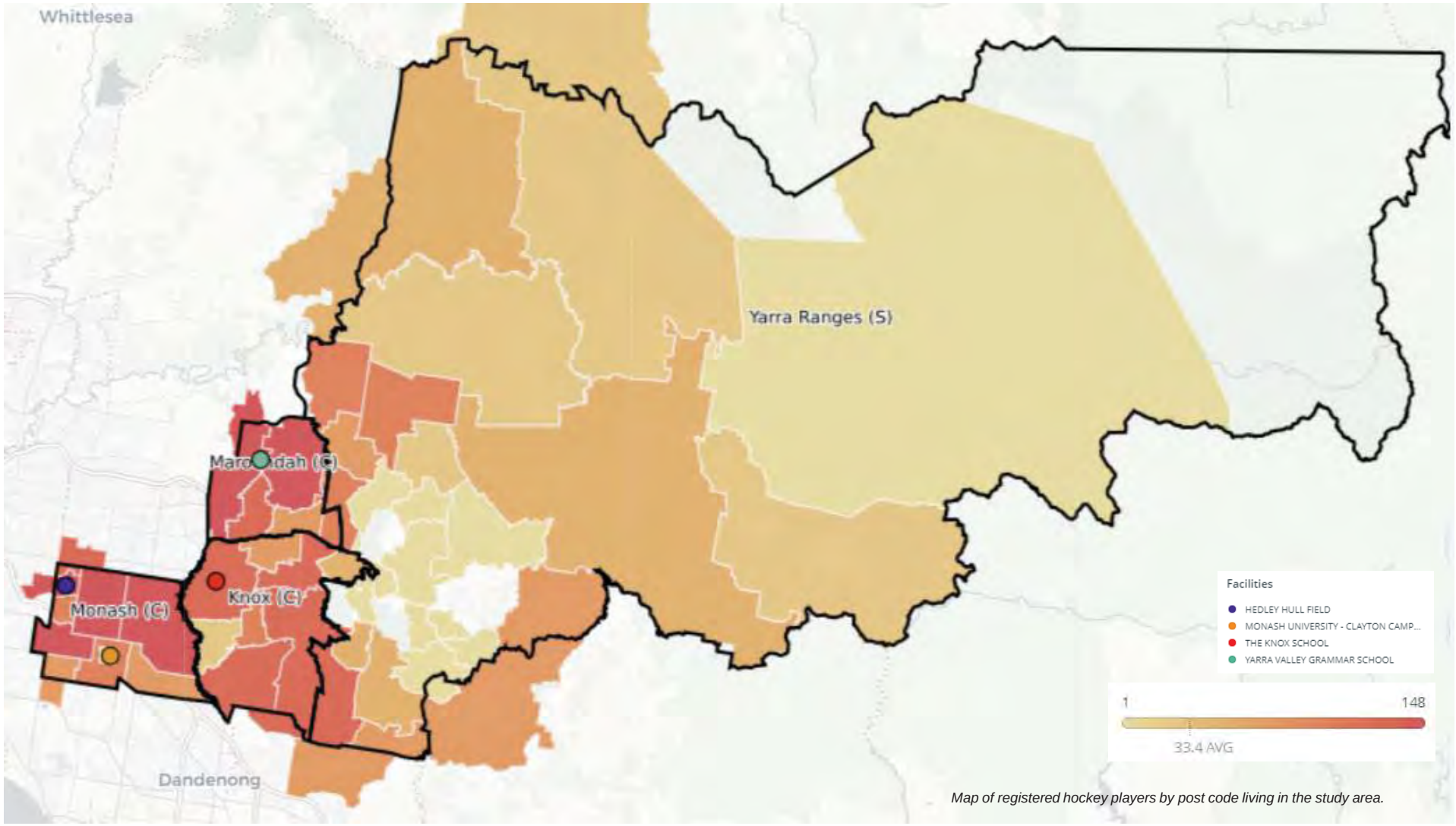
The map on the following page provides a visual representation of current hockey players living (by post code) and playing (by home club) within the study area.

The heavy red colour indicates the highest areas of hockey membership. Key participation hot spots by post code for hockey in the region are all located within the City of Monash:

- 3149 – Mount Waverley (148 hockey players).
- 3147 – Ashburton and Ashwood (121 hockey players).
- 3150 – Glen Waverley and Wheelers Hill (113 hockey players).

Other relevant participation statistics include:

- There are 1,404 registered hockey players living in the study area (regardless of where they play). Doncaster Hockey Club (136), Camberwell (59) and Greater Dandenong Warriors (42) attract the most players from within the study area.
- 825 out of 1,263 (65%) club hockey players that live and play in the study area. The Waverley Hockey Club (328) have the greatest number of players living in the study area, followed by Knox (258) Croydon (157) and Monash University (82).
- 438 hockey players live outside the study area but are members of clubs inside the study area.
- 372 resident hockey players live in the study area but play at clubs outside the study area.
- There are 3,348 hockey players playing at other clubs within the Melbourne East Region that live either within or outside the study area.



Map of registered hockey players by post code living in the study area.

EXISTING FACILITY PROVISION

The four synthetic hockey pitches in the Outer East Region are located in Monash (2), Maroondah (1) and Knox (1). Geographically the existing pitches are well spread across the study area which is enabling convenient access for players.

Currently there is no provision for hockey within the Shire of Yarra Ranges, although the soccer pitch at the Yarra Hills Secondary College in Mooroolbark is used by the Croydon Hockey Club for pre season training.

Existing facility provision across the Outer East is listed below.

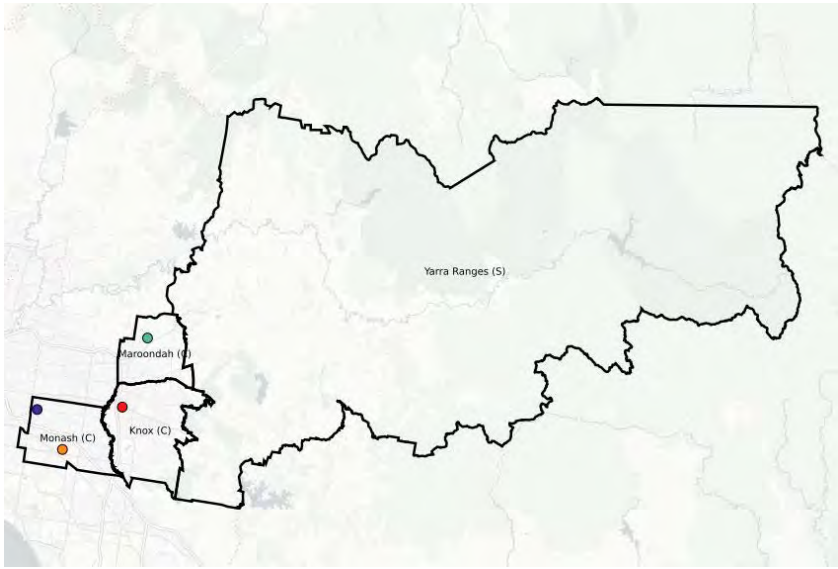
ASHWOOD RESERVE
Monash City Council
Ashwood
Waverley Hockey Club
1 hybrid synthetic grass pitch
Lighting provided (200 - 250 lux)
New LED lighting to 500 lux due late 2018

MONASH UNIVERSITY
Monash City Council
Clayton
1 hybrid synthetic grass pitch
Monash University Hockey Club
Lighting provided (200 - 250 lux)

THE KNOX SCHOOL
Knox City Council
Wantirna South
1 synthetic grass pitch
Knox Hockey Club
Lighting provided (250 - 500 lux)

YARRA VALLEY GRAMMAR
Maroondah City Council
Croydon Hills
Croydon Hockey Club
1 synthetic grass pitch
Lighting provided (250 lux)

YARRA HILLS SECONDARY SCHOOL (no located on map)
1 synthetic grass pitch
Not hockey specific
No home club (overflow venue)
No lighting provided



Map of existing hockey facilities

FACILITY USAGE

An analysis of the current usage at all four hockey pitches within the study area was undertaken to determine if pitches were exceeding recommended usage guidelines.

The hockey pitch at Ashwood Reserve in Monash is the most heavily utilised for both training and competition within the Outer East Region. The pitch is currently used approximately 43 hours per week in-season for training and competition to service the clubs 540 members.

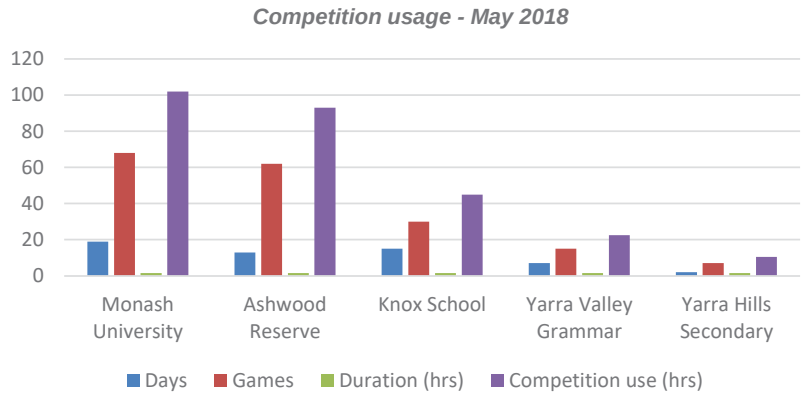
This level of use would be considered excessive in accordance with Hockey Victoria's advice that 36 hours per week should be the maximum use for a single pitch facility.

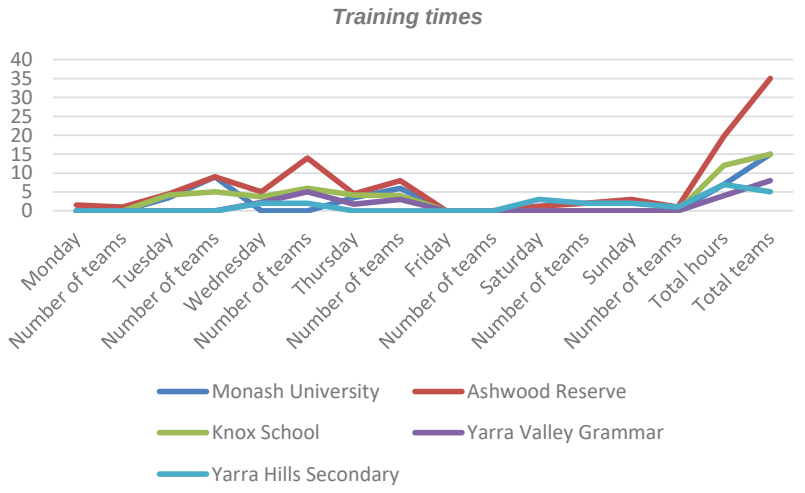
The next most heavily utilised pitch is Monash University which is used by the Monash University Hockey Club on an average of 32.5 hours per week in-season to service their 216 members. Training hours for this pitch appear lower than other pitches which has not been explained.

The Yarra Valley Grammar School has the lowest usage (less than 10 hours a week on average) and is used by the Croydon Hockey Club which have the lowest membership base. The limited access provided to the club under the current arrangement with the school could also be a factor for the low usage.

The Yarra Hills Secondary College is only being used moderately (less than 10 hours per week) for junior programs and pre season training by the Croydon Hockey Club is not appropriately dimensioned for competition hockey.

The following graphs and tables provide a more detailed breakdown of the current pitch usage (training and competition) at each venue compared to recommended capacity guidelines provided by Hockey Victoria.

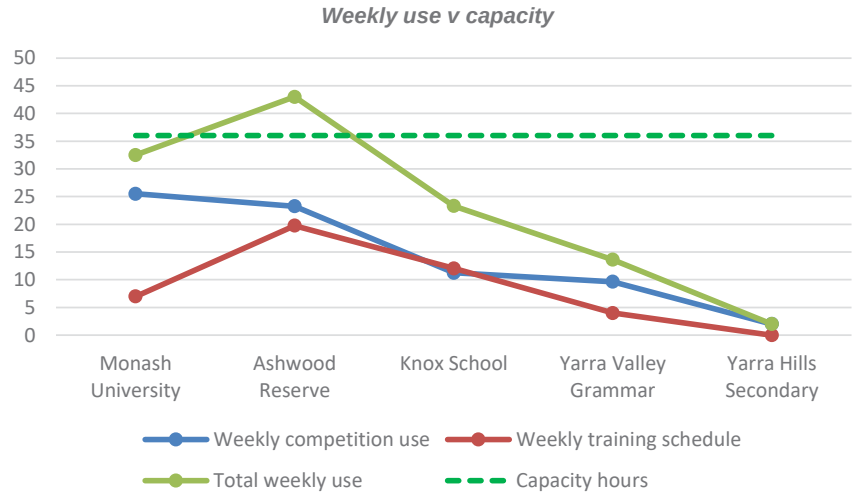




AVERAGE MONTHLY PITCH USAGE

	Competition use	Training schedule	Total weekly use	Capacity hours
Ashwood Reserve	23.3	19.75	43.0	36
Monash University	25.5	7	32.5	36
Knox School	11.3	12.05	23.3	36
Yarra Valley Grammar	9.6	4	13.6	36
Yarra Hills Secondary – *preseason and Saturday use only*	2	0	2	36

Monthly pitch usage has been sourced from Hockey Victoria fixtures (2018) and club consultation.



The weekly pitch capacity of 36 hours per week has been provided as a guideline by Hockey Victoria.

ACCESS TO FACILITIES

With fewer hockey pitches within reach of the general population compared to football ovals or basketball courts, there is a general acceptance of the need to travel to play hockey. However, the constant demand on time poor parents to drive their children significant distances to play hockey is seen as a key issue to growing the game.

A breakdown of player travel times to their respective clubs within the Outer East Region is provided below. On average approximately 80% of players are travelling up to 20 minutes to access their club facility.

Ashwood Reserve (Waverley Hockey Club)

- 540 members
- 445 (83%) live within a 20 minute drive of the facility

Monash University (Monash University Hockey Club)

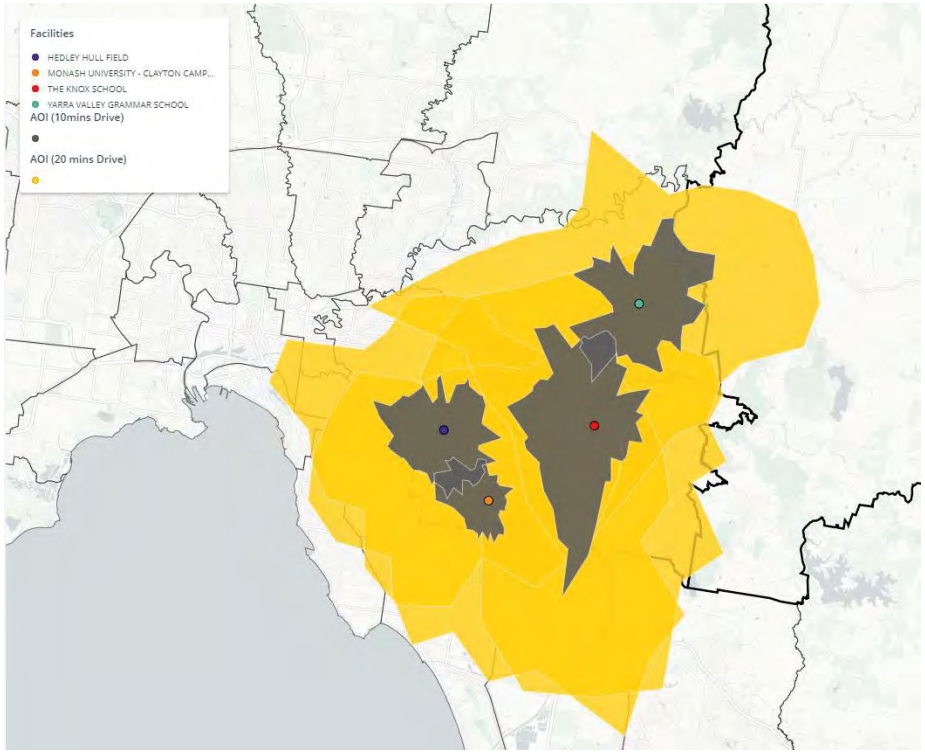
- 216 members
- 143 (67%) live within a 20 minute drive of the facility

Yarra Valley Grammar (Croydon Hockey Club)

- 179 members
- 160 (90%) live within a 20 minute drive of the facility

The Knox School (Knox Hockey Club)

- 328 members
- 275 (83%) live within a 20 minute drive of the facility



Travel times to access existing facilities - 10 minute (grey shaded area) and 20 minute (yellow shaded area).

STAKEHOLDER CONSULTATION SUMMARY

Detailed responses obtained through the consultation process have been outlined below to provide a greater level of understanding of the current needs, issues and priorities of key hockey stakeholder in the Melbourne East Region.

MELBOURNE OUTER EAST HOCKEY CLUBS

KNOX HOCKEY CLUB

- The lack of hockey infrastructure across the region is limiting opportunities for the sport.
- Some decline in club membership numbers across the past five years due to the re-formation of the Croydon Hockey Club.
- Visibility and access to the school restricts ability to grow the club and attract new members.
- Annual cost of Hockey Victoria membership has increased significantly putting financial strain on the Club.
- Uncertainty around a future facility due to the clubs lease with the school not being renewed due to the removal of the pitch.

MONASH UNIVERSITY HOCKEY CLUB

- Membership decline in recent years due the single pitch being at capacity. Difficult to schedule training with lack of pitch availability.
- Recent years has seen growth in Under 10's and 12's competition.
- Female friendly change facilities required to support female teams.
- Lack of facilities within the Melbourne East Region is hampering the ability of clubs to grow.

CROYDON HOCKEY CLUB

- Home base at Yarra Valley Grammar School - community assume it's a school based rather than a community based club.
- Multiple facility constraints at Yarra Valley Grammar including storage, shelter and poor floodlighting.
- Yarra Valley Grammar is not the clubs preferred long term option due to access constraints and the impact on potential growth. Year to year contract with the school makes it difficult for the club to invest in facility improvements / upgrades.
- Juniors use non hockey field at Yarra Hills Secondary College due to access limitations at Yarra Valley Grammar. There has been significant growth in Hookin2Hockey numbers.
- The Club would like a centralized home ground for both seniors and juniors to continue to grow membership numbers.

WAVERLEY HOCKEY CLUB

- Currently turning away members due to the pitch being at capacity.
- Significant growth being experienced in the U10 and U12 competition.
- Second pitch development to meet current demand is the highest priority.
- Lack of facilities across the Region creates issues for all existing clubs.
- Additional facility provision is required along with female friendly change facilities.

MELBOURNE EAST HOCKEY CLUBS

KEW BOX HILL HOCKEY CLUB

- The existing pitch at Elgar Park was recently resurfaced.
- A new pavilion commissioned by the City of Whitehorse was completed in 2017 at a cost of $3.3m has had a positive effect on participation growth.
- The club is seeking the development of a second pitch at Elgar Park to support growth.

DONCASTER HOCKEY CLUB

- Gradual membership growth over the past two years. Currently at 590 members.
- Additional pitch needed to meet current and future demand.
- Large catchment of players, including many from Yarra Ranges.
- Yarra Valley Grammar used as overflow ground, but is not ideally located or easily accessed by members.

CAMBERWELL HOCKEY CLUB

- A premier league club.
- The largest club in Victoria with over 1,000 members 50+ teams and continued player growth and development opportunities.
- New pavilion close to being completed that will support greater community use and access.
- Club use Koonung Secondary College as well as Matlock Reserve.

HAWTHORN HOCKEY CLUB

- Membership growth across all age groups in recent years.
- Pitch renewal at Hawthorn Malvern Hockey Centre is the clubs highest priority, followed by pavilion renewal (note the building is not council owned).
- Additional pitches in Melbourne's East are required to meet demand.
- Implementation and support for social hockey formats is required.
- Partnerships with schools should be a focus in the region to assist in growing the game.

MELBOURNE EAST LGAs

CITY OF BOROONDARA

- Three hockey pitches within the municipality.
- 2016 Sport and Recreation Strategy identified a need to increase hockey provision.
- Council is seeking partnerships with schools to increase access to hockey facilities as there is limited open space opportunities to develop new facilities.
- Camberwell hockey facility is being redeveloped.

CITY OF MANNINGHAM

- Doncaster Hockey Club is a strong and successful club and is growing.
- Council looking to assist the Club in upgrading their facility at Mullum Mullum Reserve.
- The Mullum Mullum Reserve Management Plan completed by Council in 2014 prioritised increased participation opportunities for all sports utilizing the site.

CITY OF WHITEHORSE

- Current land pressure at Elgar Park to support the development of a second pitch. Will be subject to extensive future business planning and be developed as a multi-use facility.
- The existing pitch supports overflow participation for all Whitehorse based hockey clubs.
- The development of additional hockey facilities within Melbourne East requires high specifications for floodlighting, change facilities and a provision for two fields, with flexibility in a proposed management model.

HOCKEY VICTORIA

KEY ISSUES

- Limited opportunity to implement social hockey programs as there is no capacity to access facilities during peak times.
- Current pitch usage and participation in the region is the highest in the State. There is a need to develop more pitches to grow the game.
- The pending loss of the Knox Hockey pitch.

KEY PRIORITIES

- Increasing capacity of existing facilities to allow for the implementation of social hockey programs.
- Stronger partnership with Melbourne Outer East Council's and schools to provide more security for hockey clubs.
- Social hockey incorporated into any new facility development programming schedule.
- Planning for the development of a replacement pitch for the Knox Hockey Club is a high priority.

MELBOURNE OUTER EAST EDUCATION FACILITIES

MONASH UNIVERSITY

- Hockey pitches and other sport facilities are under pressure due to lack of space at the Clayton Campus. Two existing sports fields have already been converted to student accommodation.
- There is no space for an additional pitch at Monash University. Priority is to retain the existing high grade pitch that has been used at elite level.

THE KNOX SCHOOL

- The Knox Hockey Club is the only external tenant using the pitch. The pitch was developed 20 years ago and has not seen any upgrades since.
- The land the pitch currently occupies will be redeveloped to expand school facilities beyond 2021. The school has notified the club and Council that the lease will not be renewed.
- The club has a pitch replacement (sinking fund) which may be used to contribute to the development of a replacement pitch in the future.

SUMMARY OF KEY FINDINGS AND PRIORITIES

A detailed summary of the current issues and key project drivers for the Melbourne Outer East Regional Hockey Feasibility Study are provided below to understand the needs and requirements of key stakeholders. These themes were strongly presented throughout the project engagement process and have informed the development of strategic recommendations.

PITCHES AT OR NEAR FULL CAPACITY

Current pitch usage was analysed to determine the capacity of existing pitches in the Outer East Region. Usage of Ashwood Reserve field is exceeding capacity, with Monash University and Knox operating at approximately 88% and 66% respectively. A breakdown of pitch usage and capacity is provided later in this report.

LIMITATIONS IN DELIVERING NEW SOCIAL HOCKEY PROGRAMS

High pitch usage during peak times by clubs creates challenges for Hockey Victoria in accessing facilities to run the new social hockey formats and promote the game to new markets. Investigating the use of alternate facilities and surfaces will be required to facilitate social hockey in the region.

HOCKEY FACILITIES IN SCHOOL AND UNIVERSITIES

A range of issues were identified with existing facilities being located on non Council land. The future of the Knox Hockey Club and its 328 members is uncertain with the school notifying the club and Council of its intention not to renew the lease for the hockey pitch after October 2021.

Existing arrangements for pitch access and the future use of facilities at Yarra Valley Grammar and Monash University is also uncertain.

GREATER PARTNERSHIPS WITH THE EDUCATION SECTOR

Hockey aims to strengthening partnerships with the education sector to enable greater access to facilities and increase community programming opportunities.

GAP IN HOCKEY PROVISION IN YARRA RANGES.

With no dedicated hockey facilities in Yarra Ranges and with 176 players travelling out of the Shire to participate, there will be a need to investigate shared facility development opportunities in the medium to long term.

A TWO PITCH HOCKEY FACILITY ASHWOOD RESERVE

The findings from this study supports the recommendation in Hockey Victoria's Strategic Facilities Master Plan to develop a second pitch at Ashwood Reserve. The Waverly Hockey Club has 540 members (8th largest in the State) and is unable to service the needs of existing players due to the limitations of a single pitch facility. Short to medium term planning for an additional pitch will be a focus for Monash Council.

HOCKEY PRESENCE TO MEET A GROWING POPULATION

The current hockey pitch to population ratio within the study area is 1:158,755. This will increase to 1:403,978 with the pending loss off the Knox pitch. As a hockey stronghold the Outer East will require additional pitches to meet the needs of current and future population growth, where there is expected to be an additional 44,065 people over the next ten years.

In summary, the following key focus areas were identified from the research and consultation undertaken during the development of the feasibility study:

- Development of a new facility to replace the pending loss of existing facilities.
- Development of a two pitch facility at Ashwood Reserve to meet club and community demand.
- Strengthen partnership with the education sector to increase pitch access on school and university land and provide longer term security for clubs.
- Future hockey provision in Yarra Ranges Shire will be required to provide opportunities for residents to participate and address the travel barrier.


SECTION 3 –
FUTURE DEMAND

OUTER EAST PROFILE AND DEMOGRAPHICS

The Melbourne East Region is one of the fastest growing regions in Metropolitan Melbourne. The Outer East (study area) contributes over half (56%) of the total Melbourne East population. Key population and demographic information sourced from profile.id and forecast.id are highlighted below.

MELBOURNE OUTER EAST DEMOGRAPHIC OVERVIEW

- The Outer East Region contributes 56.36% of the total Melbourne East Region population.
- Current Melbourne Outer East Region population is 635,019 with an additional +44,065 people expected to 2028.
- Overall 28.5% increase in population in the next 10 years.
- Monash population: 196,385 (+10,522 to 2028). Greatest age cohorts 40 - 49 years (12.9%) and 20-24 years (10.1%).
- Knox population: 163,170 (+12,939 to 2028). Relatively even age cohorts. 40 - 49 years highest representation at 14.1%.
- Yarra Ranges population: 158,068 (+10,609 to 2028). Greatest age cohort also 40 - 49 years (13.9%).
- Maroondah population: 117,396 (+9,995 to 2028). Relatively even age cohorts. 30 – 39 years highest representation at 14.7%.

MELBOURNE EAST SPORTING PREFERENCE

Participation in organised sport is highly valued in the Melbourne East Region, with basketball, football and netball amongst the most popular sports. Although these mainstream sports dominate overall participation, hockey has a significant presence in the Region.

PARTICIPATION TRENDS

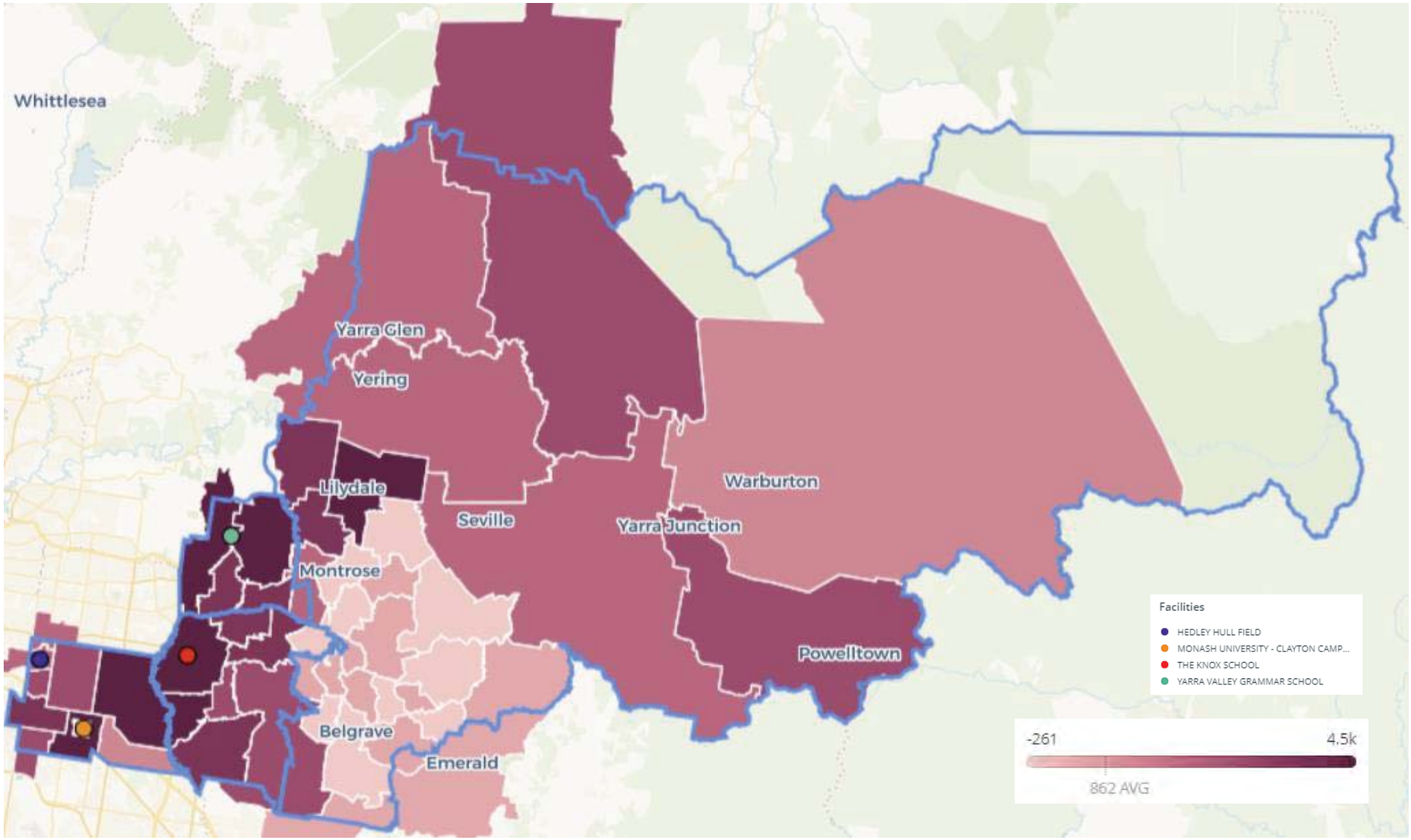
The demand for hockey and the way it is delivered will continue to grow across the Region. The way in which Australians prefer to participate in sport is changing, with busy lifestyles and time constraints playing a significant role in how sport is being consumed.

Participation in unstructured and casual forms of hockey will continue to grow, only further highlighting the need to accommodate social formats of hockey in the Melbourne Outer East Region.

KEY GROWTH AREAS

The map presented on the following page provides the forecast population growth in the Outer East Region between 2017 and 2027.

Key growth areas within the study area over the next ten years include Lilydale, Ringwood and Croydon Hills. These suburbs combined will contribute an additional 12,500 people out of a total forecast population growth of 44,065.



Map of forecast population projections in the study area.

PROJECTING DEMAND

Applying the forecast population growth to the current penetration rate for hockey in the Outer East Region is one way of projecting the number of hockey players in the future.

The study area penetration rate of 0.19% (one hockey player for every 503 residents) has been calculated by dividing the total number of hockey players at the four clubs (1,263) by the study area population (635,019), multiplied by 100. When this penetration rate is applied to the forecast population it shows an additional 95 new hockey players to 2028.

The following table provides a breakdown of potential future player growth by LGA, using post code analysis and applying individual LGA penetration rates. Please note that some post codes expand outside the study area.

LGA	2017 players	2018 – 2028 Population growth	No. of new players in 2028
Monash	633	10,522	+34
Maroondah	304	9,995	+26
Knox	291	12,939	+23
Yarra Ranges	176	10,609	+12
Total	**1,404**	**44,065**	**+95**

The map on the following page provides an illustration of the projected player numbers by LGA to 2028 based on the projected population increases and current penetration rates.

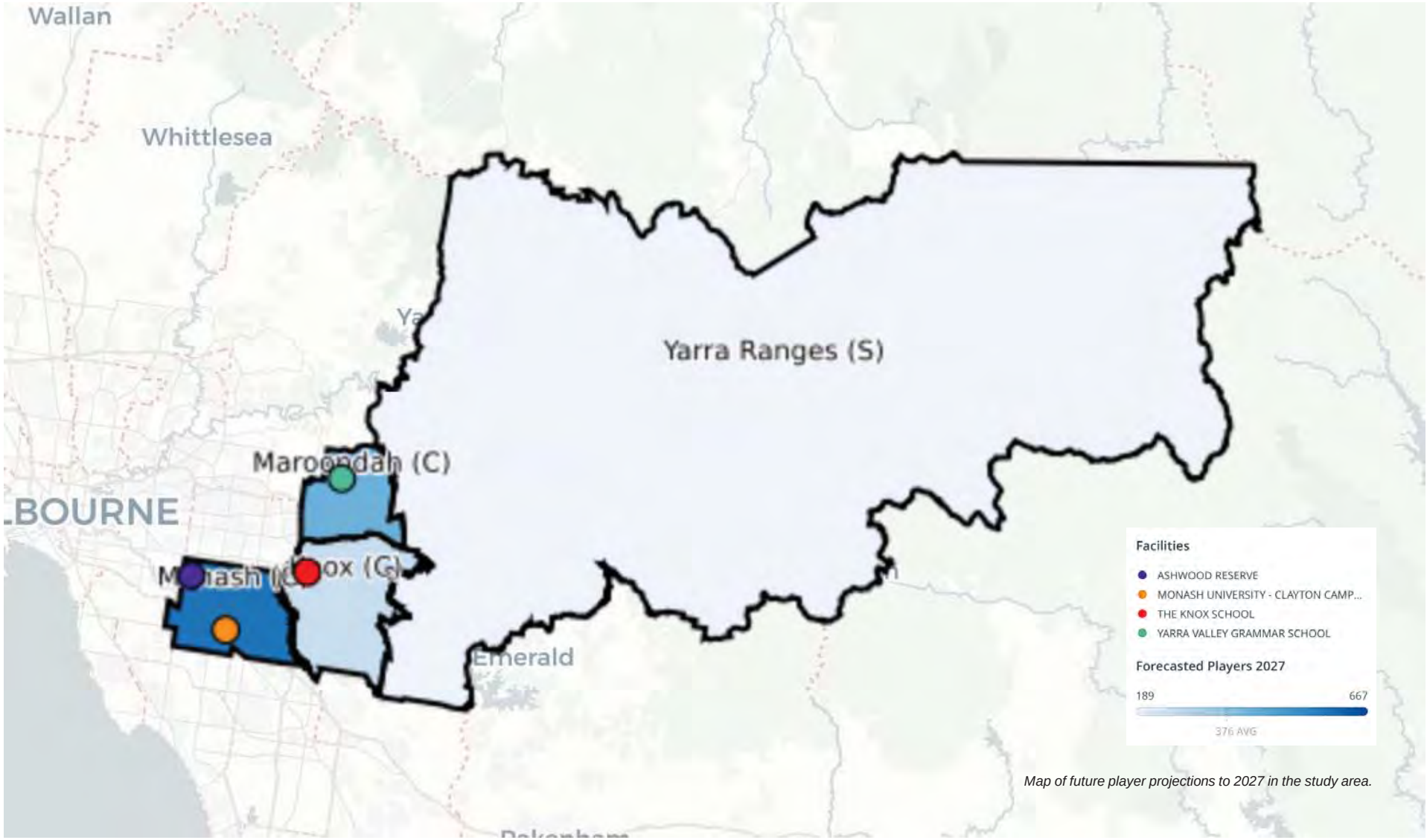
Over the previous three years (since 2015) membership numbers for the four clubs located in the Outer East Region have risen from 1,155 to 1,263, an increase of 9.35% (average 3.1% per year). Using the 3.1% annual growth rate, there is likely to be an additional 379 club hockey players associated with local clubs over the next ten years.

From a facilities perspective, integrating existing provision with industry benchmarks and current and future population can provide a guide to the number of hockey pitches required in the future. The adjacent table provides pitch to population ratios for the Outer East and for each LGA.

Current pitch to population provision ratio	1 : 158,755
Maroondah City Council average pitch to population provision ratio	**1: 117,396**
Monash City Council average pitch to population provision ratio	**1: 98,192**
Knox City Council average pitch to population provision ratio	**1: 163,170**
Shire of Yarra Ranges average pitch to population provision ratio	**0: 158,068**

If no further hockey pitches are developed in the Melbourne Outer East Region before 2028, and with the loss of Knox Hockey Club, the forecast pitch to population ratio will be 1: 403,978, significantly over Hockey Victoria's recommended synthetic pitch to population benchmark of 1:100,000.

Provision ratios should be used as a guide only. Considerations such as demographics, existing facility quality and venue accessibility are not accounted for using this method.



Map of future player projections to 2027 in the study area.

SOCIAL HOCKEY FORMATS

The way sport is being played in Australia is changing. The trend toward participation in more unstructured physical activity is evident in the 2016 AusPlay statistics, with recreational walking and gym attendances topping the list for the most popular activities for Australians.

Research undertaken by Hockey Victoria and Latrobe University in February 2018 identifies the importance of providing casual forms of hockey to meet the evolving requirements of the modern hockey participant. Two key findings from this research include:

84% of current players indicated that they would be very interested in playing at least one new format of hockey.

34% of participants highlighted the need for hockey to be offered at different times of the year.

Social Hockey is emerging as an excellent opportunity to engage both new and former hockey players to the game. Hockey Victoria, with support from VicHealth, have developed three new forms of hockey to encourage increased and new participation. These three formats are detailed in the adjacent column.

Hockey Victoria, in partnership with local clubs are investigating suitable facilities to implement social hockey programs. The preference from Hockey Victoria's perspective is to deliver these programs on an existing hockey pitch, however long pile soccer pitches or well maintained grass fields in close proximity to changerooms and toilets can also be used.

As previously mentioned, the current capacity of Melbourne Outer East hockey venues is limited, restricting the ability to support these new programs. This isn't ideal in a region with such high levels of hockey participation. For the sport to grow and develop access to existing and new facilities must be provided to enable these new social hockey formats to establish and succeed.

Hockey Game on Sixers

Aimed at past players who are not affiliated with a club and can participate without committing to regular training and competition, Hockey Sixers is a fast, fun, free-flowing version of hockey played on a smaller field, with 6 players on each team, making it more accessible and easier to get a team together.

j-Ball

J-Ball is delivered on a small hard court (43m x 22m) making it more geographically accessible. The game is played over 3 x 10 minute quarters with modified equipment, that is provided to each participant weekly, eliminating the high competition registration fees and need to purchase equipment.

KE40 Get Moving

KE40 is a new social cardio program aimed to increase and maintain fitness, and develop hockey skills. The program is delivered in conjunction with junior training and competition and is targeted at involving parents of existing participants.


Section 4 -
NEW SITE
ASSESSMENTS

FACILITY DEVELOPMENT GUIDELINES AND RESOURCES

The Victorian Government and Hockey Victoria have developed a range of resources and sport facility guidelines that should be considered when planning for the future development of a hockey facility.

Hockey Victoria's 2014 Strategic Facilities Master Plan provides information on classification levels, facility requirements and development principles. A summary of this information is outlined below to assist Outer Melbourne East LGAs to plan for a potential new hockey facility.

Classification levels and facility requirements

State Level Facility

- Two water based synthetic pitches
- 1,000 to 2,000 lux level lighting
- Player, umpires and officials change rooms
- Covered team benches
- Media amenities
- 300 seat spectator area, electronic scoring and onsite car parking

Premier League Facility

- Water based or hybrid synthetic pitch
- Greater than 300 lux level lighting
- Player and official change rooms
- Covered team benches
- Covered or uncovered viewing areas, scoreboard, onsite car parking

.

Regional Level Facility

- Hybrid synthetic pitch with capacity for use by other sports
- Additional training or half pitch (desirable)
- Greater than 250 lux level lighting
- Player change rooms and team benches
- Viewing areas, scoreboard and car parking

Club Level Facility

- Hybrid or natural grass pitch (country areas)
- Greater than 200 lux level lighting
- Change rooms and team benches
- Viewing areas, scoreboard and car parking

A more detailed checklist of on-field and off-field requirements for Premier League clubs is set by Hockey Victoria under their League Entry Criteria (LEC). All clubs competing in the Premier League must have:

- A minimum of one (1) Hybrid or Water based synthetic pitch with an FIH approved surface/ product.
- A minimum of 250 lux lighting on hybrid or water based pitch.
- A minimum of two (2) fully functional change rooms per pitch, with adequate shower facilities, which are lockable, within walking distance of pitches, have hot and cold water, and electric outlets for equipment
- Covered dugouts for players and officials including seating space for minimum 5 persons and storage space for equipment. 2.
- Covered Tech Bench area with a seating space for 3 persons.

Of the four existing hockey venues in the Outer Melbourne East only one is currently occupied by a Premier League Club (Ashwood Reserve). The remaining three are all considered club level facilities.

Development principles

The following facility development principles have been identified by Hockey Victoria.

- Enhance existing hockey facility quality and capacity.
- Address the current demand and gaps in existing facility provision.
- Improve access to hockey facilities across Victoria.
- Invest in facilities that drive participation and support local competitions.
- Create flexible spaces that encourage shared and multi-purpose use and diversify program opportunities.
- Plan for new facilities in growth areas.
- Work with stakeholders to develop whole of life costs for facility development.

HOCKEY FACILITY DIMENSIONS AND SIZE REQUIREMENTS

The following information summarises the key facility elements and components of a typical one pitch hockey development.

Main pitch

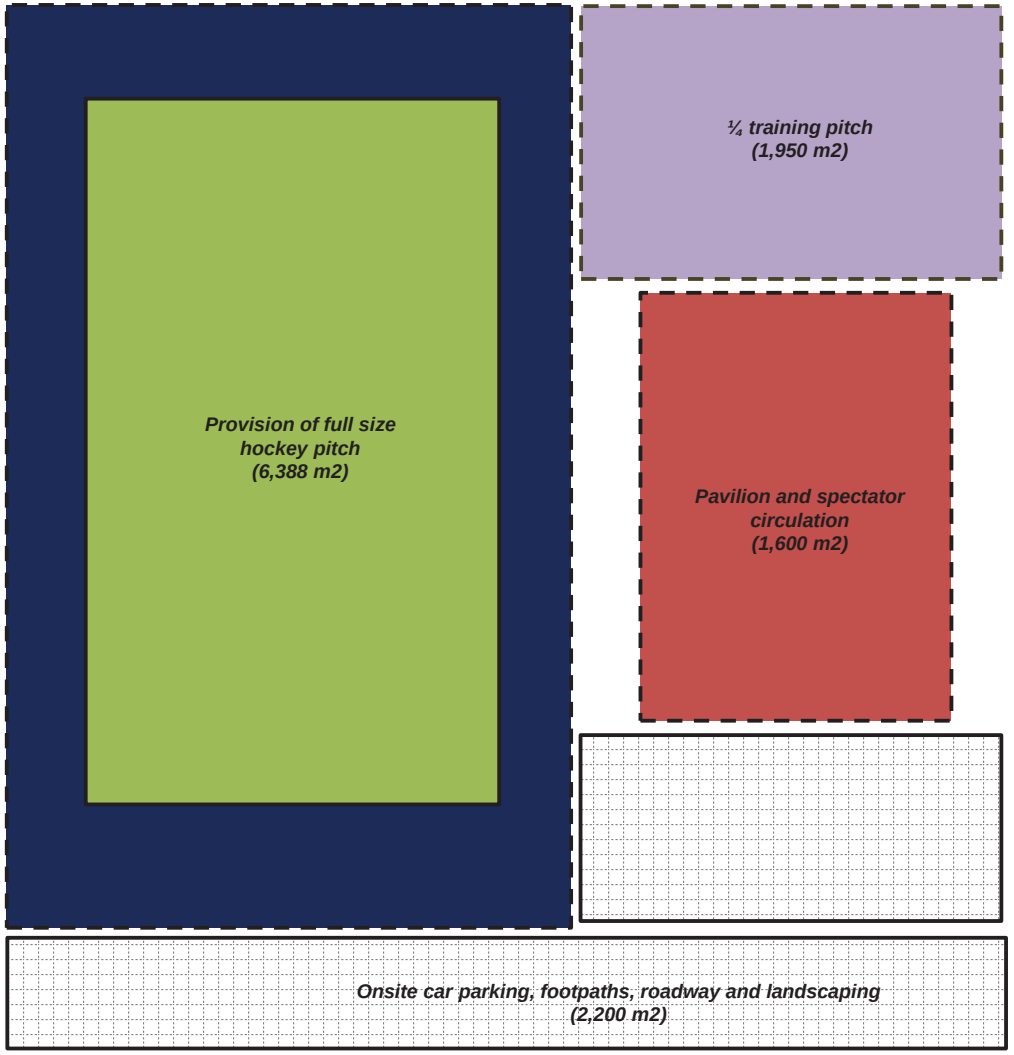
- Full-size sand-dressed synthetic hockey pitch (with maximum 5m goal line and 4m sideline run-offs).
- FIH pitch accreditation.
- 1.2m concrete perimeter pathway around pitch.
- Floodlighting to a maximum level of 500 lux.
- Set of competition and training goals.
- Player / coaches boxes with drinking fountain.
- Scoreboard (electronic scoreboard is desirable).

Pavilion amenities

- 2 unisex change rooms including toilets and showers, officials change room including toilets, shower, first-aid.
- 1 social / function area.
- 1 combined canteen / kiosk and bar area.
- 1 set of male, female and accessible toilets.
- 1 meeting room / office.
- 2 internal storage areas.

Social Hockey/Junior development / training pitch (Optional) with floodlighting to maximum level of 250 lux.

Site and spectator amenities including car parking and access roads for an estimated 140 cars, outdoor covered terraced viewing area, security lighting and site and clubhouse surround landscaping.



Indicative layout of a single pitch hockey facility with supporting amenities.

FACILITY DEVELOPMENT FRAMEWORK

Hockey Victoria's Strategic Facilities Masterplan includes a development framework and guidelines for the future planning of hockey facilities. These guidelines provide demand triggers for the establishment of new clubs through to the need for a two pitch facility, and are designed to assist clubs and local councils to plan for the future growth and development of hockey.

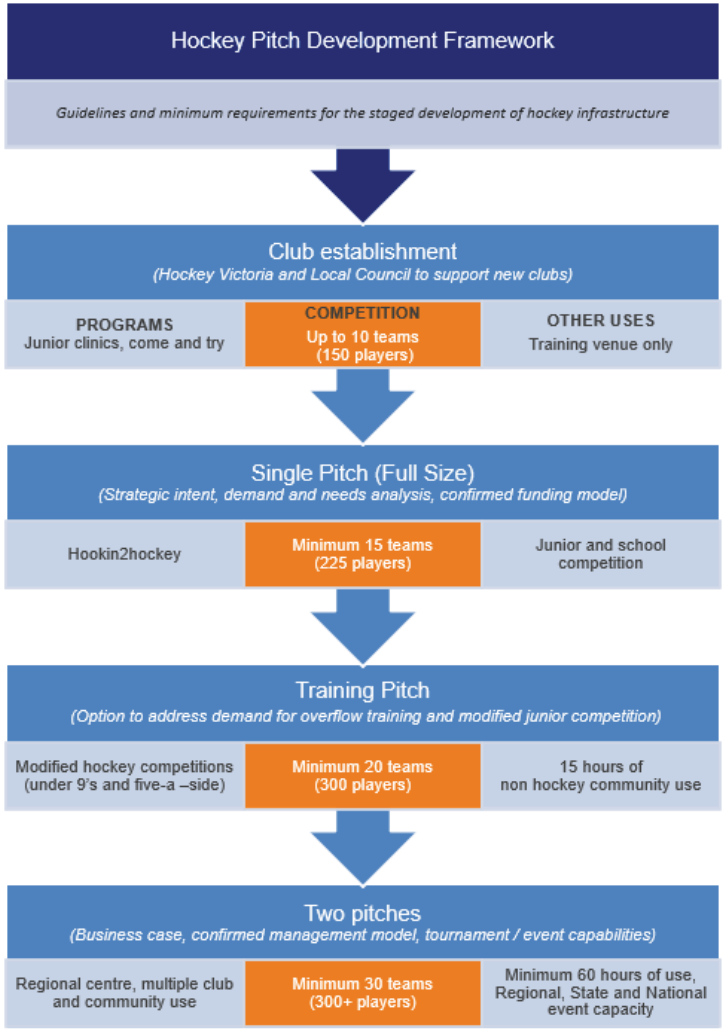
Investment in new, or the upgrade of existing pitch provision within the Outer Melbourne East Region should consider this development framework and aspire to achieve facility provision requirements and associated programming deliverables.

For the purposes of the Melbourne Outer East Regional Hockey Feasibility Study a training pitch is considered a fenced synthetic surface that is half or quarter of the size of a regular competition pitch. Training pitches are generally not required if two pitches can be developed on the same site.

The continued growth of Hookin2hockey and the introduction of social hockey programs provides support for the future development of multi-purpose training pitches to complement competition venues. These smaller pitches are looked on favourably by Hockey Victoria as they provide safe warm up areas and a facility for under 8's and modified hockey programs.

Although Hockey Victoria does not consider grass pitches as a suitable surface for either competition or training, grass is still relevant in some country areas and for junior programs. The preferred model is development of full size synthetic pitches that are either single or multi-purpose (depending on levels of use), and half or quarter size pitches for training or modified programs.

To develop the sport there are a number of other infrastructure elements that must be included in the design of a new hockey facility. This includes a functional pavilion located to the west of the pitch that offers a multipurpose social space, separate kitchen and bar facilities for both internal and external use, a minimum of 2 unisex change facilities to accommodate the use of one pitch, enhanced spectator amenity with covered viewing areas, accessible public toilets and car parking and school drop off zones.



SELECTING THE APPROPRIATE SITE

Site considerations and location requirements

There are a number of other factors that should be considered when selecting a site for the development of a new hockey facility. Sport and Recreation Victoria's *Artificial Grass for Sport Guide* indicates that construction costs can be severely impacted if the proposed site is not carefully selected.

Residential amenity, access, land stability and availability of services are just some of the factors that will affect the suitability of the site. The following broad criteria should be considered when planning for the future development of any new hockey facility.

- Minimum of 2.5 ha for a regional level (two pitch) facility (1.2ha for one pitch) with appropriate run offs, a junior development / training pitch, pavilion, car parking and circulation space.
- Relatively flat land with minimal trees to reduce the risk of long term problems with root damage.
- Prominent location that maximises public surveillance, exposure and awareness.
- Closely connected to public transport and/or major road networks (e.g. Eastlink).
- Connections to schools.
- Provision for potential future development (i.e. second pitch, and car park and/or pavilion expansion).
- Potential for multi-purpose pitch and/or pavilion use (if appropriate).
- Wind / element protection.
- Sealed car park and visible access.

The above information was considered in the development of more detailed selection criteria which has been used to assess potential development sites.

Key selection criteria for the Outer Melbourne East Region

1. Land suitability
- Is the land suitable for the development of a hockey facility?
- Is there available land for future expansion?
- Are there any significant land ownership challenges?

2. Traffic, car parking and access
- Is the site conveniently accessible by vehicles and pedestrians?
- Is the site located off a main road or residential street access?
- Is there opportunity for on and off site car parking?

3. Usage and participation
- Will the introduction of hockey support & maximise existing use?
- If a hockey facility is closing the new site should ideally be located within 5km of the existing facility to promote hockey participant retention.
- Is hockey considered compatible to other site users?

3. Local impact
- To what extent will the proximity of the proposed development and use of the site impact on local residents and neighbourhood character?
- Is there any planning or zoning issues?

4. Cost
- Any known site service issues likely to increase the potential cost?
- Is there opportunity to use existing amenities to reduce development costs?

5. Location
- Is the site considered to be in a strong catchment for participation and population growth?
- Is the site located within the accepted 20 minute drive time of the majority of current and future hockey players?

6. Shovel ready
- Is the site considered project ready once all approvals and funding has been secured?

SITE ASSESSMENTS

Site options

The site selection criteria outlined on the previous page was used to conduct a preliminary desktop assessment on a range of sites nominated by Outer East Region LGAs. All sites nominated are located within the study area and are either on Council owned or managed land or education department land.

A traffic light system was used to rank each criteria as it applied to each site.

- Green - Meets the key selection criteria
- Amber - Partially or somewhat meets the key selection criteria
- Red - Does not meet the key selection criteria

The site assessment process identified three sites as being appropriate for the future development of a hockey facility in the Outer East Region and providing a regional solution for the sport. A summary of each site including average travel distance for Knox and Croydon members is provided below.

1. Wantirna Reserve (Knox City Council)

- Existing sport and recreation reserve with adequate land available for potential future development of a regional level multi-sport hub.
- Good location with convenient access from Eastlink.
- Average travel distance for existing Knox members to Wantirna Reserve would be 9km.
- Average travel distance for existing Croydon members to Wantirna Reserve would be 12km.
- Site currently subject to the development of a Master Plan.

2. Ashwood Reserve – second pitch (City of Monash)

- Current hockey activity at Ashwood Reserve supports the need for a second pitch.
- Ashwood Reserve is a Premier League facility. An additional pitch would give it a more regional focus and attract users from a broader regional catchment.
- Average travel distance for existing Knox members to Ashwood Reserve would be 16km.
- Average travel distance for existing Croydon members to Ashwood Reserve would be 19km.
- It is important to note that a second pitch will not address broader regional demand or replace the future loss of the Knox pitch as the majority of Knox members live outside the 20 minute travel time.

3. Heathmont Secondary College - Maroondah (Education Department)

- School recently received $5.5m for development of a Wellness Centre and are exploring options to develop a hockey pitch on site.
- Average travel distance for existing Knox members to Heathmont Secondary College would be 9km.
- Average travel distance for existing Croydon members to Heathmont Secondary College would be 10km.
- A master plan process will be commencing later in 2018 with hockey to be considered in the design process.
- Car parking and other sport related amenities will need to be developed which may reduce the required footprint for hockey.

The following pages provide a more detailed assessment of each site. This includes a ranking for each criteria and scaled facility development overlays in line with the dimensions and size requirements for each core facility component.

A preliminary assessment of an additional eleven (11) sites was undertaken. These are listed in the appendices section of this report.

WANTIRNA RESERVE

Mountain Highway, Wantirna

Land suitability
Is the land suitable for development of a hockey facility?

Traffic, car parking and access
How functional and accessible is the site?

Usage and participation
Will hockey enhance participation and promote retention?

Local impact
What is the potential impact on local residents?

Cost
Do existing site conditions increase or reduce development costs?

Location
Is the site in a strong catchment for participation and population growth?

Shovel ready
Is the site considered shovel ready?

WANTIRNA RESERVE SUMMARY

The information below uses the key selection criteria to provide further detail and support for this site to accommodate the future development of a hockey facility.

Land suitability

- Wantirna Reserve is located on Crown land and is managed by Parks Victoria. Knox Council maintain and allocate use of the reserve to local sporting clubs and community groups.
- The reserve has existing sporting use and is appropriately zoned (PPRZ), providing development opportunities for additional sporting infrastructure.
- The land is large enough to accommodate one full size hockey pitch, a training pitch, on-site car parking and spectator plaza (refer Draft Concept Plans provided in the appendices section).
- The land is relatively flat with good visibility and is subject to flooding, which will need to be factored into any future design.

Traffic, parking and access

- Vehicle access is via Mountain Highway and there is ample car parking on-site that is catering for existing users.
- There is opportunity to formalise on-site parking and create in excess of 100 parking bays that will accommodate additional use.

Usage and participation

- The development of a hockey pitch on this site is compatible with existing use. Existing site users include Cricket, AFL and Tennis.
- The introduction of hockey will enhance participation at the site and complement existing use.
- The site is the closest (less than 2km) of any of the proposed sites to the existing Knox hockey facility and provides the greatest opportunity for player retention.

Local impact

- Future development of the site would not create any immediate impact on local resident. The closest residential house is approximately 400m from the site on the other side of Eastlink.
- Council is currently undertaking a Master Plan of the site which will investigate opportunities for future development and identify any local community issues.

Cost

- There is an opportunity to share the existing sports pavilion to reduce development costs. This will require further investigation from Council

Location

- Wantirna Reserve is central to the Melbourne Outer East Region.
- The site is beside Eastlink, Dandenong Creek Trail and Eastlink Trail.

Shovel ready

- Completion of the Master Plan for the site will determine project readiness and local support for future development recommendations.
- The proposed land for the potential hockey pitch is currently underutilised as open space.

ASHWOOD RESERVE

High Street & Winbirra Parade, Ashwood

Land suitability
Is the land suitable for development of a hockey facility?

Traffic, car parking and access
How functional and accessible is the site?

Usage and participation
Will hockey enhance participation and promote retention?

Local impact
What is the potential impact on local residents?

Cost
Do existing site conditions increase or reduce development costs?

Location
Is the site in a strong catchment for participation and population growth?

Shovel ready
Is the site considered shovel ready?

ASHWOOD RESERVE

The information below uses the key selection criteria to provide further detail and support for this site to accommodate the future development of a hockey facility.

Land suitability

- The site is located in the City of Monash and part owned by Monash and the Crown. Local government ownership means Council would be in a position to better support the delivery of hockey.
- The club has developed plans and costings for a second pitch which is being considered by Council. The clubs concept plan for the site is provided in the appendix.
- A quarter training pitch is not be required if a second pitch was to be developed.

Traffic, parking and access

- The site has vehicle access. Development of a second pitch would require a review of car parking provision and likely require additional perpendicular off street car parking along the edge of Winbirra Parade.

Usage and participation

- The club has approximately 35 teams. Hockey Victoria have previously indicated that 30 team is considered the benchmark for consideration of a second pitch.
- There is strong demand for the development of a second pitch at Ashwood Reserve to service the current needs of the Waverley Hockey Club.
- The existing single pitch is being overused. A second pitch would address the immediate needs of the club and enable greater community use of the facility.
- Waverley are the only premier league club in Melbourne's Outer East which offers a pathway for talented players. Other premier league clubs including Greensborough, Footscray and Camberwell have a two pitch facility.

Local impact

- The Victoria Sikh Association are a current tenant of the existing turf soccer pitch. Consultation with all existing user groups regarding a proposed second pitch will be required.
- Future development would require consultation with local residents.

Cost

- There is an opportunity to share the existing sports pavilion to reduce development costs. The existing pavilion is ideally located between existing pitch and proposed hockey synthetic pitch to the north.

Location

- Ashwood Reserve is centrally located within the Melbourne East Region and is the closest site to the CBD.

Shovel ready

- The identified land for the potential hockey pitch development is being used for soccer. Further consultation and approval by Council will be required before the site is considered shovel ready.

HEATHMONT SECONDARY COLLEGE

Waters Grove, Heathmont

Land suitability
Is the land suitable for development of a hockey facility?

Traffic, car parking and access
How functional and accessible is the site?

Usage and participation
Will hockey enhance participation and promote retention?

Local impact
What is the potential impact on local residents?

Cost
Do existing site conditions increase or reduce development costs?

Location
Is the site in a strong catchment for participation and population growth?

Shovel ready
Is the site considered shovel ready?

HEATHMONT SECONDARY COLLEGE

The information below uses the key selection criteria to provide further detail and support for this site to accommodate the future development of a hockey facility.

Land suitability

- The site is located in the City of Maroondah on education department land, limiting Councils influence over its future development and level of community use.
- The school recently received a $5.5m funding commitment from the Victorian Government to develop a Wellness Centre on the site. The project will include an upgrade of the existing gymnasium and the introduction of a potential full size multiuse synthetic hockey pitch.
- The land identified for the potential development of a hockey facility is on the existing grass playing field. There is no room for future expansion.

Traffic, parking and access

- The school is located within a built up residential area with existing vehicle and pedestrian access.
- There is approximately 100 car parking spaces on-site. Additional car parking will be required as part of the Wellness Centre project to accommodate additional community use, potentially reducing the required footprint for hockey.

Usage and participation

- The current grass playing field is used by the school and for low grade community cricket over summer outside school hours.
- The introduction of a multiuse synthetic hockey pitch on the site will enable increased use by the school and offer use 12 months of the year to local clubs and community members.
- The site is less than 7km from the existing Knox hockey facility and provides opportunity for player retention.

Local impact

- The site is on education land with no planning or zoning issues.
- Future development would require consultation with local residents due to the potential impact of lights and noise as a result of a hockey facility.

Cost

- There is a possibility that some of the $5.5m commitment from the Victorian Government can be used to develop player change rooms and amenities that would be available for community use.

Location

- The site is centrally located within the Melbourne Outer East Region and is minutes from Eastlink..

Shovel ready

- The project will be shovel ready following final design and stakeholder approval. The school is currently working with the education department on a site plan and design of the Wellness Centre.

MANAGEMENT AND SHARED USE

There are a number of different management options that could be considered by LGAs for a proposed new hockey facility at one of the prioritised Melbourne Outer East sites. These include:

1. Direct management by Council
2. Leased directly by hockey
3. Shared management by hockey and another sport (via lease or license)
4. Representative Advisory Body under Council Management
5. Committee of Management
6. Third Party or Commercial Management (via lease).

From hockey's perspective it will provide greater benefits to the sport if the facility is leased to the tenant club all year round (Option 2). A sole lease to the hockey club will provide them with a sense of ownership and care for the facility and the ability to generate revenue throughout the year that can be invested back into the facility. Traditional hockey clubs require greater access to facilities to improve their retention and manage future growth.

If the facilities are to be shared by another user then a shared management model is recommended (Option 3). The management model would consist of medium term lease agreements between the relevant LGA, resident hockey club and a compatible and suitable co-tenant (if applicable). This would involve a shared lease between the clubs for the use of the pavilion and change rooms and separate leases for the use of the playing fields (if multiple playing fields exist).

A shared lease agreement under the terms and conditions for the use of the pavilion and change rooms allows Council to transfer the general maintenance and management costs for the facility to the Clubs, and also encourages investment into the facility by the tenant Clubs.

Lease agreements will need to clearly define the broader community benefits that need to be achieved by the lessee, including the breadth of sports to be provided access to the facility, demographic or gender targets, maintenance standards and capital replacement requirements.

The individual Club lease for the use of the hockey pitch would need to consider asset renewal responsibility, which may also include a contribution to ongoing surface renewal the hockey pitch by the relevant Council.

Under a shared management model the tenant clubs would manage the facility on a daily basis and be responsible for the overall coordination and scheduling of the hockey pitch. The pavilion, change rooms and surrounding amenities, including all cleaning contracts, utility charges, asset maintenance, security, safety and risk management would also be the responsibility of the tenant clubs during their respective seasons.

As previously stated the terms and duration of these lease agreements will be determined by the relevant Council. A long term lease of 10 years or more with extension options should be considered to provide the Clubs with the security to support their long term management and financial planning and ensure stated community outcomes can be achieved.

PROVISIONAL COSTINGS

This section of the report provides recent cost estimates for the development of a purpose built hockey facility and associated amenities developed by the Knox City Council, to replace the existing Knox Hockey Club pitch at the Knox School (post October 2021). Knox City Council determined, subject to final site selection, that the establishment of a new two pitch hockey facility in Knox is estimated to cost:

Single hybrid synthetic pitch	$1.2m - $1.5m
Lighting infrastructure	$0.8m - $1m
Pavilion	$1.5m
Associated infrastructure (i.e. car parking)	$0.5m - $0.8m
Total cost estimate	**$4.5 - $4.8m**

It is important to note that costs would increase if all project elements are delivered independently to potentially accommodate project staging (if desired). However, it is reasonable to assume that cost savings could be made if all, or a combination of, elements were delivered together. For example, savings could be made in site preparation works, drainage and concrete works and project management associated with both pitches being developed simultaneously.

Alternatively, should a staged approach be preferred, the installation of electrical supply and conduit for multiple pitch floodlighting may deliver an additional cost in preliminary stages, but savings will be generated in the long-term with preparatory cabling already laid ready for connection at a later date. Costs may also be reduced if there is existing infrastructure on the site, such as a pavilion or car park, that could potential be co-shared with the hockey club. A budget for the upgrade or expansion of an existing pavilion would most likely need to factored in to accommodate the needs of hockey.

Lifecycle costs

Facility development planning must also consider ongoing maintenance expenses, as well as life-cycle and replacement costs of all hockey pitch elements, including pitch surfaces, floodlighting, fencing and equipment. In most instances, club based hockey facilities (under volunteer management), do not make sufficient revenue or retain a financial surplus to support the full cost of maintaining and replacing synthetic surfaces. As a result, the majority of clubs require the ongoing support of their land owner (generally Council), to continually provide quality infrastructure for community use.

The expected life of a hockey pitch, depending on level of usage, is between 10 and 12 years. It is expected that within a 30 year period a hockey pitch surface will need to be replaced at least twice. Replacement of pitch elements vary, from a number of years for highly used equipment such as goals, from 10 to 12 years at the time of surface replacement, through to 30 years for lighting poles and fixtures.

It will be important for LGAs to consider these future costs when structuring management and operating agreements and determining the usage fees and charges for the club and alternative hirers. The following information provides current high level life-cycle costs for key hockey pitch infrastructure and related elements over a 10 year period. These cost are in addition to the annual maintenance budget required for the facility.

Synthetic pitch surface replacement	$500,0000
Uplift and disposal of surface	$35,000
Shock pad	$75,000
Fence replacement	$50,000
Goals	$25,000
Total replacement cost (after 10 years)	**$685,000**

FUNDING OPPORTUNITIES

Maximising facility use and the ability to demonstrate increased participation opportunities and physical activity benefits through the development of a hockey pitch will be critical in being able to attract state government funding for the project.

Sport and Recreation Victoria (SRV) provide funding options that should be considered to support the development of a funding model for a hockey project. These include the Community Sports Infrastructure Fund Program and the Community Sports Infrastructure Loans Scheme.

The Community Sports Infrastructure Funding Program (Major Facilities) provides grants of up to $800,000 for construction of sub-regional and regional level sports facilities. To strengthen the identified outcomes from this funding program, Councils are required to engage SRV and other key stakeholders as early as possible to develop proposals that strongly align with the fund. To be eligible for this grant the applicant must provide:

- Site specific plan / aerial map showing location of proposed project.
- Schematic Plans (site specific) developed with SRV and stakeholder input.
- Detailed area schedule for prefabricated/modular construction projects.
- Quantity survey, tender price or independent qualified expert report are required for projects with a total project cost over $1 million.
- Evidence of confirmation of funding sources (e.g. council report confirming contribution, letter from council CEO or club bank statements).
- Environmentally Sustainable Design report(s) and budget.
- Project Management Framework.

Under this funding program SRV will provide $1 for every $3 contributed to the project from the local Council or other external funding providers. Other potential funding providers to the development of a new hockey facility to replace the planned closure of the Knox Hockey Pitch would be Knox City Council (via their capital works program) and the Knox Hockey Club who have access to a $400,000 sinking fund.

It is recommended that a condition of any hockey club lease includes a requirement of the Club to contribute to a sinking fund for future facility replacement. To ensure the Club can meet these requirements and ongoing maintenance responsibilities a whole of facility financial model should be considered as part of the Clubs lease agreement.

SRVs Community Sports Infrastructure Loans Scheme provides organisations access to low interest rate loans between $500,000 and $10 million to deliver community sport and recreation infrastructure.

The Loans Scheme can fund 100 per cent of the total project cost and be secured in conjunction with a government grant, ensuring that any grant funding program ratios are still met with the required cash contributions.

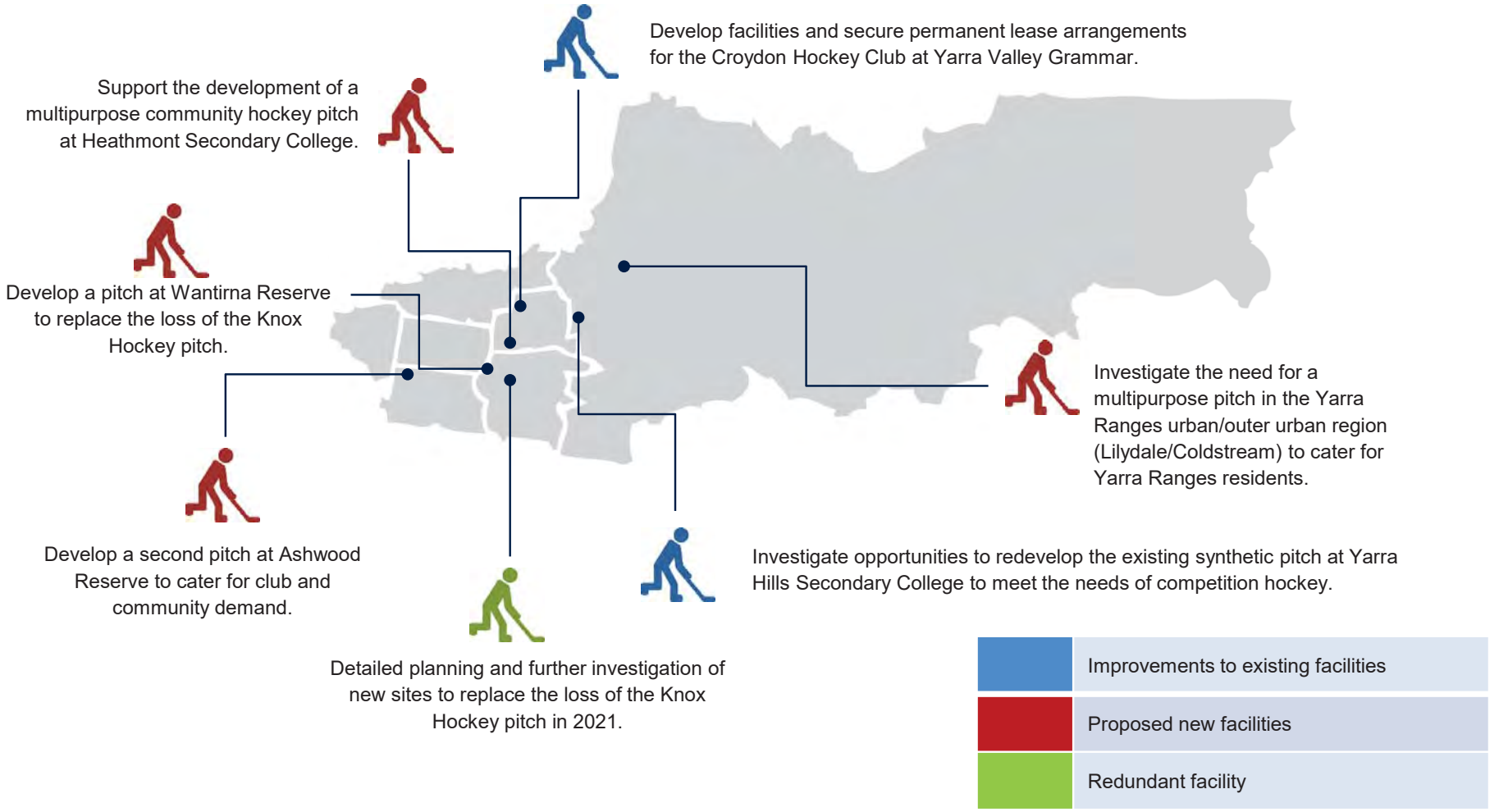
Priority will be given to the projects that provide the greatest community benefit. Of particular relevance to hockey is that the Loans Scheme can be used for projects involving synthetic sports surfaces (including replacements) and new or upgraded community sport precincts, including sports fields and lighting. Applications will consist of three components. All components must be provided in order for an application to be deemed eligible for assessment. Applicants are required to complete the loan application form and provide a supporting business case.

External funding opportunities for hockey projects will be enhanced if the project can demonstrate sharing of facilities with other sports and activities. Maximising the use of the space and encouraging greater participation opportunities for females and junior or modified programs are generally looked on favorably.

In regards to sharing a synthetic hockey pitch, lacrosse is considered a compatible sport due to its usage requirements. If demand in the area grows then the use of a new hockey facility may become a viable option for lacrosse. If this occurs, minor modifications to the pitch dimensions should be considered by the relevant LGA prior to development. Modified versions of lacrosse (e.g. Box Lacrosse) can also be played in smaller areas, similar to that of the hockey player development/training pitch.


Section 5 -
RECOMMENDATIONS

SUMMARY OF PRIORITIES FOR HOCKEY IN THE OUTER EAST



PRIORITY RECOMMENDATIONS: YEAR 1

The following strategic actions have been identified for the region and are considered critical to the successful planning, funding and delivery of hockey related projects within the Melbourne Outer East Region. It is recommended that all stakeholders in the Region acknowledge recommended actions and seek collaborative approach to their future delivery.

NO.	ACTIONS	TIMEFRAME	STAKEHOLDER RESPONSIBLE		
			INITIATE	DELIVER	SUPPORT
1.	Conduct further investigation, consultation and detailed planning for the development of a hockey venue to replace the Knox Hockey Club pitch at Knox School at one of the following preferred site options – Wantirna Reserve or Heathmont Secondary College. **	Year 1 (Immediate term)	Knox Council, Maroondah Council, Heathmont Secondary College	Knox Council, Maroondah Council, Heathmont Secondary College	Knox Hockey Club, Hockey Victoria
2.	Following agreement on the most suitable site for the Knox Hockey Club, develop a three-year relocation plan that includes a design and development program, funding model, management and operational plan, consultation and engagement process and costed design drawings.	Year 1 (Immediate term)	Knox Council, Maroondah Council, Hockey Victoria	Knox Council, Maroondah Council	Knox Hockey Club
3.	Establish stronger partnerships with the education sector and provide in principle support for the proposed future development of multi-use synthetic pitches, suitable for hockey competition at Heathmont Secondary College.	Year 1 (Immediate term)	Maroondah Council, Hockey Victoria	Maroondah Council	Department of Education and Training
4.	Undertake a feasibility study with the view to developing a sustainable funding and management model (capital and operational) for a second competition level synthetic pitch at Ashwood Reserve.	Year 1 (Immediate term)	Monash Council, Hockey Victoria, Waverley Hockey Club	Sport and Recreation Victoria, Monash Council	Hockey Victoria, Waverley Hockey Club
5.	Partner with the education sector to secure a longer-term occupancy arrangement for the Croydon Hockey Club at Yarra Valley Grammar School through the provision of upgraded player and spectator amenities.	Years 2 - 4 (Medium term)	Maroondah Council, Croydon Hockey Club	Maroondah Council, Yarra Valley Grammar School	Department of Education and Training, Hockey Victoria and Croydon Hockey Club

*** A new hockey pitch would ideally be developed on Council owned / managed land within the City of Knox and in a location easily accessible to existing Knox Hockey Club members.*

PRIORITY RECOMMENDATIONS: YEARS 2 - 4

NO.	ACTIONS	TIMEFRAME	STAKEHOLDER RESPONSIBLE		
			INITIATE	DELIVER	SUPPORT
6.	Undertake a localised demand analysis study to determine the trend in Hockey participation rates in Yarra Ranges.	Years 2 - 4 (Medium term)	Hockey Victoria, Yarra Ranges Council	Sport and Recreation Victoria, Yarra Ranges Council	Hockey Victoria
7.	Secure a sustainable funding model (capital and operational) and deliver a new hockey venue to replace the loss of the Knox Hockey pitch at Knox School, which is scheduled to close in October 2021.	Years 2 - 3 (Medium term)	Knox Council, Hockey Victoria	Sport and Recreation Victoria, Knox Council, Maroondah Council	Hockey Victoria, Knox Hockey Club
8.	Subject to findings / recommendations of the Monash City Council Ashwood Reserve Feasibility Study, undertake detailed design for a second competition level synthetic pitch with floodlighting at Ashwood Reserve.	Years 2 - 4 (Medium term)	Monash Council, Hockey Victoria, Waverly Hockey Club	Sport and Recreation Victoria, Monash Council	Hockey Victoria, Waverly Hockey Club
9.	Engage with clubs to review existing occupancy arrangements and pitch schedules to determine available times to introduce social hockey formats to the region. Support Hockey Victoria marketing strategies to promote these new formats to existing non-hockey participants.	Years 2 - 4 (Medium term)	Hockey Victoria	Hockey Victoria	All Outer East Councils and Clubs
10.	Provide support, development and occupancy advice to the Heathmont Secondary College on the proposed development of their multi-use pitch. Floodlighting, player and spectator amenities and car parking must be provided for this pitch to be suitable for club use.	Years 2 - 4 (Medium term)	Hockey Victoria, Maroondah Council	Maroondah Council, Heathmont Secondary College	Hockey Victoria, Department of Education and Training

PRIORITY RECOMMENDATIONS: YEARS 5 - 10

NO.	ACTIONS	TIMEFRAME	STAKEHOLDER RESPONSIBLE		
			INITIATE	DELIVER	SUPPORT
11.	Subject to the findings / recommendations of the Monash City Council Ashwood Reserve Feasibility Study and provision of funding, construct a second competition level synthetic pitch with floodlighting at Ashwood Reserve.	Years 5 - 10 (Long term)	Monash Council, Hockey Victoria and Waverly Hockey Club	Sport and Recreation Victoria, Monash Council	Hockey Victoria, Waverly Hockey Club
12.	Review hockey trends and re-audit existing facilities to obtain current participation, facility and demand information to inform future decision making.	Years 5 - 10 (Long term)	Hockey Victoria	Hockey Victoria	All Outer Melbourne East Councils


Section 7 -
APPENDICES

OTHER SITE ASSESSMENTS

The following nominated sites located within the study area were assessed against the agreed criteria to determine their suitability for the future development of a hockey facility. A copy of these site assessment can be provided following approval from the PCG.

Knox

- Knox Regional Sports Park
- JW Manson Reserve

Maroondah

- Quambee Reserve Horse & Pony Club
- Melba Secondary College
- Dorset Recreation Reserve
- Eastfield Park
- Greenwood Avenue

Yarra Ranges

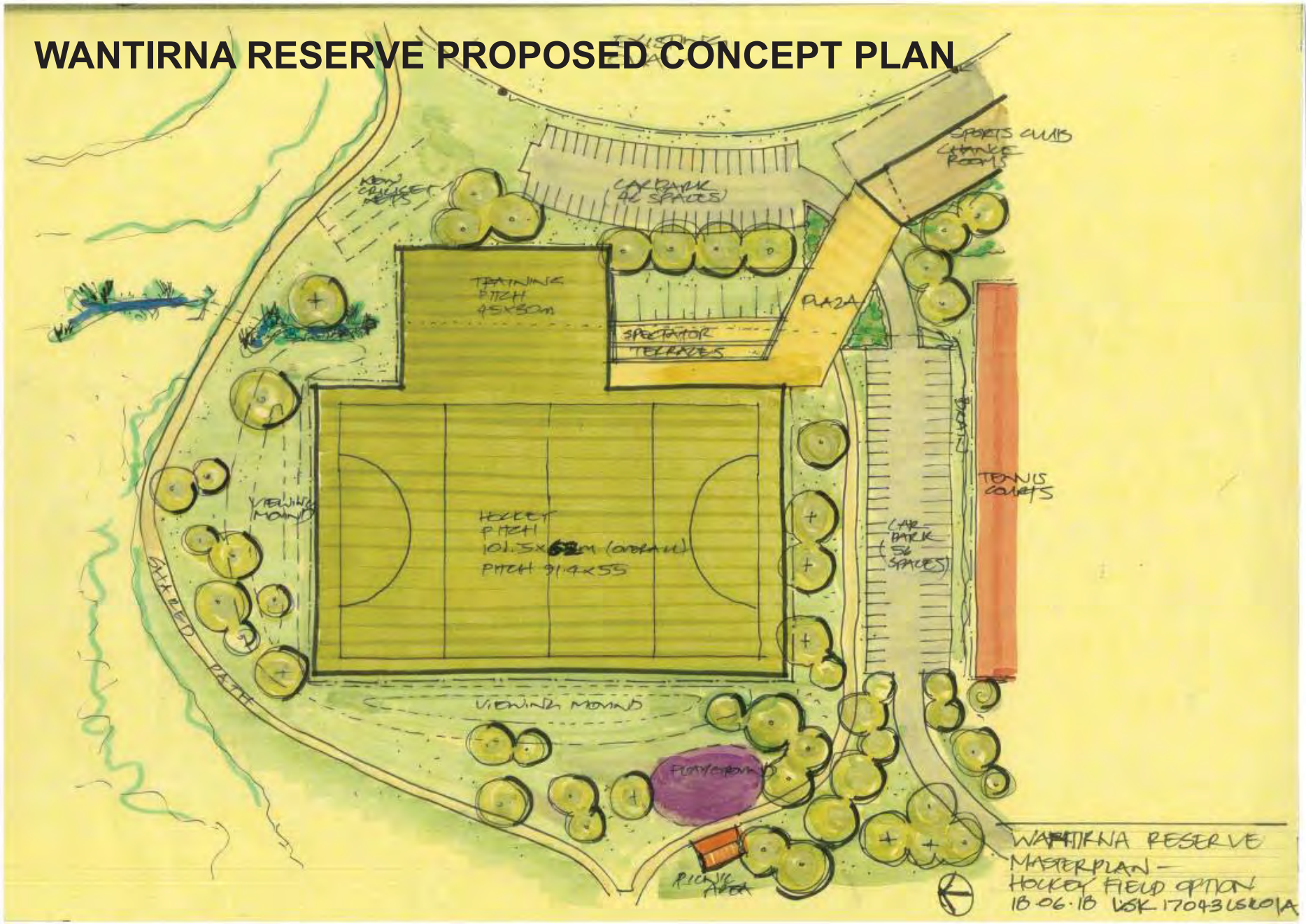
- Yarra Hills Secondary College
- Kilsyth Recreation Reserve

Monash

- Drummies Bridge Reserve
- Gladeswood Reserve


WANTIRNA RESERVE PROPOSED CONCEPT PLAN

WANTIRNA RESERVE PROPOSED CONCEPT PLAN



ASHWOOD RESERVE PROPOSED LAYOUT - CONCEPT ONLY

ASHWOOD RESERVE SCHEDULE – PITCH 1

ASHWOOD RESERVE SCHEDULE – PITCH 2

ABOUT THIS DOCUMENT

This study was commissioned by four of the seven Melbourne East Local Government Authorities (Maroondah City Council, Knox City Council, Yarra Ranges Council and City of Monash) after identifying a need to plan for the future provision of hockey across the Region.

Input and advice from the Project Control Group, consisting of representatives from the above organisations has overseen the development and delivery of this document, with support from Hockey Victoria and local clubs.

PROJECT CONSULTANTS

***insideEDGE* Sport and Leisure Planning**

Whitten Oval | 417 Barkly Street

Footscray West | VIC 3012 | Australia

Telephone | +61 3 9680 6370

Email | info@ieslp.com.au

Web | www.ieslp.com.au

Attachment 3

KNOX HOCKEY FACILITY FEASIBILITY STUDY

FEASIBILITY STUDY

Issue 001 | Revision B | 16/12/2019 | Ref: 10498-00

Author: Jess Sewell

SPORTENG

Contents

Appendices

1. Introduction

1.1 General

SPORTENG have been commissioned by Knox City Council (Council) to undertake a feasibility study and concept design for the development of the Knox Hockey Facility, within the Knox City Council municipality. The study investigates the feasibility of the development of the facility at the following sites:

- Benedikt Reserve 39-53 Rosehill St Scoresby, Victoria 3179
- Wantirna Reserve located off Mountain Highway Wantirna, Victoria 3152

The intention of the assessment is to undertake a feasibility study and produce concept designs for the following:

- One synthetic grass hockey field
- New fencing and lighting
- Site access including carparking and D.D.A compliant access to the facility
- Pavilion

This report will cover the following:

- Overview of the existing site
- Site investigation and key findings
- Development options

1.2 Existing Sites

Two locations within the municipality have been identified as potential development sites:

Benedikt Reserve (39-53 Rosehill St Scoresby)

The facility consists of the following:

- Synthetic cricket wicket
- AFL goal/ point posts
- Multi-use acrylic court
- Playground
- Pavilion and amenities block
- Formalised carpark
- Footpath network

Figure 1 - Aerial photograph of Benedikt Reserve

Wantirna Reserve (Mountain Highway Wantirna)

The facility consists of the following:

- Undeveloped green field
- Formalised AFL/ cricket oval
- Cricket nets
- Tennis Club
- Scout Hall
- Playground
- Unsealed carparks
- Connectivity to Dandenong Creek Trail

Figure 2 - Aerial photograph of Wantirna Reserve

2. Feasibility Overview

2.1 General

The site investigation consisted of the following for each respective site:

- Visual assessment
- Detailed feature survey
- Geotechnical investigation
- VicPlan assessment
- High level assessment of existing in-ground services

2.2 Visual Assessment

SPORTENG undertook a site inspection of the two sites, Benedikt Reserve and Wantirna Reserve. The assessment consisted of a visual inspection of the site to identify any site constraints that may impact on the proposed development of the site.

Refer to Appendix A for site photos.

2.3 Detailed Feature Survey

The detailed feature survey was undertaken by Surfcoast Survey & Drafting Service for both sites and consisted of the following:

- Detailed site survey to establish existing conditions

Refer to Appendix B for detailed feature surveys.

2.4 Geotechnical Investigation

Benedikt Reserve:
Ground Science conducted a geotechnical investigation of the Benedikt Reserve site on the 30th October 2019. The investigation consisted of the following:

- Drilling of 8 boreholes to a target depth of 1.5m to 2.5m below the surface level and collection of soil samples
- Laboratory testing of samples
- Preparation of report detailing geotechnical investigation, findings and recommendations for the site

Wantirna Reserve:

Council provided the following geotechnical investigation and environmental site assessment reports for review:

- Proposed Eastern Football Hub, Wantirna South Recreation Reserve Geotechnical Investigation (Preliminary), 115706. Dated the 24th March 2014 by A.S. James PTY Limited
- Preliminary Environmental Site Assessment, Wantirna Reserve Former Landfill. Dated 16 August 2019 by AECOM Services Pty Limited

Refer to Appendix C for geotechnical investigation reports and Appendix D for environmental site assessment report.

2.5 VicPlan Assessment

SPORTENG conducted a desktop assessment using Victorian State Government Environment, Land, Water and Planning electronic asset VicPlan to identify relevant land management overlays such as Land subject to inundation overlay (LSIO).

2.6 High Level Assessment of Existing In-Ground Services

Review of Dial Before You Dig (DBYD) documentation to identify any major authority underground assets.

Refer to Appendix E for relevant DBYD PDF asset plans. Note, indicative asset location only. Utilities to be traced and/ or potholed to determine impact on proposed works.

3. Assessment

3.1 Benedikt Reserve

3.1.1 Visual Assessment

Based on the visual assessment of the Benedikt Reserve site, the following key observations were noted:

- Located within a sports/ recreation hub;
  - Natural turf open field (including synthetic cricket wicket)
  - Multiuse court; tennis and half -court basketball
  - Playground
  - Pavilion and amenities block
- No sign of formal irrigation or drainage for turf open field
- Existing lighting infrastructure
- Existing AFL goal/ point posts within the field of play
- Existing path network throughout entirety of site
- Proximity/ visibility from surrounding residential road network
- No frontage to main road network, set back from Stud Road and Ferntree Gully Road within existing residential suburb of Scoresby
- Limited on-street parking
- Opportunity for off-street parking at south-east of site
- Mature trees

3.1.2 Detailed Feature Survey

Based on review of the detailed feature survey, the following was noted:

- Existing grades of the development area do not exceed governing body requirements
- Trees are located outside the development area
- Adequate spatial requirement for development of hockey field
- Survey indicates the site is serviced by the following assets:
  - Electrical - low voltage electrical conduits servicing existing light towers in vicinity of field of play
  - Gas
  - Sewer
  - Stormwater drainage
  - Potable water

3.1.3 Geotechnical Investigation

The following key findings were noted for the geotechnical investigation:

- Relatively consistent soil profile present, comprising 150mm - 300mm of organic topsoil over a silty clay material, "Humevale Formation" deposits
- The results of the laboratory testing and field tests indicate that the natural soils are considered highly reactive and likely to be subject to shrinking and/ or swelling movements
- Construction timing identified as a geotechnical risk, due to impacts of weather on the highly reactive subgrade. Construction recommended during dry, summer months

Pavement design as per Ground Science's recommendations.

3.1.4 VicPlan Assessment

Based on the desktop assessment of the VicPlan asset map the Benedikt Reserve site is outside of any land management overlays, including:

- Floodway overlay
- LSIO

3.1.5 High Level Assessment of Existing In-Ground Services

The following key observations were noted from the assessment of Dial Before You Dig PDF asset documents:

- Assets with existing site connections;
  - Electrical
  - Stormwater drainage
  - Potable water
- Assets present in surrounding areas;
  - Communications, including NBN
  - Gas
  - Sewer
- Asset mains do not appear to cut through the development area

3.2 Wantirna Reserve

3.2.1 Visual Assessment

Based on the visual assessment of the site, the following key observations were noted:

- Located within a sports/ recreation hub;
  - Adjacent natural turf oval with synthetic cricket wicket and synthetic cricket nets adjacent to development area
  - Pavilion
  - Tennis courts, Wantirna Tennis Club
  - Playground
  - Scout Hall
- Proposed development area an existing green field site - no disruption to existing formal user groups
- Proximity to adjacent high voltage electrical easement
- Existing unsealed carparks and access roads
- Signs of pavement movement observed in sealed access road and round about
- Natural swale drains with minimal formalised drainage infrastructure observed on site
- Connectivity with Dandenong Creek Trail
- Offset from Mountain Highway, no direct visibility from road network – requires signage
- Well connected with the arterial road network i.e. access from Eastlink, Mountain Highway and Burwood Highway

3.2.2 Detailed Feature Survey

Based on review of the detailed feature survey, the following was noted:

- Existing grades of the proposed development area do not exceed governing body requirements
- Trees (11) located within the proposed development area
- Adequate spatial requirement for development of hockey field
- Survey indicates the site is serviced by the following assets:
  - Stormwater drainage

3.2.3 Geotechnical Investigation

The following key findings were noted for the geotechnical investigation:

- Site was a former landfill with the exact size, extent and depth of fill not known
- The location of the proposed hockey pitch would be located over the area identified in the environmental report as the 'Northeast reworked landfill' and was operation between 1968 and 1975
- The site ownership is crownland
- Anecdotal evidence suggests that the former landfill accepted municipal waste however other waste may have been accepted
- Gas monitoring of existing structures and pits did not observe methane readings significantly greater than typical ambient readings
- Due to the presence of the underlying fill, there is a high possibility that the ground will settle over time – this will ultimately impact the performance of the overlying pavement if not properly addressed

Pavement design – Two (2) options to consider;

- Option 1 (high risk of pavement settlement)
  - Geo-composite membrane
  - 2 x 200mm capping layer with tensar grid between both layers
  - 200mm class 2 crushed rock
- Option 2 (low risk of pavement settlement)
  - Rigid pavement with piles

3.2.4 VicPlan Assessment

Based on the desktop assessment of the VicPlan asset map the Wantirna Reserve site is within the following land management overlays:

- LSIO - light blue
- Borders an environmental significance overlay area (ESO2) - lime green
- AAV Cultural Heritage area (200m offset from waterway) – a Cultural Heritage Management Plan (CHMP) required for proposed development
- Bushfire prone area

Figure 3 - VicPlan map of Wantirna Reserve with LSIO and ESO2 overlays

3.2.5 High Level Assessment of Existing In-Ground Services

The following key observations were noted from the assessment of Dial Before You Dig PDF asset documents:

- Assets with existing site connections;
  - Stormwater drainage
- Assets present in surrounding areas;
  - Communications, including NBN - Connections to adjacent oval and tennis centre pavilions
  - Electrical - Connections to adjacent oval and tennis centre pavilions
  - Potable water - Connections to adjacent sites
  - Sewer - Connections to adjacent sites
- Asset mains do not appear to cut through the development area

4. Findings

4.1.1 Benedikt Reserve

Based on the assessment of the Benedikt Reserve site the key findings are summarised in the table below.

Table 1 - Benedikt Reserve site advantages and disadvantages

Advantages	Disadvantages
• Located within an existing sports hub with adjacent oval and tennis court • Existing pavilion building – suggests sufficient services to site • Relatively flat terrain • Existing natural turf playing space has lighting – residents accustomed to sport field lighting • Playground adjacent to site • Not within a flood overlay area • Good level of passive surveillance • No tree removal required • Typical construction program - standard construction techniques, pavement tolerances maintained •	• Located within a residential area; noise and light overspill may be of concern • May impact on the current sporting groups / users of the facility (i.e. dog walkers) • Limited space for off-street parking • Neighbourhood road access only

4.1.2 Wantirna Reserve

Based on the assessment of the Wantirna Reserve site the key findings are summarised in the table below.

Table 2 - Wantirna Reserve site advantages and disadvantages

Advantages	Disadvantages
• Located within an existing sports hub consisting of adjacent oval, cricket nets and tennis courts • Adequate space for off-street parking • Undeveloped land • Relatively flat terrain • Will not impact existing sporting groups / users	• Built over an old landfill – signs of subsidence in existing sealed and unsealed pavements • Proximity to high-voltage overhead wiring • Requires removal of trees and vegetation • Potentially limited existing in-ground services for proposed pavilion • Limited existing infrastructure • Located within a flood overlay area • Limited passive surveillance • Limited opportunity to expand • Requires planning permit

5. Development Options

5.1 Project Requirement

Based on the site constraints observed, including tree retention value and spatial availability, there is limited layout options for the proposed works. SPORTENG have developed layouts for each site with the following aims:

- Provide a 'Minimum' FIH standard multi-use synthetic grass hockey field with provision for;
  - Hockey half field use
  - Soccer
  - Lacrosse
- Provide the following associated facility infrastructure, including;
  - Pavilion, size based on Knox City Council Guidelines for Developing Sports Facilities room schedule
  - Carparking
  - D.D.A compliant access between carparking, pavilion and hockey field

Refer to Appendix F for proposed development sketches.

The construction of the hockey pitch pavement and pavilion for Benedikt Reserve is not considered complex consisting of a conventional flexible pavement with capping layer. Ground conditions at Wantirna Reserve have, however dictated two potential solutions:

- Flexible pavement consisting of deep bridging layer - high risk and therefore not considered further
- Piled rigid pavement - low risk and the recommended option to be considered for the Wantirna Reserve site

Scope of works involved are considered in more detail in the following section.

5.2 Scope of Works

5.2.1 Benedikt Reserve

The scope of works for the Benedikt Reserve site and associated costs are tabulated below regarding:

- Field of play scope of works, and
- Pavilion extension scope of works

Refer to Appendix G for a detailed breakdown and assumptions and qualifications.

Table 3 - Benedikt Reserve field of play scope of works and associated costs

Field of Play Scope of Works	Cost (excl. GST)
Construction Preliminaries	$130,530
Demolition: • Remove and dispose off-site redundant in-ground services • Break out and dispose off-site existing concrete pavement • Remove and dispose off-site existing AFL goal/ point posts • Break out and dispose off-site existing light towers • Break out and dispose off-site existing synthetic cricket wicket Excavation: • Strip organic layer and dispose off-site • Cut to subgrade levels and dispose off-site • Prepare subgrade (final trim)	$135,980
In-ground Services: • Drainage: o Install hockey field drainage network and connect to existing LPoD • Electrical: o Install L.E.D lighting and posts (including footings)	$587,950
Pavements & associated elements: • Field of play works; o Construct synthetic pitch - Place and compact crushed rock layer (including capping layer) - Install FIH approved multi-use synthetic surface system including line marking o Reinstate natural turf • Construct hard pavements, including o Asphalt carpark and access road o Concrete pedestrian paths and hard stand • Concrete works; o Perimeter concrete edge strips/ kerb and channel	$1,252,560
Miscellaneous: • Fencing: o Install perimeter black chain mesh fencing (various heights) o Install pedestrian and vehicle gates with grated shoe cleaners • Sports Equipment: o Install hockey goals (including associated footings) removable o Install players and officials shelters	$193,330
Subtotal (excl. GST)	**$2,300,350**
Contingency (20%)	$460,070
Design consultancy (7%)	$161,025
Total	**$2,921,445**

Table 4 - Benedikt Reserve pavilion scope of works and associated costs

Pavilion Extension Scope of Works	Cost (excl. GST)
Construction Preliminaries	$76,440
Demolition: • Breakout bench seat and return to Council Excavation: • Strip organic layer and dispose off-site • Prepare subgrade (final trim)	$2,800
In-ground Services: • Pavilion Supply; o Electrical Services o Communications o Sewer o Hydraulics	$20,000
Pavilion: • Pavilion extension	$1,250,000
Subtotal (excl. GST)	**$1,349,240**
Contingency (20%)	$269,848
Design consultancy (7%)	$94,447
Total	**$1,713,535**

Benedikt Reserve pavilion extension is based on Knox City Council Guidelines for Developing Sports Facilities room schedule and the following methodology:

- Existing two change rooms and amenities to be retained and configured to allow each room to be divided into two and allow separate male and female change area and toilets/ showers
- Existing amenities to be extended (convert existing kitchen and storage rooms)
- Extension to provide for;
  - Medical/ trainer's room
  - Kitchen and servery
  - Social space
  - Office
  - Storage rooms, including cleaners store
- Existing toilet block to be retained

5.2.2 Wantirna Reserve

The scope of works for the Wantirna Reserve site and associated costs are tabulated below, regarding:

- Field of play scope of works, and
- Pavilion scope of works

Refer to Appendix G for a detailed breakdown and assumptions and qualifications.

Table 5 - Wantirna Reserve field of play scope of works and associated costs

Field of Play Scope of Works	Cost (excl. GST)
Construction Preliminaries	$210,030
Demolition: • Cut down and dispose of trees (including root system) • Break out existing unsealed carpark and dispose off-site Excavation: • Strip organic layer and dispose off-site • Cut to subgrade levels and dispose off-site • Prepare subgrade (final trim)	$129,250
In-ground Services: • Drainage; o Install hockey field drainage network and connect to existing stormwater drainage infrastructure • Electrical; o Site supply connection o Install L.E.D sports lighting (including footings)	$682,450
Pavements & associated elements: • Field of play works; o Construct synthetic pitch; - Rigid pavement with piles (incl. topping slab) - Install FIH approved multi-use synthetic surface system including line marking - FIH compliance testing • Construct hard pavements, including; o Concrete pedestrian paths and hard stand • Concrete works; o Perimeter concrete edge strips/ kerb and channel	$2,504,740
Miscellaneous: • Fencing: o Install perimeter black chain mesh fencing (various heights) o Install 1.2m wide pedestrian gates with grated shoe cleaners o Install 4.0m wide vehicle gate with grated wheel cleaner • Sports Equipment: o Install hockey goals (including associated footings) removable o Install players and officials shelters • Other: o Root barrier	$190,000
Subtotal (excl. GST)	**$3,716,470**
Contingency (20%)	$743,294
Design consultancy (7%)	$260,153
Total	**$4,719,917**

Table 6 - Wantirna Reserve pavilion scope of works and associated costs

Pavilion Scope of Works	Cost (excl. GST)
Construction Preliminaries	$214,150
Excavation: • Strip organic layer and dispose off-site • Cut to subgrade levels and dispose off-site • Prepare subgrade (final trim)	$2,100
In-ground Services: • Pavilion Supply; o Electrical Services o Communications o Sewer o Hydraulics	65,600
Pavilion: • Construct new pavilion – piled	$3,500,000
Subtotal (excl. GST)	**$3,781,850**
Contingency (20%)	$756,370
Design consultancy (7%)	$264,730
Total	**$4,802,950**

6. Conclusion

Both proposed sites have adequate space for the proposed development of a FIH complaint hockey pitch facility. There are key limitations for both sites:

- Benedikt Reserve:
  - Loss of open natural turf recreational space
  - Situated within a residential area
- Wantirna Reserve:
  - Former landfill site
  - Located within a flood water inundation overlay

The following table summaries the cost estimate for each site (including field of play and pavilion elements).

Table 7 - Comparison of Construction Cost Estimates

Scope of Works	Field of Play		Pavilion	
	Benedikt Reserve	Wantirna Reserve	Benedikt Reserve	Wantirna Reserve
Construction Preliminaries	$130,530	$210,030	$76,440	$214,150
Demolition & Excavation	$135,980	$129,250	$2,800	$2,100
In-ground Services	$587,950	$682,450	$20,000	$65,600
Pavements & associated elements	$1,252,560	2,504,740	-	-
Miscellaneous	$193,330	190,000	-	-
Pavilion	-	-	$1,250,000	$3,500,000
Subtotal (excl. GST)	**$2,300,350**	**$3,716,470**	**$1,349,240**	**$3,781,850**
Contingency (20%)	$460,070	$743,294	$269,848	$756,370
Design consultancy (7%)	$161,025	$260,153	$94,447	$264,730
Total	**$2,921,445**	**$4,719,917**	**$1,713,535**	**$4,802,950**

Redevelopment of Benedikt Reserve appears to be the most cost-efficient solution. Environmental factors, including existing ground conditions and site overlays indicates Wantirna Reserve is a higher risk, higher a cost option.

Appendix A - Site Photos

Benedikt Reserve, Scoresby

The following photographs provide a high-level overview of the Benedikt Reserve site.

Figure 1 - Existing changeroom / pavilion

Figure 2 - Existing natural turf playing field

Figure 3 - Flat parcel of land adjacent fields could be used for off-street parking

Figure 4 - Multi-use courts adjacent to proposed hockey pitch location

Figure 5 - Existing public amenities block

Figure 6 - Multi-use courts adjacent to proposed hockey pitch location

Wantirna Reserve, Wantirna

The following photographs provide a high-level overview of the Wantirna Reserve site.

Figure 7 - Existing unsealed carpark

Figure 8 - Undeveloped land – potential site for hockey pitch

Figure 9 - Existing cricket practice nets adjacent to proposed hockey pitch location

Figure 10 - Adjacent high-voltage overhead wires adjacent to site

Figure 11 - Existing unsealed carpark and pavilion servicing the natural turf oval

Figure 12 - Undeveloped land – potential site for hockey pitch

Appendix B - Detailed Feature Surveys


DO NOT SCALE – USE WRITTEN DIMENSIONS ONLY
No | DATE | AMENDMENTS | BY
SURFCOAST
Survey & Drafting Services P/L
CLIENT SPORTENG
PROJECT BENEDIKT RESERVE SCORESBY
DRAWING EXISTING CONDITIONS PLAN
STATUS ISSUED
NORTH POINT
DATE NOVEMBER 2019
PROJ. NO. 2019 - 646
SURVEYED SURFCOAST
DESIGNED
DRAWN SURFCOAST
DATUM AHD
SCALE (A1) 1:400
SCALE (A3) 1:800
APPROVED
FILE NAME
SHEET No. 1 of 1
REV. A
ROSEHILL STREET
ARNOLD DRIVE
BENEDIKT COURT
BENEDIKT RESERVE
TENNIS COURT
PLAYGROUND
TOILETS
SPORTS LIGHTING
SITE BENCHMARK DETAILS
POINT | EASTING | NORTHING | R.L.
BM1 | 344611.177 | 5804658.641 | 76.361
BM2 | 344807.104 | 5804654.463 | 76.759
BM3 | 344589.500 | 5804658.530 | 76.442
Legend


SURFCOAST
Survey & Drafting Services P/L
SPORTENG
KOOMBA PARK
WANTIRNA
EXISTING CONDITIONS PLAN
ISSUED
NOVEMBER 2019
2019 - 646
SITE BENCHMARK DETAILS
POINT
EASTING
NORTHING
R.L.
CRICKET NETS
CAR PARK
KOOMBA PARK
CAR PARK
Legend

Appendix C - Geotechnical Investigations

GEOTECHNICAL INVESTIGATION

BENEDIKT RESERVE, SCORESBY

Prepared for SPORTENG Pty Ltd

Report Reference: G4091.1 AA

Date: 2 December 2019

ABN 31 105 704 078
13 Brock Street, Thomastown
Victoria 3074
(P) +61 3 9464 4617
(F) +61 3 9464 4618

PROJECT DETAILS

Project Reference	G4091.1	Rev	AA
Project Title	Benedikt Reserve		
Project Location	39-53 Rosehill Street, Scoresby	State	VIC
Date	2 December 2019		

CLIENT DETAILS

Prepared For	SPORTENG Pty Ltd		
Client Address	Level 1, 206 Camberwell Road	Suburb	Hawthorn East

DISTRIBUTION

Original Held By	Ground Science Pty Ltd
One (1) Electronic Copy	SPORTENG Pty Ltd

This document presents the results of the geotechnical investigation conducted for the aforementioned project and is detailed for the sole use of the intended recipient. Should you have any questions related to this report please do not hesitate to contact the undersigned.

Author:

Gee Singh
Senior Geotechnical Engineer

Table of Contents

TABLES

1. INTRODUCTION

Ground Science have prepared this report to present the results of a geotechnical site investigation carried out for the project identified as Benedikt Reserve, located at 39 – 53 Rosehill Street in Scoresby, Victoria (the site). The scope of works detailed herein was commissioned by SPORTENG Pty Ltd (the Client) through acceptance of our fee proposal, GSP2019355 AA dated 22nd October 2019.

2. PROJECT BACKGROUND & UNDERSTANDING

We understand that the project involves the development of a synthetic playing field, which will involve conversion of the northern portion of the existing natural turf field into a synthetic hockey playing field. An overview of the site and the proposed development footprint is shown in Figure 1 below:

Figure 1: Overview of Site & Approximate Development Footprint

Ground Science were commissioned to undertake a geotechnical investigation to assist the civil and structural development of the above site, including provision for preliminary design recommendations for the proposed synthetic pavement profile.

The professional advice provided in this report is based on the information provided at the time of the report preparation and may not be valid if changes are made to the site, the development proposal or the construction methods. In the event of such changes, further advice should be sought from Ground Science.

3. SCOPE OF WORKS

The scope of works for the project generally involved the following:

- Drilling of 8 boreholes using solid flight auguring techniques to target depths of between 1.5m and 2.5m;
- Dynamic Cone Penetrometer (DCP) tests performed adjacent to each test location;
- Recover of soil samples from selected test locations and/or soil horizons for laboratory testing;
- Documentation of site features, general observations and photographs during the fieldwork.

The boreholes were advanced using a 4WD mounted ATS Drilling Rig supplied and operated by Ground Science. A suitably qualified geotechnical engineer undertook the fieldwork, located the boreholes, performed in-situ testing, logged the soils encountered and recovered soil samples. The laboratory tests were performed in Ground Science's NATA accredited testing facility in Thomastown.

4. RESULTS

4.1 REGIONAL GEOLOGICAL & GROUNDWATER CONDITIONS

Available geological information suggests the site is underlain by Devonian aged 'Humevale Formation' deposits, typically characterised as Sandstone/Siltstone overlain by associated residual soils. Available aerial imagery (obtained from Nearmap) indicates the site has remained relatively unchanged over the last 10 years, with the exception of a multi-sport paying surface constructed to the north east, however this is noted to be outside of our investigation area.

The Visualising Victoria's Groundwater (VVG) online database indicates the regional groundwater table to be located at depths exceeding 10m below surface levels. Information from nearby bores within the site or surrounding areas was not available for review.

We also understand that a low voltage (LV) service asset transects the site and the boreholes were positioned outside of such areas under the direction of an accredited utility asset locator. The approximate location of the LV service is shown on Figure 2 in Appendix A. Other service assets are also known to exist (not shown on Figure 2). It should therefore be noted that some variability in the soil profile described in the following sections may be present within trench backfill materials.

4.2 SURFACE CONDITIONS

Benedikt Reserve is situated within a residential zone and is bordered by Benedikt Court to the north, existing reserve/hard courts to the east, residential properties to the south and west. The site currently comprises of a turf field and associated club rooms/buildings on the east. Large rows of trees line the perimeter of the existing field along the east (extensively) and sporadically on the south, west and northern perimeters.

Topographically, the site was observed to be relatively flat. Minor embankments/slopes are noted along the perimeters outside of the investigation zone, generally within the existing hard-court playing area on the east. At the time of our investigation, the site was trafficable to a 4WD drilling rig. Site photographs taken during our investigation are presented in Appendix D of this report.

4.3 SUBSURFACE CONDITIONS

The subsurface soil profile encountered in the boreholes is shown on the engineering borehole logs in Appendix B of this report. A summary of the subsurface soil profile is provided below:

Unit 1: Topsoil

Unit 1 topsoil was encountered at all test locations and generally recovered as Silty CLAY (CL-CI), low plasticity, pale to dark brown, with rootlets/organics, trace sand, firm to stiff and dry.

Unit 2: Residual 'Humevale Formation' Deposits

Unit 2 Residual 'Humevale Formation' deposits were encountered at all test locations and generally recovered as Silty CLAY (CI-CH), medium to high plasticity, brown mottled grey, with trace rootlets (in the upper soil horizons), with gravel inclusions. The Unit 2 soils were typically firm to very stiff and dry to damp.

All boreholes were terminated within the Unit 2 deposits, with all boreholes achieving the target depths. Groundwater was not encountered in the boreholes during our investigation. It should be noted that groundwater can vary seasonally and with changes to drainage conditions.

A summary of the depth range of each soil unit, is shown in Table 1:

Table 1: Summary of Subsurface Soil Profile

Location	Unit 1: Topsoil	Unit 2: 'Humevale Formation'	Completion
	Depth Range of Soil Unit (m)		
BH1	0.0 – 0.15	0.15 – 2.5	Terminated @ 2.5m
BH2	0.0 – 0.20	0.20 – 1.5	Terminated @ 1.5m
BH3	0.0 – 0.20	0.20 – 1.5	Terminated @ 1.5m
BH4	0.0 – 0.15	0.15 – 1.5	Terminated @ 1.5m
BH5	0.0 – 0.15	0.15 – 1.5	Terminated @ 1.5m
BH6	0.0 – 0.15	0.15 – 1.5	Terminated @ 1.5m
BH7	0.0 – 0.2	0.2 – 1.5	Terminated @ 1.5m
BH8	0.0 – 0.3	0.3 – 2.5	Terminated @ 3.0m

4.4 DYNAMIC CONE PENETROMETER (DCP) TEST RESULTS

Dynamic Cone Penetrometer (DCP) tests were performed adjacent to each test location, and advanced from the existing surface level. The DCP results are presented below:

Table 2: Dynamic Cone Penetrometer (DCP) Test Results

DCP	DCP1	DCP2	DCP3	DCP4	DCP5	DCP6	DCP7	DCP8
Location	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Datum	Existing Surface Level							
Depth (m)	DCP Blows/100mm Penetration							
0.0 – 0.1	3	2	2	2	2	6	1	1
0.1 – 0.2	4	2	3	2	2	7	2	2
0.2 – 0.3	3	2	2	2	2	6	2	2
0.3 – 0.4	2	2	2	2	2	6	3	2
0.4 – 0.5	2	2	3	2	2	5	2	3
0.5 – 0.6	3	2	3	2	1	5	2	3
0.6 – 0.7	3	2	3	2	1	5	2	3
0.7 – 0.8	3	2	5	2	1	5	3	3
0.8 – 0.9	-	2	-	2	1	-	-	-
0.9 – 1.0	-	2	-	2	1	-	-	-
1.0 – 1.1	-	4	-	3	1	-	-	-
1.1 – 1.2	-	4	-	7	2	-	-	-
1.2 – 1.3	-	7	-	7	2	-	-	-
1.3 – 1.4	-	-	-	-	4	-	-	-
1.4 – 1.5	-	-	-	-	6	-	-	-

The DCP test results were observed to vary across test locations and with depth at each test position. The DCP tests generally indicate firm to stiff or better soil conditions at most test locations, however soft to firm test positions are noted to existing within several test positions. The DCP results indicate that poor site trafficability and workability of the soils will be experienced during wet winter months. Some difficulty may also be experienced in achieving proof rolling or compaction and it is strongly recommended that works commence during dry, summer months. Lower DCP blow counts are expected under elevated moisture levels.

4.5 LABORATORY TEST RESULTS

Soil samples were recovered from soil units Unit 2 and Unit 3 at selected locations and soil horizons. Laboratory test reports are presented in Appendix C and summarised below:

Table 3: Summary of Laboratory Tests

Sample #	Location/Depth	NMC (%)	wL (%)	pL (%)	PI (%)	PI x %≤ 425µm
#1	BH2 (0.3 – 0.5)	21.7	40	20	20	1880
#3	BH2 (1.3 – 1.5)	17.1	52	25	27	2322
#5	BH5 (0.8 – 1.0)	21.7	70	25	45	4275

NMC: Natural Moisture Content; wL: Liquid Limit; pL: Plastic Limit; PI: Plasticity Index

The laboratory test results generally indicate the samples to comprise of medium to high plasticity clay soils, with varying fractions of sand and gravel noted, as observed in the boreholes. In general, the soil samples were noted to be either close to or dry of the inferred optimum moisture content. The Weighted Plasticity Index (PI x %≤425µm) indicates the Unit 2 soils on this site to be very highly expansive in nature.

5. DISCUSSION

The boreholes have shown a relatively consistent subsurface soil profile, comprising of up to 0.3m of Unit 1 topsoil overlying Unit 2 residual Humevale Formation deposits. The laboratory test results generally supported the findings of the boreholes and indicate the soils on this site to be very highly expansive (i.e. reactive and sensitive to volumetric changes under different moisture levels). The DCP test results indicate soft to firm soil zones at some test locations and a key geotechnical risk identified on this site is construction timing, which should occur during dry, summer months.

Careful consideration must also be given to the existing embankments or surrounding elevated areas, which may direct overland surface flows towards the field. Cut-off/perimeter drains and associated collector pits shall form part of the works in such areas. If water is allowed to pond against the edge of the synthetic field, differential movements are likely to be seen in the surface. The presence of rows of large trees is also considered a geotechnical risk on this project and the use of tree root protection systems is recommended, should the playing field edges be located within a distance of 1 x Mature Heights of the trees.

For the purposes of this report, it is assumed that the proposed synthetic playing field will comprise of a horizontally draining profile. Should a vertically draining profile be adopted, further advice shall be sought from Ground Science.

5.1 SUBGRADE CHARACTERISTICS

The proposed synthetic field may be suitably founded on a prepared subgrade of the Unit 2 soils. The Unit 1 topsoil shall form part of stripping works, which we anticipate to require between 0.2m and 0.3m of existing materials. Total stripping depths shall be assessed at the time of construction. The following procedures are recommended for the subgrade preparation phase of the project:

- All existing grass cover/topsoil/organic material/exposed silts or unsuitable materials are removed to expose the Unit 2 soils;
- An assessment of the condition of the exposed subgrade is required by this office or a qualified geotechnical practitioner;
- The subgrade shall be ripped/tyned and moisture conditioned to a depth of not less than 300mm, and to within +/- 3% of OMC, and subsequently compacted to achieve a target density ratio of not less than 98% Standard;

- If the above target density ratio is not achieved, further advice must be sought from Ground Science;
- A minimum of 6 field density tests is required by a suitably qualified NATA accredited testing body.

- The stripped subgrade prior must be proof rolled using a fully loaded water cart (or plant with similar axle loading characteristics with an equivalent load of 12 tonnes) with any soft spots, deflections or rutting to be further stripped until a firm base is achieved or suitably remediated as directed by the GITA;
- If applicable, any filling works must be undertaken to Level 1 procedures as described in AS3798 (2007) 'Guidelines on Earthworks for Commercial and Residential Developments' with compaction levels to be verified by field density testing undertaken by a NATA accredited testing facility;
    - Fill materials shall be free of organic matter, oversize particles including no particle over 20% by volume, particles coarser than 37.5mm and no particle over 200mm in any dimension;
    - Fill materials shall be placed in layers not exceeding 200mm loose thickness and compacted to achieve a target dry density ratio of not less than 95% Standard Compaction (AS1289 5.1.1, 5.4.1 or 5.7.1) and not exceeding 102% Standard Compaction;
    - The top 300mm of the finished subgrade level shall be compacted to achieve a target dry density ratio of not less than 98% Standard Compaction (and not more than 102% Standard Compaction) with a minimum test frequency of 6 tests required at the top of subgrade;
    - All fill materials shall be moisture conditioned to within +/- 3% of the Optimum Moisture Content (SOMC).

If service trenches are identified during the stripping phase, further DCP or field density testing is recommended, as pre-existing poorly backfilled service trenches will be detrimental to the performance of the future sports field. If further inspections identify poorly backfilled shallow trenches (<1.5m), this material may be replaced with suitable fill or stabilised sand. For deep service trenches, a more specific remediation method may be adopted, such as the use of geotextiles or similar. This shall form part of further assessments after site stripping is completed. It is further recommended that if deleterious materials, organics, silts or unstable soils are encountered during the stripping phase, these materials shall also be removed.

5.2 SUBGRADE PROTECTION

Given the reactive and expansive nature of the subgrade, a uniform subgrade protection layer must be included in the design. The subgrade protection layer shall comprise a VicRoads Type A (soft rock) capping material and be a minimum 200mm thick. Alternative products may also be considered, such as a 40mm minus NDCR or a 20mm VicRoads Class 4 FCR.

Alternative products (to a VicRoads Type A soft rock) must be first tested for compliance to the below selection criteria:

Table 4: Capping Material Selection Criteria

Physical Properties			Limits of Grading			PI x %>425µm	PI
CBR %	Swell %	Permeability m/s	40mm	4.75mm	75µm	≤1000	≤25
≥6	≤1.5	≤5 x 10^{-9}	100	60–80	10-40		

It is advised that the selection of an appropriate capping material be undertaken during early stages of the project. Suitable capping materials, complying with Table 4 above, can be difficult to source in the current industry. The use of subgrade stabilisation (using lime/cement) may be considered as an alternative solution to the capping layer. If adopted, further advice should be sought and further optimum lime content testing may be warranted.

The capping layer shall be compacted to achieve a target density ratio of not less than 98% Standard Compaction with a minimum of 6 field density tests performed. The capping layer must extend outside the boundary of field by a minimum of 1.5m to prevent moisture infiltration into the pavement edges. The capping layer shall be finished with a smooth drum roller to prevent any protruding angular rocks or sharp edges.

A composite membrane shall be placed over the capping layer with all joins machine welded. The membrane shall also extend 1.5m outside the edge of the field (including aprons/footpaths) with the edges turned down or suitably anchored. The composite membrane must be an approved single product consisting of two layers of A24 grade geofabric or similar either side of a polyethylene membrane. The composite geomembrane must be between 0.2µm and 0.7µm in thickness.

It is further recommended that root barriers are installed along all court perimeters located within a distance of 1 x Mature Tree Heights. If trees are removed, tree roots/stumps must be fully grubbed and the soils within this zone allowed to achieve equilibrium or alternatively suitably moisture conditioned and recompacted as part of the bulk earthworks program.

5.2.1 SURFACE PROFILE

The proposed sportsfield profile may comprise a minimum 175mm thick VicRoads 20mm Class 2 or Class 3 FCR base course, compacted to achieve a target density ratio of not less than 98% Modified Compaction. The proposed playing surface may be subsequently installed over the base layer and is subject to the designer's specification.

Consideration must be given to the application of corking at joints between asphalt and concrete (including spoon drains or footpaths) around the site, if applicable. Cracks that form at this interface may exacerbate the potential for moisture infiltration into lower lying layers of the profile. A regular review and maintenance period are required of all joints around the playing field, with any observed separation be suitably remediated.

5.2.2 EFFECTS OF TREES & DRAINAGE

A suitably designed drainage system is considered critical on sports fields. We recommend that service trenches are avoided below the field, however should this not be possible, all subsurface trenches must be suitably lined with the composite membrane. Common failures in synthetic fields are a result of poor backfill procedures of all service trench works. It is highly recommended that all backfill procedures for service trench work is tested for compaction or work method placements validated by a qualified geotechnical engineer. We recommend hold points are attached to these functions for all works under critical structures.

Suitably designed spoon drains should form part of the design with the subgrade protection layer to extend past the concrete spoon drains. Consideration must also be given to drainage of surrounding areas, particularly where the existing batters slope towards the courts. It is recommended that edge batters or slopes should incorporate suitable cut of drains to ensure no edge infiltration of moisture occurs at any field perimeter.

Due to the reactive natural clay subgrade conditions in some areas, trees within close proximity to the playing courts will likely result in further shrinking and swelling of the subgrade soils, causing differential movements and pavement failure. Due to the fine tolerances within synthetic fields it is suggested that root barriers are installed as previously recommended in this report. A qualified arborist should be commissioned to provide advice regarding mature heights and safe distances. Careful consideration should be given to the removal of trees, as tree removal may allow for the subgrade soils to become wet and swell, potentially compromising the performance of the pavements.

Drainage during the construction phase of the works must also be suitably managed. The timing of construction, levels of stripping and delays from the stripping phase to construction phase are all likely to contribute to further issues, if not suitably managed. All areas of the site must be suitably drained and/or graded to prevent ponding

of surface water. Dry weather periods are highly likely to result in surface desiccation of the reactive clays and if left exposed, may act as a conduit for water to penetrate the lower lying subgrade soils.

6. CLOSURE

Ground Science must be consulted and confirmation of the applicable site conditions, design procedures, construction/material specifications and proposed methodology will require a review, depending on the choice of works. We appreciate that different construction companies may adopt different construction approaches including (but not limited to) material sourcing, equipment, timeframes, methodology and required hold points. Sufficient time and cost shall be allowed for by the successful tenderer to open discussions with Ground Science prior to construction.

This document is detailed for the sole use of the intended recipient(s) or its authorised representatives. Distribution of this report may be carried out at the Clients discretion and must be reproduced in full. Should you have any questions related to this report please do not hesitate to contact this office.

For & on behalf of
Ground Science Pty Ltd

Gee Singh
Senior Geotechnical Engineer

7. LIMITATIONS

The advice provided in this document (as per our commission) is not designed or capable of identifying all soil conditions, (which can vary with products chosen). The advice given in this document is based on the assumption that the test results are representative of the overall soil conditions. However, it should be noted that actual conditions in some parts of the site might differ from those found. If further sampling/ testing reveals soil characteristics significantly different from those shown in our findings, Ground Science must be consulted.

The scope and the period of Ground Science services are described in the document and are subject to restrictions and limitations. Ground Science did not perform a complete assessment of all possible conditions or circumstances that may exist. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Ground Science in regards to it.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Ground Science for incomplete or inaccurate data supplied by others.

It is recognised that the passage of time affects the information and assessment provided in this document. Ground Science's assessment is based on information that existed at the time of the preparation of this document. It is understood that the services provided allowed Ground Science to form no more than an opinion of the actual site conditions observed during sampling and observations of the site visit and cannot be used to assess the effects of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

8. REFERENCES

- AS1289 Testing of Soils for Engineering Purposes.
- Geological Survey of Victoria, Ringwood Map Sheet (scale 1:63,360)
- AS3798 - 2007 Guidelines on Earthworks for Residential and Commercial Developments.
- Austroads - 2017 Guide to Pavement Technology, Part 2: Pavement Structural Design.

APPENDIX A

Figure 2: Site Locality Plan

Rev		Drawn	Date	Checked	Scale
0	Figure 2: Site Plan and Test Locations	SE	31/09/19	GS	NTS

Legend

- Approximate Borehole Locations
- Approximate Locality of LV Underground Asset

BENEDIKT RESERVE
SCORESBY, VICTORIA

Prepared For: SPORTENG Pty Ltd

Job No: G4091.1 AA

GroundScience

APPENDIX B

Borehole Log Sheets

GroundScience

ENGINEERING BOREHOLE LOG

Borehole No: BH1

JOB No : G4091.1

CLIENT:	SPORTENG Pty Ltd	TEST DATE:	30-Oct-19
PROJECT:	Benedikt Reserve	LOGGED BY:	SE
LOCATION:	Scoresby	CHECKED BY:	GS
TEST LOCATION:	Refer to Site Plan, Appendix A		
DRILL METHOD:	ATS Drill Rig	INCLINATION:	90°
HOLE DIAMETER:	100mm	SURFACE RL:	ND
EASTING:	ND		
NORTHING:	ND		

DRILLING				SAMPLING		FIELD MATERIAL DESCRIPTION					
PENETRATION RESISTANCE 1 2 3 4	WATER	DEPTH (metres)	DEPTH (RL)	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC SYMBOL	SOIL / ROCK MATERIAL DESCRIPTION	CONSISTENCY DENSITY	MOISTURE	ADDITIONAL OBSERVATIONS
		0.0					CL	FILL: silty CLAY, low plasticity, pale brown, with rootlets, trace sand	St	D	Topsoil
			0.15				CH	silty CLAY, high plasticity, brown mottled dark grey, gravel inclusions	F - St	D-Dp	Inferred Anderson Creek Formation
		0.5									
		1.0									
			1.30					pale brown mottled grey/white/red	St - VSt	D	
		1.5									
			1.70					with sand			
		2.0									
		2.5	2.50					Borehole Terminated @ 2.5m			
		3.0									
		3.5									

PENETRATION	CONSISTENCY		DENSITY		MOISTURE CONDITION		TEST NOTES			
1 2 3 4 no resistance refusal	Vs	Very Soft	Fb	Friable	D	Dry	PP	Pocket Penetrometer Test	▼	Groundwater Level
	S	Soft	VL	Very Loose	Dp	Damp	U63	Undisturbed Sample 63mm	UTP	Unable to Penetrate
	F	Firm	L	Loose	M	Moist	D	Disturbed Sample		
	St	Stiff	MD	Medium Dense	W	Wet	Bs	Bulk Sample		
	VSt	Very Stiff	D	Dense	S	Saturated	E	Environmental sample		
	H	Hard	VD	Very Dense	PL	Plastic Limit	HSV	Hand Shear Vane test		
					LL	Liquid Limit	Cu	Undrained Shear Strength		

HAM_LOG_2.0 2009

Sheet 1 of 1

GroundScience

ENGINEERING BOREHOLE LOG

Borehole No *BH2*

JOB No : G4091.1

CLIENT:	SPORTENG Pty Ltd	TEST DATE:	30-Oct-19
PROJECT:	Benedikt Reserve	LOGGED BY:	SE
LOCATION:	Scoresby	CHECKED BY:	GS
TEST LOCATION:	Refer to Site Plan, Appendix A		
DRILL METHOD:	ATS Drill Rig	EASTING: ND	INCLINATION: 90°
HOLE DIAMETER:	100mm	NORTHING: ND	SURFACE RL: ND

DRILLING				SAMPLING		FIELD MATERIAL DESCRIPTION				
PENETRATION RESISTANCE 1 2 3 4	WATER	DEPTH (metres)	DEPTH (RL)	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC SYMBOL	SOIL / ROCK MATERIAL DESCRIPTION	CONSISTENCY DENSITY	MOISTURE	ADDITIONAL OBSERVATIONS
		0.0					CL-CI	FILL: silty CLAY, low to medium plasticity, dark brown, with rootlets, trace sand	F	D	Topsoil
			0.20	#1	D		CH	silty CLAY, high plasticity, brown mottled grey	F	D-Dp	Inferred Anderson Creek Formation
		0.5									
			0.60	#2	D			pale brown mottled grey/white/red			
		1.0	1.00						St - VSt	D	
				#3	D			with sand			
			1.40								
		1.5	1.50					Borehole Terminated @ 1.5m			
		2.0									
		2.5									
		3.0									
		3.5									

PENETRATION	CONSISTENCY		DENSITY		MOISTURE CONDITION		TEST NOTES			
1 2 3 4 no resistance refusal	Vs	Very Soft	Fb	Friable	D	Dry	PP	Pocket Penetrometer Test		Groundwater Level
	S	Soft	VL	Very Loose	Dp	Damp	U63	Undisturbed Sample 63mm	UTP	Unable to Penetrate
	F	Firm	L	Loose	M	Moist	D	Disturbed Sample		
	St	Stiff	MD	Medium Dense	W	Wet	Bs	Bulk Sample		
	VSt	Very Stiff	D	Dense	S	Saturated	E	Environmental sample		
	H	Hard	VD	Very Dense	PL	Plastic Limit	HSV	Hand Shear Vane test		
					LL	Liquid Limit	Cu	Undrained Shear Strength		

HAM_LOG_2.0 2009 *Sheet 1 of 1*

GroundScience

ENGINEERING BOREHOLE LOG

Borehole No *BH3*

JOB No : G4091.1

CLIENT:	SPORTENG Pty Ltd	TEST DATE:	30-Oct-19
PROJECT:	Benedikt Reserve	LOGGED BY:	SE
LOCATION:	Scoresby	CHECKED BY:	GS
TEST LOCATION:	Refer to Site Plan, Appendix A		
DRILL METHOD:	ATS Drill Rig	EASTING: ND	INCLINATION: 90°
HOLE DIAMETER:	100mm	NORTHING: ND	SURFACE RL: ND

DRILLING				SAMPLING		FIELD MATERIAL DESCRIPTION					
PENETRATION RESISTANCE 1 2 3 4	WATER	DEPTH (metres)	DEPTH (RL)	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC SYMBOL	SOIL / ROCK MATERIAL DESCRIPTION	CONSISTENCY DENSITY	MOISTURE	ADDITIONAL OBSERVATIONS
		0.0					CL-CI	FILL: silty CLAY, low to medium plasticity, dark brown, with rootlets, trace sand	F - St	D	Topsoil
			0.20				CH	silty CLAY, high plasticity, brown mottled grey, gravel inclusions	F	D-Dp	Inferred Anderson Creek Formation
			0.40					pale brown mottled grey/white/red	St - VSt		
		0.5									
			0.80							D	
		1.0									
		1.5	1.50					Borehole Terminated @ 1.5m			
		2.0									
		2.5									
		3.0									
		3.5									

PENETRATION	CONSISTENCY		DENSITY		MOISTURE CONDITION		TEST NOTES			
1 2 3 4	Vs	Very Soft	Fb	Friable	D	Dry	PP	Pocket Penetrometer Test		Groundwater Level
no resistance refusal	S	Soft	VL	Very Loose	Dp	Damp	U63	Undisturbed Sample 63mm	UTP	Unable to Penetrate
	F	Firm	L	Loose	M	Moist	D	Disturbed Sample		
	St	Stiff	MD	Medium Dense	W	Wet	Bs	Bulk Sample		
	VSt	Very Stiff	D	Dense	S	Saturated	E	Environmental sample		
	H	Hard	VD	Very Dense	PL	Plastic Limit	HSV	Hand Shear Vane test		
					LL	Liquid Limit	Cu	Undrained Shear Strength		

HAM_LOG_2.0 2009 *Sheet 1 of 1*

GroundScience

ENGINEERING BOREHOLE LOG

Borehole No *BH4*

JOB No : G4091.1

CLIENT:	SPORTENG Pty Ltd	TEST DATE:	30-Oct-19
PROJECT:	Benedikt Reserve	LOGGED BY:	SE
LOCATION:	Scoresby	CHECKED BY:	GS
TEST LOCATION:	Refer to Site Plan, Appendix A		
DRILL METHOD:	ATS Drill Rig	EASTING: ND	INCLINATION: 90°
HOLE DIAMETER:	100mm	NORTHING: ND	SURFACE RL: ND

DRILLING				SAMPLING		FIELD MATERIAL DESCRIPTION					
PENETRATION RESISTANCE 1 2 3 4	WATER	DEPTH (metres)	DEPTH (RL)	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC SYMBOL	SOIL / ROCK MATERIAL DESCRIPTION	CONSISTENCY DENSITY	MOISTURE	ADDITIONAL OBSERVATIONS
		0.0					CL-CI	FILL: silty CLAY, low to medium plasticity, dark brown, with rootlets, trace sand	F	D	Topsoil
			0.15				CH	silty CLAY, high plasticity, brown mottled grey, trace rootlets and gravel inclusions	F	Dp	Inferred Anderson Creek Formation
		0.5									
			0.90					pale brown mottled grey/white/red			
		1.0									
			1.10						St - VSt	D	
		1.5	1.50					Borehole Terminated @ 1.5m			
		2.0									
		2.5									
		3.0									
		3.5									

PENETRATION	CONSISTENCY		DENSITY		MOISTURE CONDITION		TEST NOTES			
1 2 3 4 no resistance refusal	Vs	Very Soft	Fb	Friable	D	Dry	PP	Pocket Penetrometer Test		Groundwater Level
	S	Soft	VL	Very Loose	Dp	Damp	U63	Undisturbed Sample 63mm	UTP	Unable to Penetrate
	F	Firm	L	Loose	M	Moist	D	Disturbed Sample		
	St	Stiff	MD	Medium Dense	W	Wet	Bs	Bulk Sample		
	VSt	Very Stiff	D	Dense	S	Saturated	E	Environmental sample		
	H	Hard	VD	Very Dense	PL	Plastic Limit	HSV	Hand Shear Vane test		
					LL	Liquid Limit	Cu	Undrained Shear Strength		

HAM_LOG_2.0 2009 *Sheet 1 of 1*

GroundScience

ENGINEERING BOREHOLE LOG

Borehole No *BH5*

JOB No : G4091.1

CLIENT:	SPORTENG Pty Ltd	TEST DATE:	30-Oct-19
PROJECT:	Benedikt Reserve	LOGGED BY:	SE
LOCATION:	Scoresby	CHECKED BY:	GS
TEST LOCATION:	Refer to Site Plan, Appendix A		
DRILL METHOD:	ATS Drill Rig	EASTING: ND	INCLINATION: 90°
HOLE DIAMETER:	100mm	NORTHING: ND	SURFACE RL: ND

DRILLING			SAMPLING		FIELD MATERIAL DESCRIPTION					
PENETRATION RESISTANCE 1 2 3 4	WATER	DEPTH (metres) / DEPTH (RL)	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC SYMBOL	SOIL / ROCK MATERIAL DESCRIPTION	CONSISTENCY DENSITY	MOISTURE	ADDITIONAL OBSERVATIONS
		0.0				CL-CI	FILL: silty CLAY, low to medium plasticity, dark brown, with rootlets, trace sand	F	D	Topsoil
		0.15				CH	silty CLAY, high plasticity, brown mottled grey, trace rootlets and gravel inclusions	F	Dp	Inferred Anderson Creek Formation
		0.5	#4	D						
			#5	D						
		1.0	1.00				brown mottled grey/red			
			1.30					St - VSt	D - Dp	
		1.5	1.50				Borehole Terminated @ 1.5m			
		2.0								
		2.5								
		3.0								
		3.5								

PENETRATION	CONSISTENCY		DENSITY		MOISTURE CONDITION		TEST NOTES			
1 2 3 4 no resistance refusal	Vs	Very Soft	Fb	Friable	D	Dry	PP	Pocket Penetrometer Test	▽	Groundwater Level
	S	Soft	VL	Very Loose	Dp	Damp	U63	Undisturbed Sample 63mm	UTP	Unable to Penetrate
	F	Firm	L	Loose	M	Moist	D	Disturbed Sample		
	St	Stiff	MD	Medium Dense	W	Wet	Bs	Bulk Sample		
	VSt	Very Stiff	D	Dense	S	Saturated	E	Environmental sample		
	H	Hard	VD	Very Dense	PL	Plastic Limit	HSV	Hand Shear Vane test		
					LL	Liquid Limit	Cu	Undrained Shear Strength		

HAM_LOG_2.0 2009 *Sheet 1 of 1*

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ENGINEERING BOREHOLE LOG

Borehole No *BH6*

JOB No : G4091.1

CLIENT:	SPORTENG Pty Ltd	TEST DATE:	30-Oct-19
PROJECT:	Benedikt Reserve	LOGGED BY:	SE
LOCATION:	Scoresby	CHECKED BY:	GS
TEST LOCATION:	Refer to Site Plan, Appendix A		
DRILL METHOD:	ATS Drill Rig	EASTING: ND	INCLINATION: 90°
HOLE DIAMETER:	100mm	NORTHING: ND	SURFACE RL: ND

DRILLING			SAMPLING		FIELD MATERIAL DESCRIPTION					
PENETRATION RESISTANCE 1 2 3 4	WATER	DEPTH (metres) / DEPTH (RL)	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC SYMBOL	SOIL / ROCK MATERIAL DESCRIPTION	CONSISTENCY DENSITY	MOISTURE	ADDITIONAL OBSERVATIONS
		0.0				CL-CI	FILL: silty CLAY, low to medium plasticity, pale brown, with rootlets, trace sand	VSt	D	Topsoil
		0.15				CH	silty CLAY, high plasticity, brown mottled grey, trace rootlets	VSt	D	Inferred Anderson Creek Formation
		0.5 / 0.50					brown/red mottled grey			
		1.0								
		1.30					brown mottled grey/white/red	St - VSt		
		1.5 / 1.50					Borehole Terminated @ 1.5m			
		2.0								
		2.5								
		3.0								
		3.5								

PENETRATION	CONSISTENCY		DENSITY		MOISTURE CONDITION		TEST NOTES			
1 2 3 4 no resistance refusal	Vs	Very Soft	Fb	Friable	D	Dry	PP	Pocket Penetrometer Test	▽	Groundwater Level
	S	Soft	VL	Very Loose	Dp	Damp	U63	Undisturbed Sample 63mm	UTP	Unable to Penetrate
	F	Firm	L	Loose	M	Moist	D	Disturbed Sample		
	St	Stiff	MD	Medium Dense	W	Wet	Bs	Bulk Sample		
	VSt	Very Stiff	D	Dense	S	Saturated	E	Environmental sample		
	H	Hard	VD	Very Dense	PL	Plastic Limit	HSV	Hand Shear Vane test		
					LL	Liquid Limit	Cu	Undrained Shear Strength		

HAM_LOG_2.0 2009 *Sheet 1 of 1*

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ENGINEERING BOREHOLE LOG

Borehole No *BH7*

JOB No : G4091.1

CLIENT:	SPORTENG Pty Ltd	TEST DATE:	30-Oct-19
PROJECT:	Benedikt Reserve	LOGGED BY:	SE
LOCATION:	Scoresby	CHECKED BY:	GS
TEST LOCATION:	Refer to Site Plan, Appendix A		
DRILL METHOD:	ATS Drill Rig	EASTING: ND	INCLINATION: 90°
HOLE DIAMETER:	100mm	NORTHING: ND	SURFACE RL: ND

DRILLING				SAMPLING		FIELD MATERIAL DESCRIPTION					
PENETRATION RESISTANCE 1 2 3 4	WATER	DEPTH (metres)	DEPTH (RL)	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC SYMBOL	SOIL / ROCK MATERIAL DESCRIPTION	CONSISTENCY DENSITY	MOISTURE	ADDITIONAL OBSERVATIONS
		0.0					CL-CI	FILL: silty CLAY, low to medium plasticity, dark brown, with rootlets, trace sand	F	D	Topsoil
			0.20				CH	silty CLAY, high plasticity, brown mottled grey	F - St	Dp	Inferred Anderson Creek Formation
		0.5									
		1.0									
			1.30					brown mottled grey/white/red	St - VSt	D	
		1.5	1.50					Borehole Terminated @ 1.5m			
		2.0									
		2.5									
		3.0									
		3.5									

PENETRATION	CONSISTENCY		DENSITY		MOISTURE CONDITION		TEST NOTES			
1 2 3 4 no resistance refusal	Vs	Very Soft	Fb	Friable	D	Dry	PP	Pocket Penetrometer Test	▼	Groundwater Level
	S	Soft	VL	Very Loose	Dp	Damp	U63	Undisturbed Sample 63mm	UTP	Unable to Penetrate
	F	Firm	L	Loose	M	Moist	D	Disturbed Sample		
	St	Stiff	MD	Medium Dense	W	Wet	Bs	Bulk Sample		
	VSt	Very Stiff	D	Dense	S	Saturated	E	Environmental sample		
	H	Hard	VD	Very Dense	PL	Plastic Limit	HSV	Hand Shear Vane test		
					LL	Liquid Limit	Cu	Undrained Shear Strength		

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GroundScience

ENGINEERING BOREHOLE LOG

Borehole No *BH8*

JOB No : G4091.1

CLIENT:	SPORTENG Pty Ltd	TEST DATE:	30-Oct-19
PROJECT:	Benedikt Reserve	LOGGED BY:	SE
LOCATION:	Scoresby	CHECKED BY:	GS
TEST LOCATION:	Refer to Site Plan, Appendix A		
DRILL METHOD:	ATS Drill Rig	INCLINATION:	90°
HOLE DIAMETER:	100mm	SURFACE RL:	ND
EASTING:	ND		
NORTHING:	ND		

DRILLING			SAMPLING		FIELD MATERIAL DESCRIPTION					
PENETRATION RESISTANCE 1 2 3 4	WATER	DEPTH (metres) / DEPTH (RL)	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC SYMBOL	SOIL / ROCK MATERIAL DESCRIPTION	CONSISTENCY DENSITY	MOISTURE	ADDITIONAL OBSERVATIONS
		0.0				CL	FILL: silty CLAY, low plasticity, pale brown, with rootlets, trace sand	F - St	D	Topsoil
		0.30				CH	silty CLAY, high plasticity, brown mottled dark grey	F - St	Dp	Inferred Anderson Creek Formation
		0.5					brown mottled grey/red			
		0.60								
		1.0								
		1.5					white/brown	St - VSt	D	
		1.60								
		2.0								
		2.5					Borehole Terminated @ 2.5m			
		2.50								
		3.0								
		3.5								

PENETRATION	CONSISTENCY		DENSITY		MOISTURE CONDITION		TEST NOTES			
1 2 3 4 no resistance refusal	Vs	Very Soft	Fb	Friable	D	Dry	PP	Pocket Penetrometer Test	▽	Groundwater Level
	S	Soft	VL	Very Loose	Dp	Damp	U63	Undisturbed Sample 63mm	UTP	Unable to Penetrate
	F	Firm	L	Loose	M	Moist	D	Disturbed Sample		
	St	Stiff	MD	Medium Dense	W	Wet	Bs	Bulk Sample		
	VSt	Very Stiff	D	Dense	S	Saturated	E	Environmental sample		
	H	Hard	VD	Very Dense	PL	Plastic Limit	HSV	Hand Shear Vane test		
					LL	Liquid Limit	Cu	Undrained Shear Strength		

HAM_LOG_2.0 2009

Sheet 1 of 1

APPENDIX C

Laboratory Test Results

GroundScience
A C N 105 704 078
13 Brock Street, Thomastown, VIC P 03 9464 4617 **Email** reception@groundscience.com.au

Particle Size Distribution & Atterberg Limits Test Report

Client:	SPORTENG PTY LTD	Job No.	**G4091.1**
Project:	BENEDIKT RESERVE	Test Date:	**18-Nov-19**
Location:	SCORESBY	Report No.	**AA**
Lab Reference No.	**#1**	Sample Identification:	**BH2 @ 0.3 - 0.5m**
Laboratory Specimen Classification:	CLAY, medium plasticity, yellow/brown, trace sand, trace gravel		

Particle Size Distribution AS1289 3.6.1

Sieve Size	% Passing	Specification
150 mm	**100**	
75 mm	**100**	
53mm	**100**	
37.5 mm	**100**	
26.5 mm	**100**	
19.0 mm	**100**	
13.2 mm	**100**	
9.5 mm	**100**	
6.7 mm	**99**	
4.75 mm	**99**	
2.36 mm	**96**	
1.18 mm	**95**	
600 um	**95**	
425 um	**94**	
300 um	**94**	
150 um	**93**	
75 um	**92**	

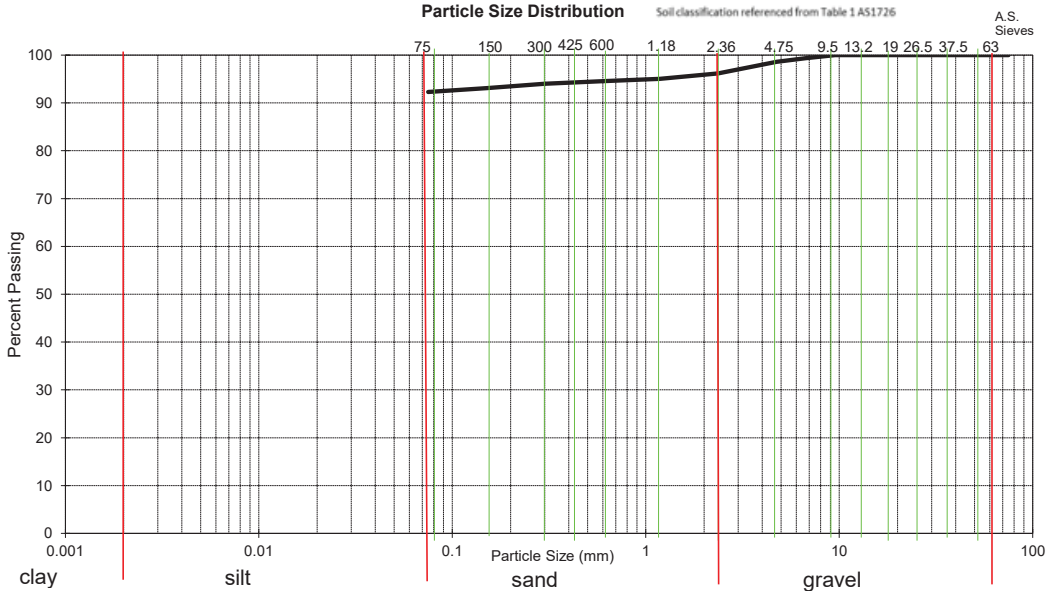
Consistency Limits and Moisture Content

Test		Method	Result	Spec.
Liquid Limit	%	AS1289 3.1.2	**40**	
Plastic Limit	%	AS1289 3.2.1	**20**	
Plasticity Index	%	AS1289 3.3.1	**20**	
Linear Shrinkage	%	AS1289 3.4.1	**7.0**	
Moisture Content	%	AS1289 2.1.1	**21.7**	

Sample History: Oven Dried
Preparation Method: Dry sieved
Crumbling / Curling of linear shrinkage: Cracking
Linear shrinkage mould length: 250 mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship AS 1289 5.2.1
Maximum Dry Density: t/m^3
Optimum Moisture Content: %

Notes: Sampling Method AS1289 1.2.1(6.5.3)
Sampled by SE 30/10/2019



Date: 21/11/2019

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards. .

Tim Senserrick
Approved Signatory

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GS005A/R V9 Oct 2018
App KC

GroundScience
A C N 105 704 078
13 Brock Street, Thomastown, VIC P 03 9464 4617 **Email** reception@groundscience.com.au

Particle Size Distribution & Atterberg Limits Test Report

Client:	SPORTENG PTY LTD	Job No.	**G4091.1**
Project:	BENEDIKT RESERVE	Test Date:	**18-Nov-19**
Location:	SCORESBY	Report No.	**AB**
Lab Reference No.	**#3**	Sample Identification:	**BH2 @ 1.3 - 1.5m**

Laboratory Specimen Classification: CLAY, high plasticity, light brown, trace gravel, trace sand.

Particle Size Distribution AS1289 3.6.1

Sieve Size	% Passing	Specification
150 mm	**100**	
75 mm	**100**	
53mm	**100**	
37.5 mm	**100**	
26.5 mm	**100**	
19.0 mm	**100**	
13.2 mm	**100**	
9.5 mm	**97**	
6.7 mm	**92**	
4.75 mm	**91**	
2.36 mm	**89**	
1.18 mm	**88**	
600 um	**87**	
425 um	**86**	
300 um	**86**	
150 um	**86**	
75 um	**85**	

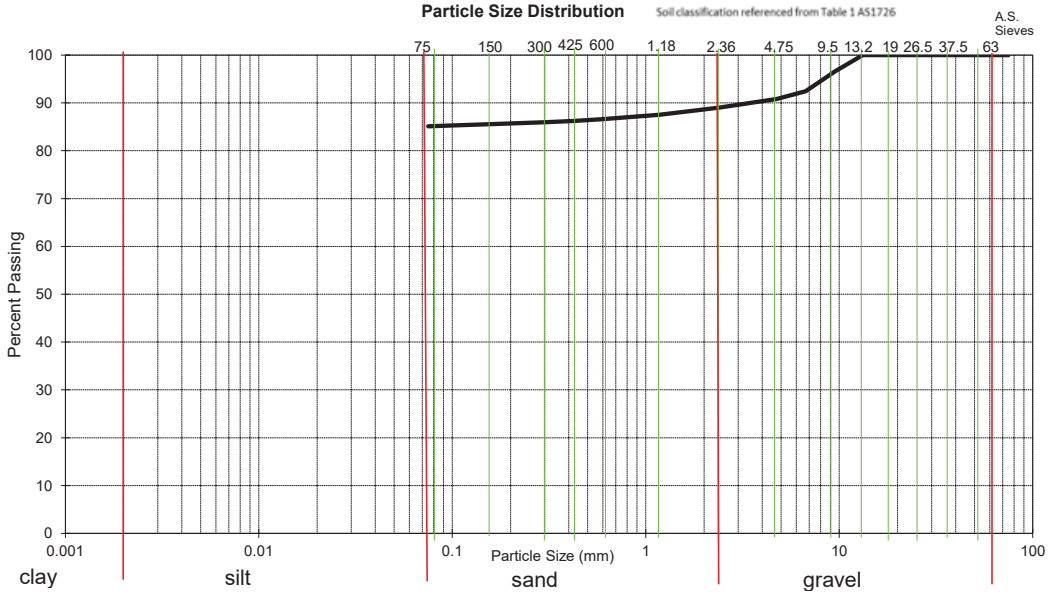
Consistency Limits and Moisture Content

Test		Method	Result	Spec.
Liquid Limit	%	AS1289 3.1.2	**52**	
Plastic Limit	%	AS1289 3.2.1	**25**	
Plasticity Index	%	AS1289 3.3.1	**27**	
Linear Shrinkage	%	AS1289 3.4.1	**4.0**	
Moisture Content	%	AS1289 2.1.1	**17.1**	

Sample History: Oven Dried
Preparation Method: Dry sieved
Crumbling / Curling of linear shrinkage: Cracking
Linear shrinkage mould length: 250 mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship AS 1289 5.2.1
Maximum Dry Density: t/m^3
Optimum Moisture Content: %

Notes: Sampling Method AS1289 1.2.1(6.5.3)
Sampled by SE 30/10/2019



Date: 21/11/2019

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards. .

Tim Senserrick
Approved Signatory

H

GS005A/R V9 Oct 2018
App KC

GroundScience
A C N 105 704 078
13 Brock Street, Thomastown, VIC P 03 9464 4617 **Email** reception@groundscience.com.au

Particle Size Distribution & Atterberg Limits Test Report

Client:	SPORTENG PTY LTD	Job No.	**G4091.1**
Project:	BENEDIKT RESERVE	Test Date:	**18-Nov-19**
Location:	SCORESBY	Report No.	**AC**
Lab Reference No.	**#5**	Sample Identification:	**BH5 @ 0.8 - 1.0m**

Laboratory Specimen Classification: CLAY, high plasticity, brown, trace sand, trace gravel.

Particle Size Distribution AS1289 3.6.1

Sieve Size	% Passing	Specification
150 mm	**100**	
75 mm	**100**	
53mm	**100**	
37.5 mm	**100**	
26.5 mm	**100**	
19.0 mm	**100**	
13.2 mm	**100**	
9.5 mm	**100**	
6.7 mm	**99**	
4.75 mm	**98**	
2.36 mm	**96**	
1.18 mm	**95**	
600 um	**95**	
425 um	**95**	
300 um	**95**	
150 um	**94**	
75 um	**94**	

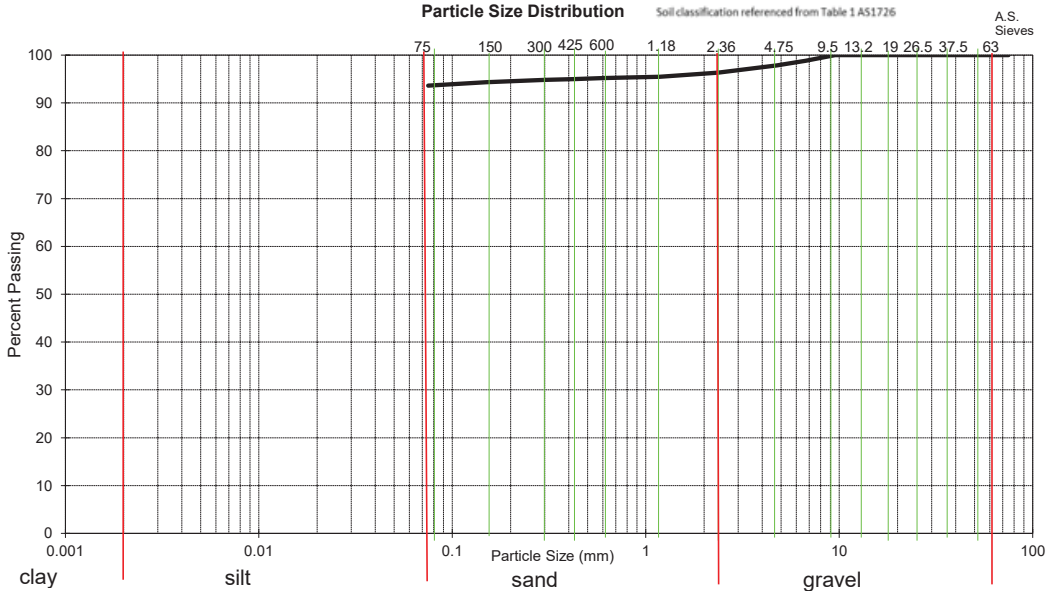
Consistency Limits and Moisture Content

Test		Method	Result	Spec.
Liquid Limit	%	AS1289 3.1.2	**70**	
Plastic Limit	%	AS1289 3.2.1	**25**	
Plasticity Index	%	AS1289 3.3.1	**45**	
Linear Shrinkage	%	AS1289 3.4.1	**12.5**	
Moisture Content	%	AS1289 2.1.1	**21.7**	

Sample History: Oven Dried
Preparation Method: Dry sieved
Crumbling / Curling of linear shrinkage: -
Linear shrinkage mould length: -
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship AS 1289 5.2.1
Maximum Dry Density: t/m^3
Optimum Moisture Content: %

Notes: Sampling Method AS1289 1.2.1(6.5.3)
Sampled by SE 30/10/2019



Date: 21/11/2019

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards. .

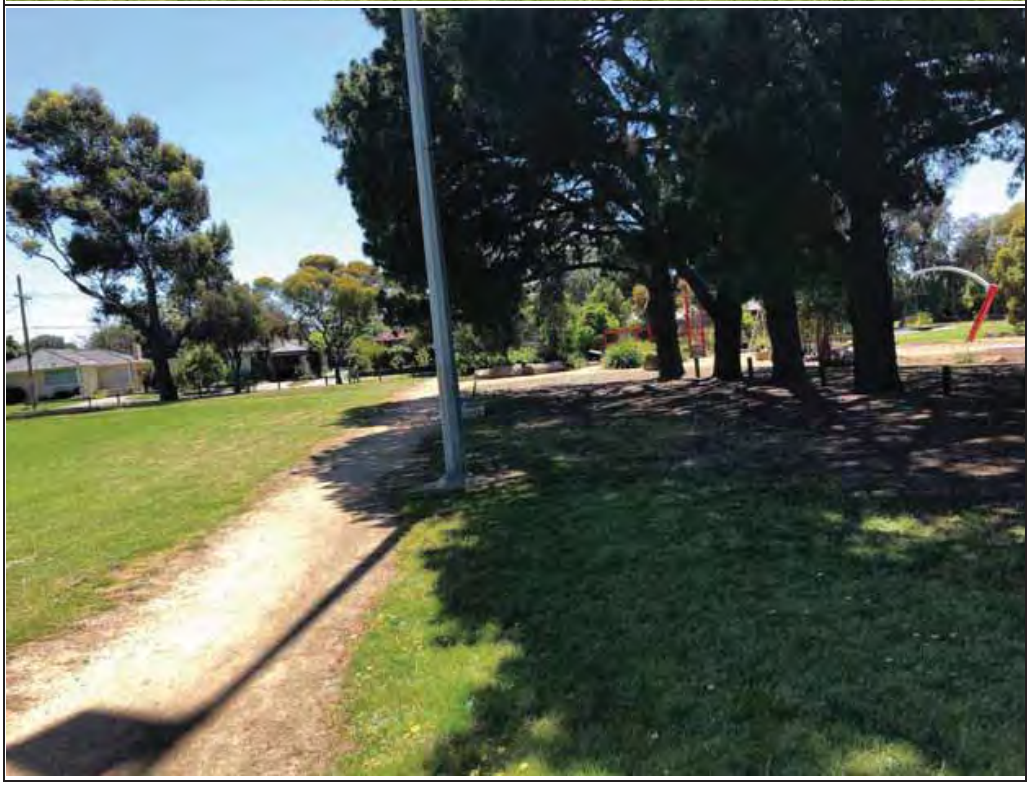
Tim Senserrick
Approved Signatory

H

GS005A/R V9 Oct 2018
App KC

APPENDIX D

Site Photographs




R 9 7
THE PLACE TO BE

INSIDE EDGE SPORT AND LEISURE PLANNING

PROPOSED EASTERN FOOTBALL HUB

WANTIRNA SOUTH RECREATION RESERVE

50 MOUNTAIN HIGHWAY

WANTIRNA

Report No: 115706

Date: 24 March 2014

GEOTECHNICAL INVESTIGATION (PRELIMINARY)

By

A.S. JAMES PTY LIMITED
15 Libbett Avenue,
Clayton South Vic. 3169
Tel: 613 9547 4811
Fax: 613 9547 5393
E-mail: melb@asjames.com.au

X:\James\Geotechnical\Commercial\115706 Eastern Football Hub, WANTIRNA\FINAL REPORT DOCUMENTS\115706 Proposed Eastern Football Hub.docx

A.S.JAMES PTY LTD
A.C.N. 004 584 534 A.B.N. 40 004 584 534
Geotechnical Engineers
SINCE 1963

15 Libbett Avenue
Clayton South Vic 3169
Tel: (613) 9547 4811
Fax: (613) 9547 5393
E-mail: melb@asjames.com.au

1. INTRODUCTION

1.01 **Investigation Requested By**: The geotechnical investigation was commissioned by Mr Michael Bodman Bolton of Inside Edge Sport and Leisure Planning via email correspondence dated 21st February 2014.

1.02 **Purpose of Investigation**: The scope for this investigation is as follows:

General: It was proposed to develop the Wantirna South Recreation Reserve into an Australian Rules Football training and administration hub. In doing so, bringing together training and development functions of the Eastern Football League, Eastern Rangers TAC, Eastern Region Umpires, AFL Victoria and Hawthorn Football Club.

Proposed Infrastructure: The proposed developments to the site are as follows:

- The conversion of the existing playing field (eastern oval) from grass to an AFL/CA approved synthetic oval
- The development of disused open space (current picnic/play area) to premier quality natural turf, sand based oval of MCG size and quality
- The development of a 1500m2 (double story) office administration, social and change room complex
- The development of roadways and car parking to meet the demands of the upgraded site

Information provided indicates the site was believed to be a landfill pre 1968 and the existing road ways were developed in 1998. The likely specifications for the proposed main natural grass playing field or (Western Oval) are in accordance with the '*Colac Central Reserve*' document provided. Specifications for the proposed synthetic oval (Eastern Oval) are understood to be in accordance with the '*Australian Football League and Cricket Australia Handbook of Testing for Synthetic Turf*' also provided by the client.

Discussions: The following are requested aspects of the site to be discussed.

- Key issues associated with the sub-surface conditions and how they may impact the proposed infrastructure
- Earthworks

1.03 **Geology:** At least part of the site, as previously indicated, was historically used as a landfill before being converted into parklands and recreational space. The Geological Survey of Victoria, 1:63,360 Series, Ringwood Sheet, indicates the subject site to be underlain by sedimentary deposits which are of the Silurian age and form part of the Dargile Formation. Typically, these deposits comprise of laminated and current bedded sandstones, interbedded with massive siltstones and shales. Some alluvial deposits may exist in the lower elevations.

1.04 **Field Methods**: As part of the geotechnical investigation the following field methods were incorporated:

i) **Auger Drilling:** All boreholes were drilled using a truck mounted Gemco HP 7 rotary drilling rig equipped with continuous flight 125 millimetre diameter augers fitted with tungsten carbide drill bits.

ii) **In-situ Vane Shear Strength Testing:** In-situ vane shear strength testing was carried out within the cohesive soils at shallow depths using a Pilcon hand vane tester. The tests were conducted in accordance with the test procedure outlined in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes". Test Method F2. 1, June 1977.

iii) **Standard Penetration Testing:** Standard penetration testing was conducted at regular intervals within the boreholes in accordance with the test procedure outlined in Australian Standard 1289, "Methods of Testing Soils For Engineering Purposes," Test Method 6.3.1, June 1993.in accordance with Australian Standard AS 1726 - 1993, "Geotechnical Site Investigations."

i**v)** **Logging of Soil Profiles:** The soil profile encountered in the borehole was logged in accordance with Australian Standard AS 1726 - 1993, "Geotechnical Site Investigations."

1.05 **Laboratory Test Methods:** All soil samples were transferred to A.S. James' National Association of Testing Authorities (NATA) registered Clayton South laboratory, where mechanical testing was undertaken by a team of trained laboratory technicians. All laboratory testing was performed in strict accordance with the test methods outlined in Australian Standard AS 1289, "Method of Testing Soils for Engineering Purposes," as follows:

Suggested testing in the brief was modified too.

	AS 1289 Test Method
• Atterberg Limits	3.1.1, 3.2.1, 3.3.1.3.4.1

2. RESULTS

2.1 FIELD TESTING

2.1.1 **Bore Locations:** Twenty (20) boreholes were drilled at the locations indicated on Figures 1 and the logs of these boreholes are given on Figures 2 – 17. The results of standard penetration tests are given on the logs.

2.1.3 **Sub-Surface Soil Profile:** The results of the borehole drilling program conducted at the site, have been summarised in Table 1 & 2 below.

Borehole	Depth Range of crushed rock (m) (FILL)	Depth Range of Filling (Sandy silt) (m) (FILL)	Depth Range of Silt/ Clay Cap (m) (FILL)	Depth Range of Historic Tip (m) (FILL)	Depth Range of Reworked Natural Material (m) (FILL)	Depth Range of Natural Clayey Silt (m) (SILT) (MH)	Dargile Formation Depth Range of Natural Silty Clay (m) (CLAY) CH /CL
1	-	0-0.2	0.2-0.6	0.6-4.0	-	-	4.0-4.5
2	-	0-0.6	-	0.6-2.0	-	-	-
3	-	0-0.2	-	0.2-3.0	-	-	-
4	-	0-0.1	-	0.1-2.0	-	-	-
5	0-0.1	-	-	0.1-2.0	-	-	-
6	0-0.1	-	0.1-0.6	0.6-2.0	-	-	-
7	-	-	0-2.2	2.2-3.0	-	-	-
8	0-0.15	-	-	-	0.15-1.7	-	1.7-3.0
9	0-0.1	-	-	-	0.1-3.0	-	3.0-3.4
10	0-0.05	-	0.05-1.0	1.0-1.4	-	1.4-1.6	1.6-6.4
11	0-0.05		0.05-1.6	1.6-3.5	-	-	3.5-6.4
12	0-0.05	-	0.05-1.7	1.7-4.0	-	-	4.0-6.4
13	0-0.05	-	-	-	0.05-2.5	-	2.5-6.0
14	-	-	1.4-1.8	1.8-4.5	0-1.4	-	4.5-4.6

Table 1: Summary of Sub-surface Soil Profiles within Depths Investigated (Bores 1-14).

Borehole	Depth Range of Filling (Silty Sand) and (Sand / Silt / Gravel) (m) (FILL) Playing Surface	Depth Range of Reworked Natural Material (m) (FILL)	Depth Range of Natural Silt (m) (SILT) (MH)	Dargile Formation Depth Range of Natural Silty Clay or Silty Sand (m) (CLAY) CH /CL, (SAND) (SM)
15	0-0.3	-	-	0.3-2.0
16	0-0.3	0.3-1.0	-	0.3-1.0
17	0-0.3	-	-	0.3-2.0
18	0-0.3	0.3-1.3	-	1.3-2.0
19	0-0.1	-	0.1-0.3	0.3-2.0
20	0-0.3	0.3-1.0	-	0.3-1.0

Table 1: Summary of Sub-surface Soil Profiles within Depths Investigated (Existing Sporting Oval).

Bores 1-4 were carried out at the picnic / play area of the site, bores 5, 6, 7, 8, 9 & 14 were carried out in the car-park area of the site and bores 10-13 were carried out within the proposed new double story building envelope. Bores 15-20 were carried out on the existing sports oval.

A summary of each of the soil units encountered at the subject site is provided as follows:

- Crushed Rock Fill: ***Car Park Areas:*** Within the car parking areas, a layer of dry, medium dense silty and sandy crushed rock fill of thickness ranging from 0.05-0.15m generally was encountered. **The suitability for re-use around the site or as future sub-base has not yet been determined.**

- Sandy Silt: ***Picnic / Play Area***: A layer of generally brown, dry, medium dense sandy silt with an organic content was encountered within the picnic / play area of the site, ranging in depths of 0.1-0.6 m.

- Sand: ***'Capping' Fill used to develop the playing surface of the existing sports oval***: A thin layer of moist brown silty sand in medium dense condition was encountered approximately 0.1 m in depth over the existing sports oval to the east. Underlying this a layer of brown sand / silt / gravels was encountered of medium density, 0.2 m thick.

- Silt / Clay Capping: Predominantly within the existing car parking areas and accessible locations of the proposed double story building envelope. A likely reworked natural material was encountered, mostly a yellow brown / orange brown occasionally mottled red silty clay however

appearing as a clayey silt at times. This layer was typically of stiff consistency or medium dense, dry tending moist with a gravel content.

- Historic Landfill: Underlying much of the site in particular the proposed western natural grass oval is the historic tip. This unit typically presented as a grey brown / brown grey moist silty clay of medium density. Accessory materials encountered includes, glass, brick, plastic, metal, gravels and other miscellaneous items such as the sole of a shoe encountered in BH14. Within the depths investigated this unit ranged from 0.1 m up to 4.0 m below ground surface. Typically over the picnic / play area the sandy silt was overlying the historic land fill and within the car park and proposed building envelope where encountered, the historic landfill was underlying the silt / clay capping. Perched water tables were encountered at BH1 and BH14 at approximately 3.0 m above the underlying clay.

- Reworked Natural Material: Encountered at boreholes in close proximity to the existing sporting oval and eastern parts of the sporting oval. Reworked natural materials were encountered of characteristics to those similar to the natural undisturbed materials underlying the site in addition to what appears to be a crushed siltstone fill. This profile generally appeared as a dry to moist yellow brown / orange brown / grey occasionally mottled red stiff silty clay, in medium dense condition.

- Natural Clayey Silt (MH): Observed in BH10 below the historic tip profile a thin layer of pale grey moist, loose to medium dense clayey silt was encountered. It is possible this was the original ground surface level before filling associated with the historic tip began.

- Natural Silurian Age Dargile Formation: Encountered underlying historic tip fill, natural clayey silts or reworked natural materials, a grey / orange brown stiff silty clay in moist condition was encountered. At deeper depths greater than 5.0 m sub-angular ironstones were encountered including variably ferruginous occasional grit and gravel bands. Of note, the silty clay tended to a sandy / silty clay at approximately 5.0 m within BH11.

2.1.5 **Discussion of possible historic earthworks:** With reference to the attached Cross Section A-A', the following is observed site notes regarding the possible previous earthworks at the site. The bore logs indicate that a possible earthworks program previously conducted at the site included the cutting of natural materials from the eastern areas of the existing oval and subsequent benching by filling of the remaining areas, westwards over the oval. In addition, placement of natural materials over the historic landfill, predominantly over the car park areas and existing

building area. It appears the materials were also placed in a somewhat uncontrolled manner. The historic landfill appears to reduce in depth as it approaches the existing oval however, relatively significant depths of landfill were still recorded west of the existing pavilion adjacent to the sports oval.

2.1.6 **Ground Water:** No permanent free ground water was encountered at the time of the site investigation and none would normally be expected within the depths investigated. However at two locations a perched water table was encountered within the historic landfill profile at approximately 3.0 m. It should be noted, however, that following prolonged periods of rainfall the surface fills, historic landfill and reworked natural materials, clayey silt and shallow silty clay may be susceptible to moisture ingress, thereby significantly reducing the workability and strength of both the surface fill and the underlying sands at shallow depths.

2.2 LABORATORY TESTING

2.2.1 **Test Program:** Upon receipt in the laboratory, the disturbed soil samples retrieved from Boreholes were prepared as necessary before Atterberg limit testing was carried out.

2.2.2 **Test Results:** The results of the laboratory Atterberg limits are given attached.

3. DISCUSSION & RECOMMENDATIONS

3.1 PROPOSED STRUCTURE: Double storey, well-articulated and able to accommodate minor movement.

3.1.1 **Site Classification:** In selecting an appropriate foundation arrangement the following factors have been taken into account:

- Sub-surface soil profiles and results of visual site observations
- Local geological conditions;
- Knowledge of the site and previous likely earthworks on this development.

If required the site should be classified as Class 'P' in accordance with AS 2870 – 2011 and fully suspended construction will be necessary.

3.1.2 **Piled Footings:** Pile footings should be adopted. Considering the variation of historic landfill depths, the piles need to extend into the silty clay below any clayey silt, reworked natural material or historic fill.

3.1.3 **Bored Piers:** Bored piers could be considered although some instability may be encountered and temporary liners will be necessary.

If required for a preliminary design a bearing pressure of 300 kPa could be adopted subject to a penetration of 1.0 m into the underlying clay. A skin friction of 30 kPa could be adopted below this level.

3.1.4 Provided that adequate protection is provided against the possibly aggressive ground conditions that may prevail with the historic fill profile, the use of precast concrete piles appears appropriate for the proposed development.

Pile Load Capacity: Provided that adequate protection is provided against the possibly aggressive ground conditions that may prevail within the historic fill profile, the use of precast concrete piles appears appropriate for the proposed development.

Considering the potential for variation of the subsurface profile across the site the piles will need to be driven into the "Dargile Formation" layer and piles need to be driven until the required set is achieved.

The load carrying capacity of driven piles in the stiff clay will significantly be shaft resistance. In this site, it is expected significant load development will not occur until up to in all likelihood 4.0 metres due to the historic landfill and possibly uncontrolled fill. Obviously, variability in both the depth of historic fill and the properties of the Dargile Formation across the site will influence final piling depths and embedment depth variation will exist.

As per our calculations, based on a conservative depth of fill at 4.0m a 350 sq. smooth pile driven 3.0 metres into the Dargile Formation will provide a working load of 160 kN. That is a total pile depth of approximately 7.0m, although site variation and density will determine ultimate depths, and increased pile sizes could be considered. Greater bearing pressures can be provided subject to further geotechnical investigation to deeper depths within the 2-story building envelope until rock is encountered, this is estimated in the order of 8-10 m below ground surface level.

Piling contractors should make their own assessment of piling conditions and load carrying capacities of proprietary pile types. Design geotechnical strength is the calculated design ultimate geotechnical strength multiplied by a geotechnical strength reduction factor. As per the piling code (Revision of AS 2159-1995) the geotechnical strength reduction factor should be determined considering the site, design and installation of piles.

We emphasise that the historic landfill depths are variable up to 4.0 m recorded within the building envelope and variable depths can be expected and will occur.

3.1.5 The use of CFA (Continuous Flight Auger) or driven piles could be considered and the logs should be referred to proprietary piling contractors.

3.1.6 **Pile Settlements:** Pile settlements could be assessed using a Young's Moduli (E) for the stiff silty tending sandy clay of 50 MPa.

3.1.7 **Pile Groups:** The total working load for the pile will be developed by a combination of end bearing and shaft friction into the silty tending sandy clay.

It is recommended that the following precautionary measures be taken during the pile driving operations.

- Continuous monitoring of pile heads during installation to ensure eccentricities do not develop.
- A construction sequence be developed to minimise potential interaction (suggest three diameters) of piles and drive central, inner and outer.
- Pre-bore (with casing, if necessary) to remove material and obstructions in the historic landfill.
- Ensure the use of a proprietary tensile capacity joint or during monitoring (both laterally and vertically) have the capacity to 'reset' piles lifting.

It is recommended the driven piles be initially checked using dynamic pile testing (Pile Driving Analyser) and confirmed using CAPWAP analysis or similar on selected piles (10% in Number, but subject to Quality Risk Factors).

3.1.8 **Pile Downdrag:** The down-drag stress at any point on the pile within the historic landfill could be calculated using the following equation:

$$f_{nf}=0.3\sigma'_v$$

where f_{nf} is the downdrag stress

σ'_v is the effective overburden stress (adopt a bulk unit weight of 15 kN/m^3 for the fill including capping, reworked natural materials and historic landfill)

Pile down drag should be considered to a depth 1.0m above the base of the stiff clay. Based on the information this can be considered at approximately 3.0 m in depth.

3.1.9 **Protection of Piles:** The possibility remains of the fill to be of aggressive nature to concrete, in all likelihood it will be necessary to provide an appropriate level of protection for the proposed precast concrete piles. Such protection should include the use of cement rich, high quality, very dense, impervious concrete, which should be placed with a high degree of vibration. As a guide the concrete should contain not less than 425 kg/m3 cement and 50 kg/m3 flyash placed with a super-plasticiser at a water cement ratio of 0.30. Care will also need to be taken to ensure that the steel segmented pile joints are not located within the uppermost 4.0 m. Other proprietary options could also be considered.

3.1.10 **Earthquake Loading:** In accordance with Australian Standard 1170.4-2007, Part 4, "Earthquake Actions in Australia", site sub-soil class of C_e – shallow soil site and Hazard Factor (Z) of 0.09 should be adopted for the design of the proposed structure at the subject site.

3.1.11 **Discussion of Settlements of proposed premier quality natural turf, sand based oval (Proposed Western Oval):** In accordance with the provided likely specifications for the proposed premier quality natural turf sand based oval taken from the Colac Central Reserve, it is stated within Section 8.1 of the document that the 'soil rootzone layer' will be to a consolidated depth of 250 mm so that the finished surface has a tolerance of + or – 10 mm.'

Given the ongoing settlement that will occur underlying the site and the relatively poor engineering quality of the landfill materials, it is envisioned that due to these inevitable settlements / differential settlements that will take place at the proposed location, the tolerance of + or - 10mm will be significantly exceeded. Drainage in particular is likely to be affected due to the differential settlement of the oval.

Significant cost will be expended in remediating this area of the site and in fact would likely be cost prohibitive. A 'use and maintain' approach would appear all that is reasonable.

3.1.12 **Discussion of Settlements of Australian Football League and Cricket Australia Grade Synthetic Turf Oval (Eastern Oval):** After reviewing the provided handbook, regarding the specifications for a synthetic oval. Settlement tolerances were not provided, however it is assumed that this type of construction, similar to the natural turf, sand based oval is sensitive to movements and drainage is critical.

As the synthetic turf oval is proposed to be located at the existing sports oval. Given the presence of reworked natural fill materials, particularly from the centre of the existing sporting oval heading westwards. The likely resulting consolidation settlements are expected to be outside + or – 10 mm, if the proposed synthetic turf oval was to be located at the existing ovals location. The use of an impact roller on this existing fill may be sufficient to reduce the settlements in the fill to acceptable limits. However, more and intrusive investigation is required with test pits.

3.1.13 **Discussion of Environmental Condition of Site:** Given the site history as to a landfill. It is understood there are no available records to the type and quantity of material that was bought on site. Due to the uncontrolled nature of the filling, it is possible and likely that the soil is contaminated to some degree, however to what degree at this stage is largely unknown and until firm proposals exist no testing is warranted.

Landfills can be typically heterogeneous in both physical and chemical composition. As such, environmental preliminary sampling and analytical testing can be misleading as both the physical and chemical composition can change over relatively short distances. Therefore, more detailed environmental investigations are recommended as follows; however, this is outside the scope of this investigation.

A preliminary phase 1 environmental assessment focuses on site history in the aim of determining possible environmental impacts by ascertaining possible contaminants of concern related to the sites previous use.

Upon the completion of a site history study, a limited sampling and analysis program can be completed testing for contaminants of concern using a specific sampling strategy. Collection of ecological information on background inorganic element and organic compounds present would also be completed. In doing so, this gathered information would aid in reviewing results and determining if possible impacts may be imposed on ecological receptors. Contaminant threshold concentration levels can be adopted for human health and ecological receptors in accordance with the current '*National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No.1).'*

A preliminary off-site disposal categorisation can be provided in accordance with Victorian EPA Publication IWRG-621-June 2009 '*Soil Hazard Categorisation and Management'. Along* with any necessary details and recommended practices for disposing the soil off-site. It should be noted as above, given the likely heterogeneous nature of landfill material a conservative approach is likely to be adopted.

The production of landfill gases will also require investigation at the social and change room complex.

Note: Given the high content of municipal/domestic waste and industrial wastes in the historic landfill profile, the fill cannot be used as engineered / structural fill. A prescribed industrial waste category will need to be assigned to the landfill material and if required disposed of at a licenced facility.

Upon the completion of the preliminary Phase 1 environmental assessment, a further phase 2 investigation may be recommended to further explore / delineate any contamination found or determine an appropriate remediation strategy in line with a hierarchy of control.

In the case construction was to commence at the site, a site specific environmental management plan should be completed addressing any contamination on site to inform any contractors of the conditions, and how to manage them for both safety, and compliance.

3.2 PAVEMENT CONSTRUCTION & GROUND FLOOR SLAB

3.2.1 **Pavements:** All building pavements should be fully suspended.

3.2.2 **External Pavements Constructed on Fill:** Some ongoing settlements within the fill underlying the subject site will result in distortion and maintenance requirements to pavements constructed on the existing ground surface level. Recognising this, any proposed pavements should be constructed on an adequately prepared subgrade with maximum possible grades to minimise future maintenance and ponding of water. Settlements are difficult to assess however may be as much as 50mm. (Except for the landfill area)

Flexible pavements and floor slabs constructed on an adequately prepared fill subgrade may be designed using a Design CBR value of 2.0 % Rigid pavements, on the other hand, constructed on a similar subgrade, may be designed using a Modulus of Subgrade reaction value of 20 kPa/mm.

Alternatively, rigid pavements may be designed in accordance with the Cement and Concrete Association of Australia, 1997 publication, "Industrial Pavements - Guidelines for Design, Construction and Specification" using long and short term Young's Moduli of 10 and 12 MPa respectively.

The effects of movements on any proposed rigid pavements can be minimised by incorporation of positive load transfer devices such as dowels.

It should be pointed out, however, that the pavement design parameters recommended above are given subject to the subgrade preparation outlined in Clause 3.2.2 and 3.2.3 being carried out, in addition to adequate subgrade drainage control, as outlined in Clause 3.2.4.

3.2.3 **Preparation Fill Subgrade:** The fill subgrade should be compacted with a heavy weight vibrating sheepsfoot roller. A minimum dry density ratio of 98% of the maximum dry density value determined by the Standard Compaction Test in accordance with Australian Standard AS1289 5.1.1 - 1993 should be achieved.

Under extreme conditions, if the subgrade exists in a saturated state, it may be necessary to strip the saturated clays and replace these with suitable granular fill compacted to a dry density not less than 98% of the maximum dry density value determined by the Standard compaction test in accordance with AS1289 5.1.1.

It should be appreciated that the long term performance of the proposed pavements constructed on a fill subgrade significantly depends on the subgrade moisture conditions at the time of construction.

If very wet conditions are prevalent at the time of construction then there is the risk of some subsequent shrinkage occurring as the clay dries out. On the other extreme, if very dry conditions have prevailed for a significant period then there could be a risk of some resulting heave as the clays wet up.

As outlined above, impact rolling could be considered to improve performance.

3.2.4 **Long Term Subgrade Moisture Control:** It is considered essential for the long term performance of the proposed pavements at the subject site that both an effective surface and lateral cut-off drainage system be provided and maintained to minimise the risk of moisture migration into both the pavement sub-base and subgrade layers. Under no circumstances should the pavement and subgrade layers be permitted to remain in a saturated condition.

3.2.5 **Earthworks:** It is pointed out that the clay/silt fills including the capping layer over much of the site are notoriously difficult to work and if not compacted at or very close to the optimum moisture content, can exhibit measurable volume change with time. As such, the use of these clays will require close supervision.

Any imported structural fill should essentially be of a granular nature. All fill material should have a nominal particle size of 75 millimetres or less and, if required, a guide for selecting an appropriate material would be as follows:

- Plasticity Index. x Percentage Passing 0.425 millimetres (AS Sieve) less than or equal to 600

Structural fill should be compacted in layers not greater than 200 millimetres when loose and should be compacted to a dry density not less than 98% of the maximum dry density value determined by the Standard Compaction Test in accordance with Australian Standard AS 1289 5.1.1 - 1993 using an appropriate heavy weight vibrating roller.

During compaction, the fill material should have moisture content within the range 85% to 115% of the optimum moisture content as determined by the Standard Compaction Test in accordance with AS 1289 E1.1 - 1993.

3.2.6 **Fully Suspended Construction:** If the anticipated pavement settlements cannot be tolerated it will be necessary to fully suspend the proposed pavements on a series of piles.

3.3 GENERAL

3.3.1 **Underground Services:** Ongoing settlements within the significant depths of fill underlying the subject site will result in distortion and maintenance requirements to underground services at the subject site. Recognising this, the following precautions should be taken for any proposed underground services at the subject site:

- All services should be laid with maximum possible grades to minimise future maintenance requirements.
- Flexible joints should be incorporated for all services.
- Services connecting to the proposed structure should be appropriately sleeved at the point of connection to allow for differential settlements where the structure is suspended.

3.3.2 **Inspection of Footing Excavations:** All footing excavations must be examined to ensure that the required founding soil has been exposed. Any unusual features must be reported to this office immediately in order to ensure that the recommendations outlined in this report remain relevant.

3.3.3 **General:** The Modulus of Subgrade reactions specified throughout the report are referred to as the K(0.3) value in most literature on the subject. As such, they are directly relevant where point loads are critical, but otherwise will require amendment depending on the value of the loading and geometry of the structural element involved. We would be pleased to advise further once relevant details are available.

Conditions may change with the seasons. In particular, the surface silts and residual clays underlying the site at shallow depths may become saturated and unworkable following prolonged periods of rainfall.

The above recommendations are based on the bore and test results, together with experience of similar conditions and are expected to be typical of the area or areas being considered. Nevertheless, all excavations should be examined carefully and any unusual feature reported to us in order to determine whether any changes might be advisable.

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REVIEWED BY
T .J. HOLT MIEAust CPEng EC-1022
A.S. JAMES PTY LTD

J .T. HOLT BEng
Grad Inst of Engineers
A.S. JAMES PTY LTD

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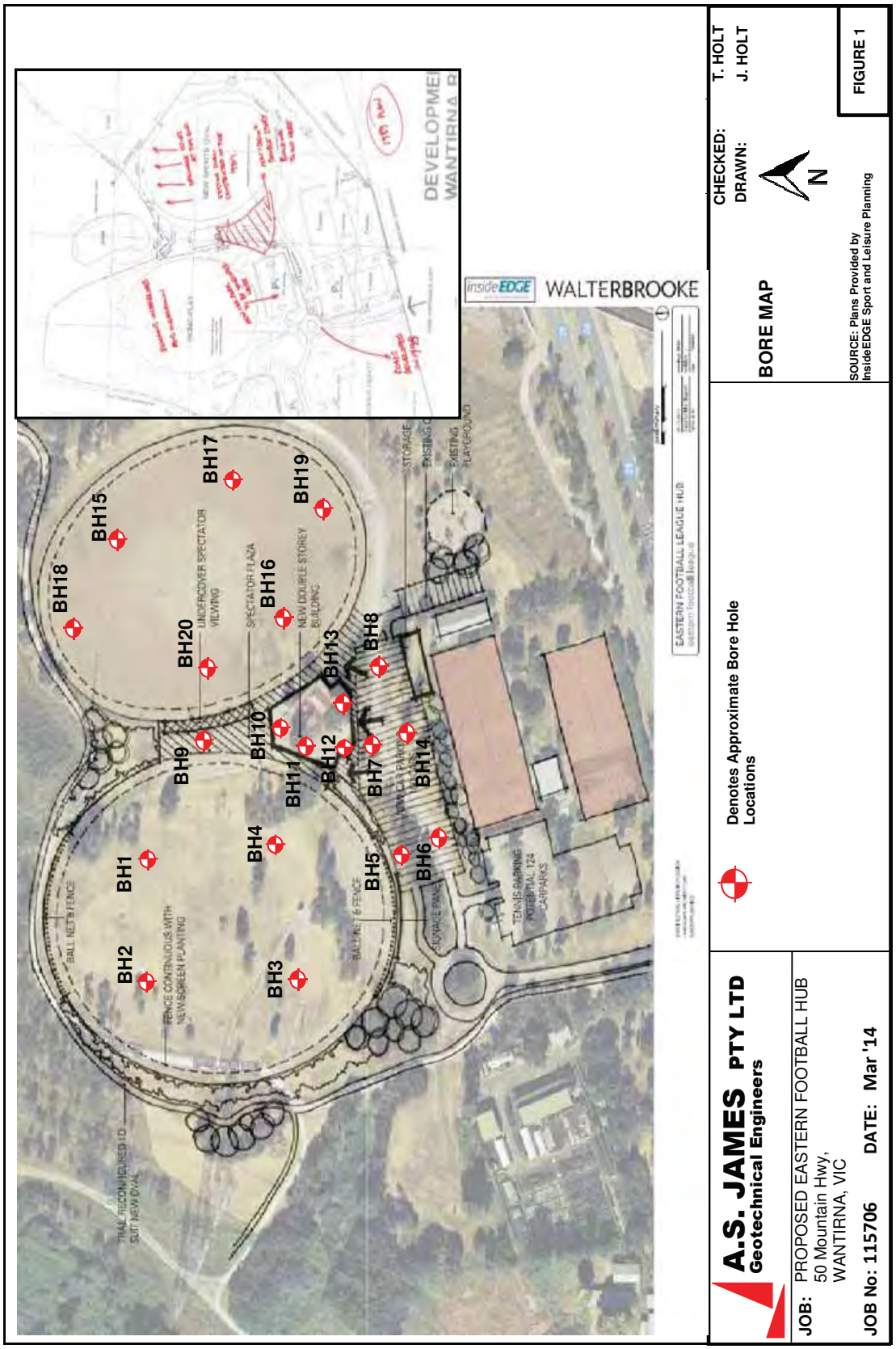
WALTERBROOKE
BH1
BH2
BH3
BH4
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BH6
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BH14
BH15
BH16
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BH18
BH19
BH20
Denotes Approximate Bore Hole Locations
A.S. JAMES PTY LTD
Geotechnical Engineers
JOB: PROPOSED EASTERN FOOTBALL HUB
50 Mountain Hwy,
WANTIRNA, VIC
JOB No: 115706 DATE: Mar '14
BORE MAP
CHECKED: T. HOLT
DRAWN: J. HOLT
N
SOURCE: Plans Provided by InsideEDGE Sport and Leisure Planning
FIGURE 1

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 1
Job No. 115706 **Date:** Mar '14
Ground Water: Perched water table at approximately 3.0 m.

Soil Type	Description	Depth	Tests	Results
FILL	Brown Silt	0		
	Accessory Materials: Trace sand and grass roots			
	Dry, medium dense	0.2		
FILL	Yellow brown / orange brown stiff clay			
	Accessory Materials: Gravels, silt			
	Dry, medium dense			
	Likely Reworked Natural Material	0.6		
	(Capping Layer)			
FILL	Brown grey / grey brown firm clay			
	Accessory Materials: Silt, plastic, brick fragments, glass, gravels			
	Moist, medium dense			
	Historic Landfill			
CLAY (CH/CL)	Grey / orange brown	4.0		
	Silty			
	Moist, stiff			
	Dargile Formation			
	BOREHOLE TERMINATED	4.5		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 2

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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 2
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth
FILL	Grey brown silt Accessory Materials: Trace gravels Dry, medium dense	0
		0.6
FILL	Brown grey / yellow brown / grey firm clay Accessory Materials: Silt, plastic, gravels Dry to moist, medium dense **Historic Landfill**	
	BOREHOLE TERMINATED Note: This bore was terminated still within the historic landfill profile	2.0

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 3

A.S.JAMES PTY. LTD.
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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 3
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown silt	0		
	Accessory Materials: Gravels			
	Dry, medium dense	0.2		
FILL	Brown grey / orange brown / grey firm clay			
	Accessory Materials: Silt, plastic, gravels, copper			
	Dry to moist, medium dense			
	Historic Landfill			
	Note: Very Moist at the bottom of the borehole			
	BOREHOLE TERMINATED	3.0		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 4**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

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Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 4 & 5
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown silt	0		
	Accessory Materials: Gravels, grass roots	0.1		
	Dry, medium dense			
FILL	Grey brown / orange brown / grey firm clay			
	Accessory Materials: Silt, plastic, gravels, glass			
	Dry to moist tending very moist, medium dense			
	Historic Landfill			
	BOREHOLE TERMINATED	2.0		
BH5				
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.1		
	Dry, medium dense			
FILL	Grey brown / orange brown / grey stiff clay			
	Accessory Materials: Silt, cloth, gravels, steel			
	Dry to moist, medium dense			
	Historic Landfill			
	BOREHOLE TERMINATED	**2.0**		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 5**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 6
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.1		
	Dry, medium dense			
FILL	Yellow brown / orange brown mottled red			
	stiff clay			
	Accessory Materials: Gravels, silt			
	Dry, medium dense	0.6		
	Likely Reworked Natural Material			
	(Capping Layer)			
FILL	Grey tending dark grey firm clay			
	Accessory Materials: Silt, plastic, glass, steel			
	Moist, medium dense			
	Historic Landfill			
	BOREHOLE TERMINATED	2.0		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 6

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 7
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Yellow brown silt Accessory Materials: Silt, sand, tending clayey Dry to moist, medium dense **Likely Reworked Natural Material** **(Capping Layer)**	0		
FILL	Dark grey brown firm clay Accessory Materials: Silty, plastic, glass, steel, brick fragments Moist, medium dense **Historic Landfill**	2.2		
	BOREHOLE TERMINATED	3.0		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 7**
l Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 8
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand			
	Dry, medium dense	0.15		
FILL	Yellow brown / orange brown mottled red			
	stiff clay / silt			
	Accessory Materials: Gravels			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
FILL / CLAY	Orange brown stiff clay	1.3		
(CH/CL)	stiff clay			
	Accessory Materials: Silty			
	Dry to moist, medium dense			
	Possibly Reworked Natural Material	1.7		
CLAY	Grey / orange brown			
(CH/CL)	Silty			
	Moist, stiff			
	Ironstone (Sub-angular) gravels present at deeper			
	depths including occasional grit and gravel			
	bands, variably ferruginous			
	Dargile Formation			
	BOREHOLE TERMINATED	3.0		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 8

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 9
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.1		
	Dry, medium dense			
FILL	Yellow brown / orange brown / grey mottled red			
	stiff clay / silt			
	Accessory Materials: Gravels			
	Dry to moist, medium dense			
	Note: tending to clay			
	Likely Reworked Natural Material			
FILL	Dark grey / orange brown firm clay	1.6		
	Accessory Materials: Silty			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
FILL	Dark brown / orange firm clay	2.3		
	Accessory Materials: Silty			
	Moist, medium dense, Note: Auger grabbing			
	Possibly Reworked Natural Material	2.6		
FILL / CLAY	Dark brown / orange / grey stiff clay			
(CH/CL)	Accessory Materials: Silty			
	Moist, medium dense			
	Possibly Reworked Natural Material	3.0	+	N = 3 / 5 / 6
CLAY	Grey / orange brown			
(CH/CL)	Silty			
	Moist, stiff			
	Dargile Formation	3.4		
	BOREHOLE TERMINATED			

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 9**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 10
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.05		
	Dry, medium dense			
FILL	Orange brown / grey stiff clay			
	Accessory Materials: Gravels, silty			
	Dry to moist, medium dense, **Likely Reworked**	1.0		
	Natural Material (Capping Layer) (0.05-1.0 m)			
FILL	Brown gravels / silt	1.4		
	Accessory Materials: Clay, plastic, brick fragments,	1.6	+	N = 3 / 3 / 4
	glass, steel			
	Dry to moist, medium dense			
	Historic Landfill (1.0-1.4 m)			
SILT	Pale grey			
(MH)	Clayey	2.5		
	Moist, loose to medium dense (1.4-1.6 m)			
CLAY	Dark Brown mottled orange /grey		+	N = 2 / 3 / 4
(CH/CL)	Silty			
	Moist, stiff (1.6-2.5 m)			
CLAY	Grey / orange brown			
(CH/CL)	Silty			
	Moist, stiff			
	Ironstones (Sub-angular) present and deeper		+	N = 4 / 6 / 7
	depths including occasional grit and gravel			
	bands, variably ferruginous			
	Dargile Formation			
			+	N = 5 / 9 / 10
	BOREHOLE TERMINATED	6.4		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 10

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 11
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.05		
	Dry, medium dense (0-0.05 m)	0.3		
FILL	Red mottled grey / brown orange stiff clay			
	Accessory Materials: Silty			
	Dry, medium dense, (0.05-0.3 m)			
FILL	Orange brown / grey stiff clay			
	Accessory Materials: Gravels, silty			
	Dry to moist, medium dense, **Likely Reworked**	1.6		
	Natural Material (Capping Layer) (0.3-1.6 m)			
FILL	Grey brown / orange brown / dark grey firm clay			
	Accessory Materials: Silt, plastic, gravels, glass			
	Moist, loose to medium dense			
	Historic Landfill (1.6-3.5 m)			
	Note: Silty Clay lenses			
CLAY	Orange brown /grey	3.5		
(CH/CL)	Silty			
	Moist, stiff			
			+	N = 4 / 6 / 7
CLAY	Grey / orange brown	5.0		
(CH/CL)	Silty, tending sandy			
	Moist, stiff			
	Ironstone (Sub-angular) gravels present at deeper depths including occasional grit and gravel bands, variably ferruginous		+	N = 6 / 7 / 9
	Dargile Formation			
	BOREHOLE TERMINATED	6.4		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 11

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 12
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.05		
	Dry, medium dense (0-0.05 m)			
FILL	Orange brown / grey stiff clay			
	Accessory Materials: Gravels, silty			
	Dry to moist, medium dense, **Likely Reworked**			
	Natural Material (Capping Layer)			
		1.7		
FILL	Dark Grey brown firm clay			
	Accessory Materials: Silt, plastic, gravels, sand			
	Moist, loose to medium dense			
	Historic Landfill			
CLAY	Grey / orange brown	4.0		
(CH/CL)	Silty			
	Moist, stiff			
	Ironstone (Sub-angular) gravels present at deeper		+	N = 4 / 6 / 8
	depths including occasional grit and gravel			
	bands, variably ferruginous			
	Dargile Formation			
			+	N = 11 / 13 / 14
	BOREHOLE TERMINATED	6.4		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 12**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 13
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.05		
	Dry, medium dense (0-0.05 m)			
FILL	Orange brown / red / grey stiff clay			
	Accessory Materials: Trace gravels, silty			
	Dry to moist, medium dense, **Likely Reworked Natural Material**	1.6		
FILL / CLAY (CL / CH)	Orange brown /grey Silty Moist, stiff **Possibly Reworked Natural Material**	2.5		
			+	N = 7 / 9 / 12
CLAY (CH/CL)	Grey / orange brown Silty, tending sandy Moist, stiff Ironstone (Sub-angular) gravels present at deeper depths including occasional grit and gravel bands, variably ferruginous **Dargile Formation**		+	N = 7 / 9 / 10
			+	N = 9 / 12 / 22
	BOREHOLE TERMINATED	6.4		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 13**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 14
Job No. 115706 **Date:** Mar '14
Ground Water: Perched water table at approximately 3.0 m.

Soil Type	Description	Depth	Tests	Results
FILL	Orange brown silt	0		
	Accessory Materials: Gravels , clayey			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
	Note: Tending to silty clay			
FILL	Orange brown / grey stiff clay	1.4		
	Accessory Materials: Gravels , silty			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
	(Capping Layer)	1.8		
FILL	Grey brown firm clay			
	Accessory Materials: Silt, plastic, glass, steel			
	sand, sole of shoe			
	Moist, loose to medium dense			
	Historic Landfill			
		4.5		
CLAY	Orange /grey	4.6		
(CH / CL)	Silty			
	Moist, stiff			
	Dargile Formation			
	BOREHOLE TERMINATED			

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 14**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 15 & 16
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth			
BH15	**Grass Playing Surface**				
FILL	Brown Sand	0			
	Accessory Materials: silt, organics	0.1			
	Moist, Medium Dense (0 - 0.1 m)				
FILL	Brown Sand / Silt / Gravels	0.3			
	Moist, Medium Dense (0.1 - 0.3 m)				
					s > 140 kPa
CLAY	Orange / grey / red				
(CH / CL)	Silty				
	Moist, very stiff				
	Dargile Formation				s > 140 kPa
					s = 120 kPa
	BOREHOLE TERMINATED	2.0			
BH16	**Grass Playing Surface**				
FILL	Brown Sand	0			
	Accessory Materials: silt, organics	0.1			
	Moist, Medium Dense (0 - 0.1 m)				
FILL	Brown Sand / Silt / Gravels	0.3			
	Moist, Medium Dense (0.1 - 0.3 m)				
FILL	Orange brown / yellow brown silt				
	Accessory Materials: Clay				
	Dry to moist, medium dense, **Likely Reworked**				
	Natural Material				
		1.0			s = 114 kPa
CLAY	Orange /grey				
(CH / CL)	Silty				
	Moist, very stiff				s = 136 kPa
	Dargile Formation				
	BOREHOLE TERMINATED	2.0			

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 15**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 17 & 18
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
BH17	**Grass Playing Surface**			
FILL	Brown Sand	0		
	Accessory Materials: silt, organics	0.1		
	Moist, Medium Dense (0 - 0.1 m)			
FILL	Brown Sand / Silt / Gravels	0.3		
	Moist, Medium Dense (0.1 - 0.3 m)			
			.	s > 140 kPa
CLAY	Orange /grey			
(CH / CL)	Silty			
	Moist, very stiff			
	Dargile Formation		.	s > 140 kPa
		1.3		
SAND	Fine to Medoum Grained			
(SM)	Grey Brown / yellow brown mottled red		.	s > 140 kPa
	Silty			
	Moist			
	Dense			
	BOREHOLE TERMINATED	2.0		
BH18	**Grass Playing Surface**			
FILL	Brown Sand	0		
	Accessory Materials: silt, organics	0.1		
	Moist, Medium Dense (0 - 0.1 m)			
FILL	Brown Sand / Silt / Gravels	0.3		
	Moist, Medium Dense (0.1 - 0.3 m)			
FILL	Orange brown / yellow brown silt			
	Accessory Materials: Clay			
	Dry to moist, medium dense, **Likely Reworked**			
	Natural Material			
		1.3		
CLAY /	Orange / grey brown mottled red			
FILL	Silty		.	s = 102 kPa
(CH / CL)	Moist, stiff			
	Note: Possibly reworked Natural Materials			
	BOREHOLE TERMINATED	2.0		

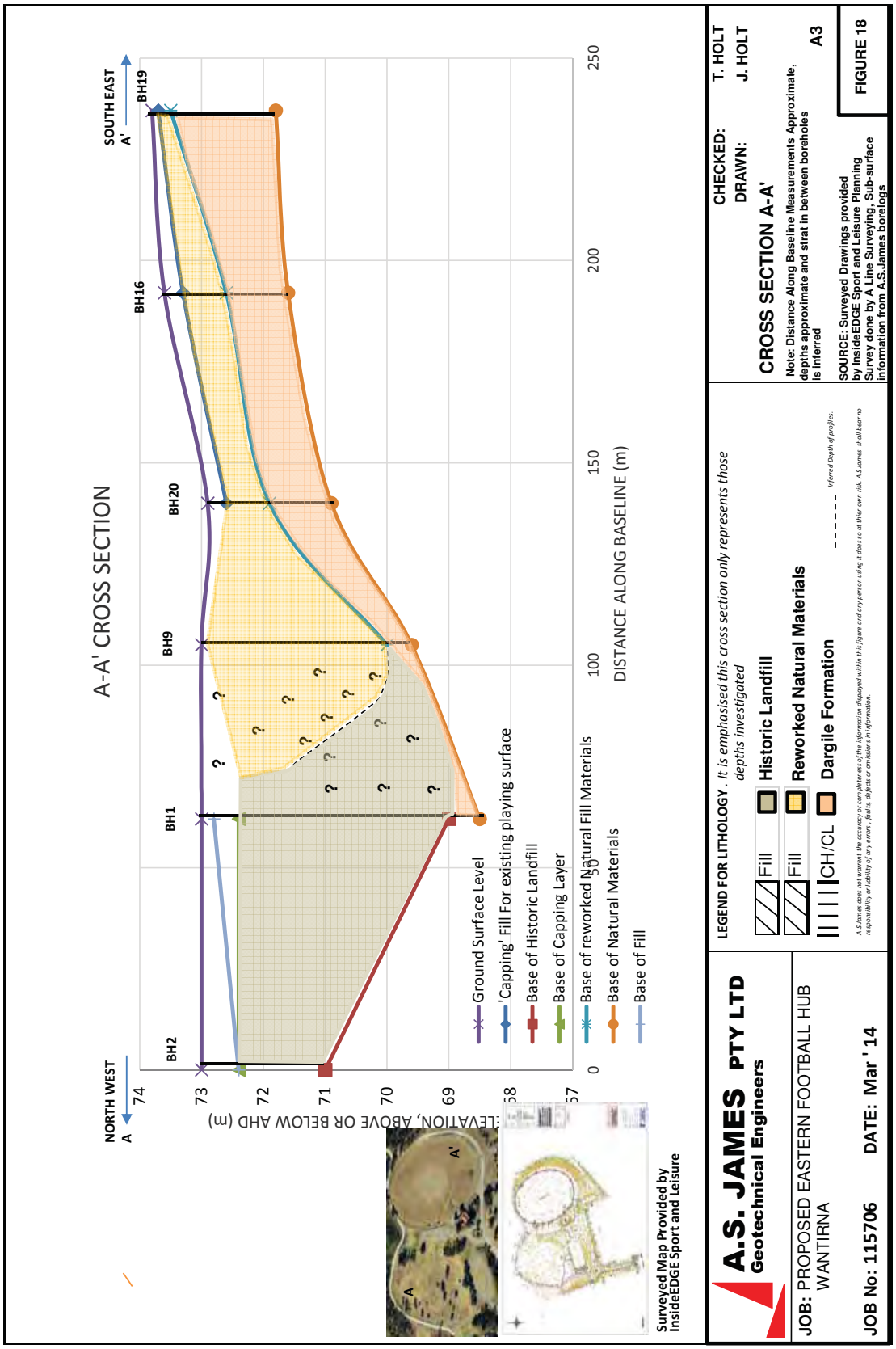
+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 16**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 19 & 20
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
BH19	**Grass Playing Surface**			
FILL	Brown Sand	0		
	Accessory Materials: silt, organics	0.1		
	Moist, Medium Dense (0 - 0.1 m)			
SILT	Grey brown containing trace gravels and sand	0.3		
(ML)	Moist, Medium Dense (0.1 - 0.3 m)			
			.	s > 140 kPa
CLAY	Grey Brown / orange brown / red at deeper depths			
(CH / CL)	Silty			
	Moist, very stiff			
	Dargile Formation		.	s = 130 kPa
			.	s = 140 kPa
	BOREHOLE TERMINATED	2.0		
BH20	**Grass Playing Surface**			
FILL	Brown Sand	0		
	Accessory Materials: silt, organics	0.1		
	Moist, Medium Dense (0 - 0.1 m)			
FILL	Brown Sand / Silt / Gravels	0.3		
	Moist, Medium Dense (0.1 - 0.3 m)			
FILL	Orange brown / grey brown stiff clay			
	Accessory Materials: Silt			
	Dry to moist, medium dense, **Likely Reworked**			
	Natural Material			
		1.0	.	s = 94 kPa
CLAY	Grey Brown / orange brown			
(CH / CL)	Silty			
	Moist, very stiff		.	s = 90 kPa
	Dargile Formation			
	BOREHOLE TERMINATED	2.0		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 17**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	


A-A' CROSS SECTION
NORTH WEST
A
SOUTH EAST
A'
BH2
BH1
BH9
BH20
BH16
BH19
ELEVATION, ABOVE OR BELOW AHD (m)
74
73
72
71
70
69
68
67
0
50
100
150
200
250
DISTANCE ALONG BASELINE (m)
Ground Surface Level
'Capping' Fill For existing playing surface
Base of Historic Landfill
Base of Capping Layer
Base of reworked Natural Fill Materials
Base of Natural Materials
Base of Fill
A
A'
Surveyed Map Provided by InsideEDGE Sport and Leisure
A.S. JAMES PTY LTD
Geotechnical Engineers
JOB: PROPOSED EASTERN FOOTBALL HUB
WANTIRNA
JOB No: 115706
DATE: Mar '14
LEGEND FOR LITHOLOGY . It is emphasised this cross section only represents those depths investigated
Fill
Historic Landfill
Fill
Reworked Natural Materials
CH/CL
Dargile Formation
Inferred Depth of profiles.
A.S.James does not warrant the accuracy or completeness of the information displayed within this figure and any person using it does so at their own risk. A.S.James should bear no responsibility or liability of any errors , faults, defects or omissions in information.
CHECKED: T. HOLT
DRAWN: J. HOLT
CROSS SECTION A-A'
Note: Distance Along Baseline Measurements Approximate, depths approximate and strat in between boreholes is inferred
A3
SOURCE: Surveyed Drawings provided by InsideEDGE Sport and Leisure Planning Survey done by A Line Surveying, Sub-surface information from A.S.James borelogs
FIGURE 18

Appendix D - Environmental Site Assessment

AECOM Imagine it. Delivered.

Wantirna Reserve Former Landfill Investigation

DRAFT

16-Aug-2019

Preliminary Environmental Site Assessment

Wantirna Reserve Former Landfill

D R A F T

Preliminary Environmental Site Assessment

Wantirna Reserve Former Landfill

Client: Knox City Council

ABN: 24 477 480 661

Prepared by

AECOM Services Pty Ltd
Level 10, Tower Two, 727 Collins Street, Melbourne VIC 3008, Australia
T +61 3 9653 1234 F +61 3 9654 7117 www.aecom.com
ABN 46 000 691 69046 000 691 690

16-Aug-2019

Job No.: 60548185

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Revision 1 – 16-Aug-2019
Prepared for – Knox City Council – ABN: 24 477 480 661

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			Name/Position	Signature
1	16-Aug-2019	Draft	Vera Levina Principal Hydrogeologist	

D R A F T

Table of Contents

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1.0 Introduction

AECOM Services Pty Ltd (AECOM) was engaged by Knox City Council (KCC) to undertake a Preliminary Phase 1 Environmental Site Assessment (ESA) desktop study for the landfilled area at Wantirna Reserve (61 Mountain Hwy, Wantirna, Victoria)(Refer to **Figure F1, Appendix A**). The reserve is located at the intersection of Mountain Highway and Eastlink Toll Road (M3). The Wantirna Reserve (the Reserve) is over 10 hectares in size.

1.1 Project Background

KCC has recently identified the reserve to be a former landfill, with a 2014 geotechnical investigation by A.S. James Geotechnical (A.S. James, 2014) encountering waste. The exact size, extent and thickness of the landfilled area is currently uncertain. Melways Maps from 1970 and 1971-1972 refer to a 'City of Knox Tip' in two different locations at the site, however KCC records do not confirm this. The site boundary and facilities layout are presented in **Figure 1** (**Appendix A**).

Wantirna Reserve has been used as grounds for various recreational activities and associated facilities (including football oval, cricket, tennis, scouts, walking and cycling path). An investigation to confirm the location and extent of the historical tip in the 1971-1972 Melways Map is required to inform potential infrastructure upgrades at the site. It is also required to confirm whether historical filling was undertaken in the area of the 'City of Knox Tip' outlined in the 1970 Melways map, including the western portion of Wantirna Reserve and the privately owned property to the southwest.

1.2 Objective

The primary objective of the Phase 1 ESA was to review the site history of the Reserve, assess the extent of the landfilling and identify potential sources and types of contamination, in association with former landfilling activities.

1.3 Scope

The scope of works comprised a desktop assessment, site inspection and landfill gas monitoring at identified likely emission locations. The ESA included the review of the following:

- Historical aerial imagery of the site and surrounds,
- Historical titles and site plans,
- Interviews with long term site users;
- Relevant documentation held by the VIC EPA or other Authorities,
- Site-specific environmental setting,
- Former landfill-specific potential contaminants,
- Discharges to environment and associated pollution controls and performance monitoring,
- On-site and/or nearby receptors;
- A site inspection and monitoring at potential areas of landfill gas emissions, carried out by suitably qualified AECOM personnel;
- Assessment of the site as per EPA Publication 1671 *Local Council Self-Assessment Tool for Closed Landfill Environmental Risk* (February 2018).; and
- Preparation of a Phase 1 report (this report).

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2.0 Site Description

2.1 General Site Description

2.1.1 Landfilled Area Description

The locations of the two separate tip areas, as presented on historic Melways maps and the potentially landfilled areas, identified from historical aerials are presented in **Figure 2** (**Appendix A**). Copies of the two Melways Maps from 1970 and 1971-1972 are presented in **Appendix F** and historical aerials in **Appendix C**. For the purpose of this investigation, the two potential landfilled areas are referred to as the North East Reworked/Landfilled Area (NE Landfilled Area) and South West Reworked Area (SW Reworked Area) below.

Descriptions of the landfilled areas are summarised below:

- NE Landfilled Area: covers approximately 32,000 m^2 and is located 150 m north of Mountain Highway, between the Reserve entry road and the western boundary of the current oval field. The area is approximately 260 m in length and a maximum of 180 m wide at the largest extent.
- SW Reworked Area: covers approximately 11,500 m^2 and is located approximately 80 m north of Burwood Highway between the private pond waterbody and the overhead power lines. The area is approximately 160 m in length and 130 m in width. This area is private property and not part of the Reserve.

2.1.2 Wantirna Reserve Site Layout

The Reserve is a large public park and recreation area with sports and recreational facilities.

The Reserve is accessed by an unnamed road entering from Mountain Highway to the south. A roundabout approximately 100 m north of Mountain Highway provides access to all facilities.

Within the NE area, in the southern portion of the Reserve are ten (10) tennis courts, tennis clubrooms and playground area. Two carpark areas are located to the north and west of the club. East of the tennis club is a Scouts Hall, small carpark and a public playground. North of the playground is a cricket and football oval with a small pavilion on the western boundary and batting cages to the northern oval boundary. A Stormwater Pond is located directly northwest of the current cricket oval.

Further northwest of the oval is a grassed and vegetated area with a northeast-southwest aligned walking and cycling path (Eastlink Trail). Dandenong Creek flows to the west of the Reserve and Dandenong Creek Trail follows the creek alignment in a north-south direction before turning west in the western portion of the site. Dense vegetation occurs in the western portion of the site adjacent to Dandenong Creek.

A low-lying grassed and marsh area triangular in shape and small wetlands are present in the southwestern portion of the Reserve. Immediately adjacent to the southwest is the SW Reworked Area, which intersects a privately owned commercial haulage and transport building and part of a Private Pond.

Wantirna Reserve area is shown in **Figure 1**, **Appendix A**.

2.2 Site Location and Ownership

The Reserve is located at the corner of the Mountain Highway (State Route 28) and the Eastlink Tollway (M3), Wantirna, Victoria, Australia (refer to **Figure 1** – **Appendix A**). The area covered by the assessment consists of Crown Allotment 2202, Parish of Scoresby. The site details are summarised in Table 1 below.

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Table 1 Site Identification

Topic	NE Landfilled Area	SW Reworked Area
Site Location	61 Mountain Hwy, Wantirna, Victoria	1 Burwood Highway, Wantirna, Victoria
Current Land Use	Public Park and Recreational facility (Tennis, Cricket, Football, Walking, Cycling)	Commercial Property – Haulage and Transport
Land Use Zoning	Public Park and Recreation Zone (PPRZ)	Urban Flood Zone (UFZ)
Legal Property Description	Standard Parcel Identifier: 2202\PP3478 Parent Title Volume: 11705 Folio 190 Crown Description: Allot. 2202 PARISH OF SCORESBY	Not reported
Site Ownership	Crown Land	Private
Approximately Site Area (m^3)	NE Landfilled Extent: 32,000 m^2	SW Reworked Extent: 11,500 m^2

Current and historical site information, including aerial photographs, were obtained from Lotsearch (**Appendix C**). Zoning information was obtained from the Department of Environment, Land, Water and Planning online website (http://www.dtpli.vic.gov.au/planning) on 26 July 2019 and is presented in **Appendix D**. Current Reserve ownership information was obtained from the current certificate of title by KCC in **Appendix B.**

2.3 Surrounding Land Use

The Reserve is situated in the local government area of Port Phillip, within an area of mixed land use, including commercial, residential, roadways and parkland or reserve areas.

Current land use surrounding the Reserve is summarised in Table 2 below:

Table 2 Surround Reserve Land Use

Directions	Land Uses surrounding the Wantirna Reserve
North	To the north of the Reserve the public park and recreation area extends north to Boronia Road (State Route 36).
South	The site extends to Mountain Highway, which is in turn bordered by the Melbourne School of Theology and Ambulance Victoria facilities. This is followed by Burwood Highway and park and recreation fields.
East	To the east of the Reserve is the Eastlink Tollway (M3), followed by residential properties.
West	Dandenong Creek followed by Morack Public Golf Course borders the majority of the Reserve, while in the south west boundary adjacent to the Tennis Courts is a private garden nursery, one rural zoned residential property and commercial buildings (in vicinity of SW Reworked area).

2.4 Planning Scheme and Planning Policy Considerations

2.4.1 Zones and Overlays Affecting Site

Pursuant to the Victorian Planning Scheme, the Reserve is situated within a Public Park and Recreation Zone (PPRZ). Further details can be found in the Lotsearch report in **Appendix C** and the council property planning report in **Appendix D**. The zones and overlays affecting the site are listed below in Table 3.

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Table 3 Site Zones and Overlays

Planning Type	NE Landfilled Area	SW Reworked Area
Planning Zone	Public Park and Recreation Zone (PPRZ)	Urban Floodway Zone (UFZ)
	Public Conservation and Resource Zone (PCRZ)	
Planning Overlay	Environmental Significance Overlay - Schedule 2 (ESO2)	Environmental Significance Overlay - Schedule 2 (ESO2)
	Land Subject to Inundation Overlay (LSIO)	Land Subject to Inundation Overlay (LSIO)
		Public Acquisition Overlay (PAO2)

The Planning Scheme indicates that the Reserve is currently not subject to an Environmental Audit Overlay (EAO), however, the local Council may require an environmental audit in the future as part of a planning or building permit for sensitive land use.

2.4.2 Planning Overlays Surrounding Reserve

Planning overlays of note surrounding the Reserve within a 1 km buffer radius include:

- A Vegetation Protection Overlay – Schedule 1 (VPO1) is located approximately 40 m southwest of SW reworked area; and
- A Special Building Overlay (SBO) is located both 100 m east and 250 m northeast of the NE landfilled area, and 230 m west of the SW reworked area.

2.4.3 Zoning Surrounding Reserve

The land immediately southwest of the Reserve entry road is zoned a Rural Living Zone (RLZ). Land to the east and south of the Reserve is zoned Road-Category 1 (RDZ1), and south of Mountain Highway is a Commercial 2 Zone (C2Z). A Public Use Zone – Service and Utility (PUZ1) is located southwest of the Reserve, south of Burwood Highway.

2.4.4 Cultural Heritage Sensitivity

The Lot Search Report indicates that the Reserve and surrounding site is within an area of Cultural Heritage Sensitivity as specified in Division 3 of Part 2 in the Victorian Aboriginal Heritage Regulations 2007.

Further details can be found in the Lotsearch reports in **Appendix C**.

2.4.5 Bushfire Prone Areas

The Reserve has been identified as being within a designated bushfire prone area and therefore special bushfire construction requirements will apply.

Further details can be found in the property planning reports in **Appendix C**.

2.5 EPA Register Search

2.5.1 EPA Priority Sites Register Search

The Priority Sites Register lists sites for which EPA Victoria has requirements for active management of land and groundwater contamination (EPA Publication 735 EPA Contaminated Site Information Systems Priority Sites Register, December 2000). Appropriate clean-up and management of such sites is an EPA priority and, as such, EPA has issued ‘Clean Up’ or ‘Pollution Abatement’ notices on the occupiers of such sites.

A search of the Priority Sites Register was undertaken on 8 July 2019 (EPA Victoria). The results of the search indicated that as of 8 July 2019, the Reserve is not listed on the Priority Sites Register and is not within the vicinity of a site listed on the register.

It should be noted that the Priority Sites Register does not list all sites known to be contaminated in Victoria, and a site should not be presumed to be free of contamination if it does not appear on the Priority Sites Register. However, since the Reserve does not exist on the EPA Priority Sites Register, no active management plan is required for the Reserve.

2.5.2 Certificates and Statements of Environmental Audit

A search on EPA Interaction Portal for properties issued with a certificate or statement of environmental audit as part of a 53X audit or with a report as part of a 53V audit, under part IXD of the Environment Protection Act 1970 was undertaken on 8 July 2019 (**Appendix C**). The Reserve is not listed on a certificate or statement of environmental audit. However, the Reserve is within 1 km of 1 property that has previously been issued with a certificate or statement of environmental audit. This audit site, Victorian EPA CARMS No. 72881-1, is located approximately 350m to the southeast of the Reserve at 56 Mountain Highway, Wantirna. Site investigation was undertaken between 2013 and 2015. The audit site was previously used as a market garden from 1954 to 2004 and for Eastlink Construction Depot use from 2004 to 2006. Groundwater quality was not assessed with groundwater not encountered within 20 m of ground surface in Silurian siltstone. Minor small amounts of remnant asbestos containing material and inert solid waste items may be present in soils. It was determined that the site was suitable for Low Density Residential or Urban Residential and Public Open Space as defined in the National Environmental Protection Measure (NEPM) guidelines.

2.5.3 Groundwater Quality Restricted Use Zone (GQRUZ)

The SEPP Waters of Victoria establishes a framework for the prevention and management of contamination of groundwater in Victoria. As part of this, the SEPP incorporates the use of groundwater quality restricted use zones (GQRUZ) to function as a tracking and information tool, which can be applied when groundwater is not suitable for particular beneficial uses, due to contamination. A search of the EPA database conducted by Lotsearch (**Appendix C)** reported no GQRUZ is located within 1 km of the site.

2.5.4 Registered Waste Management Facilities & Landfills

A search on the EPA Victorian Landfill Register for properties registered as landfill sites was undertaken by Lotsearch on 8 July 2019 (**Appendix C**). The search reported one site approximately 300 m to the southwest of the site that is currently closed. This site was reported on the Melways 1970 and 1971-1972 maps as the ‘City of Nunawading Tip’ and appears to be closed in the 1986 Melways Map, replaced with a ‘City of Nunawading Waste-Transfer and Recycling Centre’. A search of the Statewide Waste and Resource Recovery Infrastructure Plan Facilities returned one facility located at the closed landfill above, the Whitehorse Recycling & Waste Centre, which is operated by the Whitehorse City Council since approximately 1998.

Neither of the two ‘City of Knox Tip’ sites appear in the EPA Victoria Landfill Register.

3.0 Site Environmental Setting

3.1 Topography

Based on the topography of the site, the site slopes to the northwest towards Dandenong Creek. A low-lying flood plain is situated to the west of the entrance roundabout and extends towards the SW Reworked Area. The area of the NE Landfilled area is undulating in profile. The carpark area is slightly elevated above the surrounding grassed areas.

The elevation contours provided by LotSearch (**Appendix C**) appear to be based on survey data between 1970 and 1985 and display unnatural topography within the two reworked areas (NE Landfilled Area and SW Reworked Area).

3.2 Sensitive Receptors

Sensitive receptors located within a 1 km radius of the site include:

- Rural residential housing immediately southwest and residential housing 400 m east of the site.
- Dandenong Creek located immediately adjacent to the north western site boundary.
- Wetlands in low-lying areas in the western portion of the site; and
- Public recreational facilities located on the site.

3.3 Geology

Regional geology of the site was obtained from GeoScience Victoria (GSV), Earth Resources through the GeoVic online portal (a division of the Department of Economic Development, Jobs, Transport and Resources). According to the Seamless Geology Spatial Dataset 2014 (Scale 1:50,000), accessed on 23 July 2019 (https://earthresources.vic.gov.au/geology-exploration/maps-reports-data/geovic), the geology underlying the site is identified as:

- Quaternary aged alluvium (Qa1); and
- Silurian aged 'Anderson Creek Formation' (Sxa) comprising massive siltstones interbedded with thin sandstones and minor conglomerate.

The site specific information is described below in Section 4.4. At least 0.6 m thick clay to silt cover layer over the historic landfill was reported in the NE Landfilled Area.

3.4 Hydrogeology

Information and data on the regional hydrogeology relevant to the site have been obtained from the Department of Environment, Land, Water and Planning (DELWP) website (https://www.water.vic.gov.au). The Groundwater Resource Report indicated the site comprises of the following groundwater aquifers / aquitards:

- QA Quaternary Aquifer comprises sand, gravels, clay, silts and extends to 7 m bgl with total dissolved solids (TDS) concentrations ranging from 1,001 to 3,500 mg/L; and
- BSE Mesozoic and Palaeozoic Bedrock (basement) sedimentary (fractured rock): Sandstone, siltstone, mudstone, shales. Igneous (fractured rock): includes volcanics, granites, granodiorites. These extend from 7 to 207 m bgl with TDS locations ranging from 1,001 to 3,500 mg/L.

Based on Leonard (2006), hydraulic conductivities of the Palaeozoic Bedrock vary depending on the degree of fracturing and/or weathering and are generally low, between 0.001 m/day and 0.3 m/day. As described in Section 4.4, in the site-specific bores the reworked fill was underlain by clays suggesting low permeability of the sediments underlying the site.

According to the groundwater resource report, the depth to groundwater is generally less than 5 m bgl. As described in Section 4.4, groundwater was encountered at approximately 3.0 m below ground level (m bgl) in the NE Landfilled Area. Based on the site walkover observations there are significant marsh

and swamp areas within the site near Dandenong Creek suggesting a very shallow water table in the vicinity of the site. TDS concentrations were noted to range between 1,001 to 3,500 mg/L, which classifies the groundwater across several segments of the State Environment Protection Policy (SEPP Waters) (2018) and would conservatively classify the site as Segment A2.

The Visualising Victoria's Groundwater map (https://www.vvg.org.au/vvg_map accessed 12 August 2019) indicates the salinity in the area is 3,501 to 13,000 mg/L. This would classify the site as Segment C under SEPP Waters (2018).

The protected beneficial uses of the most conservative segment (Segment A2) include: Water Dependant Ecosystems and Species, Potable Water Supply (acceptable), Potable Mineral Water Supply, Agriculture and Irrigation (irrigation and stock watering), Industrial and Commercial, Water-based Recreation (primary contact recreation), Traditional Owner Cultural Values, Cultural and Spiritual Values, Buildings and Structures and Geothermal Properties. It is considered that groundwater beneath the site is unlikely to be suitable for water supply, based on background TDS and therefore we have adopted Segment B for use in assessing landfill risk (Section 6).

Based on the site location and current usage, Water Dependant Ecosystems and Species represent the most realistic protected beneficial use at the site.

A copy of the groundwater resource report from DELWP and image of the VVG salinity map is provided in **Appendix E**.

3.5 Registered Groundwater Search

A search for registered groundwater users located within a 2 km radius of the site was undertaken by Lotsearch, using the Water Measurement Information System (WMIS) maintained by DELWP.

The results indicate that there were approximately 190 registered groundwater bores within a 2 km radius of the site. Given the large number of groundwater bores in the area, the review for this ESA excluded groundwater bores registered for 'Non-Groundwater' purposes. A total of 18 registered groundwater bores are located within 2 km of the site, three (3) of which are registered for groundwater investigation purposes and 15 for domestic and stock purposes. It should be noted that the total depth of all bores was less than 15 m and therefore are unlikely to be used for domestic supply.

Table 4 Registered Groundwater Bores Search (2 km), WMIS

Bore ID	Date Completed	Depth (m)	Direction	Distance from Centre (m)	Registered Use
WRK960389	22/11/2002	6	SW	238	Investigation
WRK960388	22/11/2002	6.4	SW	248	Investigation
WRK960390	22/11/2002	6	SW	252	Investigation
WRK981922	11/7/2007	5	SW	556	Domestic & Stock
WRK981923	10/7/2007	8.5	SW	556	Domestic & Stock
WRK981924	11/7/2007	10	SW	556	Domestic & Stock
WRK981925	11/7/2007	5	SW	556	Domestic & Stock
WRK981926	12/7/2007	5.5	SW	556	Domestic & Stock
WRK981927	12/7/2007	13	SW	556	Domestic & Stock
WRK981928	13/7/2007	15	SW	556	Domestic & Stock
WRK981930	12/7/2007	5.5	SW	556	Domestic & Stock
WRK981931	12/7/2007	13	SW	556	Domestic & Stock
WRK981932	13/7/2007	15	SW	556	Domestic & Stock
WRK981933	10/7/2007	10.5	SW	556	Domestic & Stock

Bore ID	Date Completed	Depth (m)	Direction	Distance from Centre (m)	Registered Use
WRK981934	13/7/2007	15	SW	556	Domestic & Stock
WRK981935	10/7/2007	8.5	SW	556	Domestic & Stock
WRK981936	11/7/2007	10	SW	556	Domestic & Stock
WRK981937	13/7/2007	15	SW	556	Domestic & Stock

3.6 Hydrology

The nearest surface water body is Dandenong Creek, which flows in a southwest direction and bounds Wantirna Reserve immediately to the west and northwest of the site.

A stormwater pond is located directly north of the current cricket oval and collects surface water from the drains adjacent to the cricket batting cages located northwest of the oval. There is an extensive stormwater drainage network associated with the sporting grounds. Surface water is diverted from the former landfill area, towards a storage dam in use to the northwest of the current oval.

According to, SEPP Waters (2018) surface water at the site is classified as Urban (the areas within the urban growth boundary for Metropolitan Melbourne), which includes Dandenong Creek, the tributaries of the Yarra, Maribyrnong and Werribee Rivers, and the current developed areas in the Mornington Peninsula and Western Port catchments. This classifies the site as highly modified for water dependent ecosystems.

4.0 Historical and Background Information Review

4.1 Current and Historical Title Review

Current and historical certificates of title for the Reserve only and not the private property in the SW Reworked area were provided by KCC, which were obtained from Feigl & Newell Title Searchers Pty Ltd for the property address 61 Mountain Highway, Wantirna, Victoria. The current title describes the property as Volume 11770 Folio 352, under the ownership of the Crown. The certificate of title indicates that the Crown have owned all land parcels in this title since 4 January 2001 and is listed for Crown Land Temporarily Reserved for Recreation Leisure and Tourism. A total of eight (8) separate parcels have been split and/or consolidated over time to create the current title.

A summary of the certificate of title is provided in Table 5 below and certificates of title are presented in **Appendix B**.

Table 5 Table of Historical and Current Certificates of Title

Certificate of Title Reference	Location	Period of Ownership	Proprietor
Volume 2747 Folio 250	All of site	31/10/1899 - 04/03/1903	Allan Williamson (Market Gardener)
		04/03/1903	The Equity Trustees Executors and Agency Company Ltd
		04/03/1903 - 06/04/1911	Edward Ford (Butcher)
		06/04/1911 – 02/12/1930	John Sanders (Farmer)
Volume 5751 Folio 143	Derived from V. 2747, F. 250	2/12/1930 – 3/10/1940	John Sanders (Farmer)
Volume 6488 Folio 592	Derived from V. 5751 F.143	3/10/1940 – 7/05/1947	Frederick McDowall (Contractor)
Volume 7220 Folio 886	Derived from V. 6488 F. 592	7/05/1947 – 18/08/1949	Elsie McLean
		18/08/1949 – 28/06/1966	William Nest (Butcher)
Volume 8626 Folio 157	Derived from V. 7220 F. 886	28/06/1966 - 27/09/1977	**The President Councillors And Ratepayers Of The Shire Of Knox**
		27/09/1977 - 13/03/1996	**Melbourne Metropolitan Board of Works**
		13/03/1996 - 30/11/2001	**Melbourne Parks & Waterways**
		30/11/2001 - present	**Transferred to Crown**
Volume 4676 Folio 112	Derived from V. 2747, F. 250	15/03/1923 - 23/10/1936	Archibald Sanders (Orchardist)
		23/10/1936 - 31/08/1944	Norman Taintor (Orchardist)
		31/08/1944 - 16/07/1974	Frederick Finger (Orchardist)
		16/07/1974 – 10/10/1984	Country Roads Board
Volume 9585 Folio 004	Derived from V. 4676, F. 112	10/10/1984 – 13/03/1996	Melbourne And Metropolitan Board of Works
		13/03/1996 – 30/11/2001	Melbourne Parks & Waterways
		30/11/2001 – Present	**Transferred to Crown**
Volume 5030 Folio 844		03/09/1925 – 27/09/1977	The President Councillors And Ratepayers Of The Shire Of Fern Tree Gully

Certificate of Title Reference	Location	Period of Ownership	Proprietor
	Derived from V. 2747, F. 250	27/09/1977 – 13/03/1996	Melbourne And Metropolitan Board of Works
		13/03/1996 – 30/11/2001	Melbourne Parks & Waterways
		30/11/2001 - Present	**Transferred to Crown**
Volume 11770 Folio 352	Derived from V.8626 F. 157, V. 9585 F. 004 and V. 5030 F. 844 (and other parcels outside of investigation area)	4/12/2001 - Present	**Crown Land Temporarily Reserved for Recreation Leisure And Tourism**

According to the certificate of title, Volume 8626 Folio 157 was transferred to the ownership of The President Councillors And Ratepayers Of The Shire Of Knox on 26 August 1966 and then transferred to the Melbourne Metropolitan Board of Works on 27/09/1977. This is consistent with the time period of the NE Landfilled Area operating under the ownership of KCC.

4.2 Historical Aerial Photography

A search of relevant historical aerial photographs was undertaken. Nine historical aerial photographs were reviewed for the site from the period 1951 to 1991 and two Google Earth images were reviewed from 2005 to 2009. The information obtained during the review for a selection of significant aerial photographs is summarised in Table 6 below. Copies of all of the aerial photographs and Google Earth images obtained are attached in **Appendix C**.

Table 6 Aerial Photograph Review

Date	Description
1951	*Reserve and Surrounds* Predominantly vacant with grass likely used for agricultural purposes (grazing). Tree cover present along Dandenong Creek. Two tennis courts in the location of current tennis club and faint circular field visible to north of courts. A small structure is also located on the site immediately to the north of the site. The use of this structure is not clear. North of the field appears to be NE/SW aligned natural drainage channels. The area surrounding the site is sparsely populated and appears to be dominated by agricultural land with some orchards. Several small structures, potentially residential, are located southwest of the site long Burwood Highway.
1960	*Reserve* Unsealed road runs N/S through the middle of the site, developed along the alignment of the power lines also running N/S. Some development extended beyond the boundary to the north and north east. New orchards developed to the east of the tennis courts and cricket oval. *Surroundings* New development to the south west of the Reserve appears to be visible with reworked surface cover along the section north of Burwood Highway.
1962	*Reserve* Remains vacant and unchanged since the 1960 aerial photograph. *Surroundings*

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Date	Description
	Tear drop shaped dam constructed to the immediate west of the reserve and south of the Dandenong Creek tree cover in the vicinity of the SW Reworked Area. Additional reworked surface cover west of this area in the 1960 aerial photography is present, which is consistent with groundworks for site development. A minor track appears to link the dam with the reworked area, which may be the origin of the material. Some tree cover to the north of the dam appears to have been cleared.
1963	*Reserve* Remains vacant and unchanged since the 1962 aerial photograph. *Surroundings* Tear drop shaped dam completed to the immediate west of the reserve.
1966	*Reserve* Remains vacant and unchanged since the 1963 aerial photograph. *Surroundings* Major dam excavation in the south-western portion of the SW Reworked Area, replacing the tear-shaped dam. Area SE of the excavation appears to be reworked / holding excavated material. No evidence of other filling suggesting municipal waste disposal is apparent. The area to the east of the SW Reworked Area appears to have been levelled.
1967	*Reserve* Some reworked material appears showing signs of stockpiling. *Surroundings* Major dam excavation in the south-western portion of the SW Reworked Area is complete. Area SE of the excavation appears to be similar to the 1966 aerial photograph. New buildings present to the west of the original oval, potentially residential.
1968	*Reserve* Reworked material still visible to the north of the cricket oval and a distinct unsealed track to the north of the cricket oval. *Surroundings* Development of several buildings west of the cricket oval with some defined roads and vehicles. The area north of these buildings appears to have been reworked but appears to be consistent with levelling of the site and no evidence of other filling suggesting municipal waste disposal is apparent. Ground disturbance appears to occur in the location of the stormwater pond, east of the NE Landfilled Area and north of the orchards. The small triangular pond further east of the stormwater pond area is completed.
1970	*Reserve* Unsealed road developed to the west of the cricket oval providing access to the triangular shaped area where landfilling appears to be occurring. Defined tracks and material stockpiling is visible suggesting municipal waste disposal and infilling. *Surroundings* The stormwater pond is completed to the east of the NE Landfilled Area. A small area to the west of the NE Landfilled Area appears to have been levelled, but no evidence of stockpiling or landfilling is apparent.
1975	*Reserve* The original oval has been removed and appears to have been levelled with fill. It is uncertain whether landfilling occurred in this area between 1970 and 1975. A new cricket oval has been constructed in the area where the NE Landfilled Area was in the 1970 aerial photograph. The area surrounding the oval appears to be still under construction. *Surroundings*

Date	Description
	Infrastructure including three small ponds is constructed west of the Dandenong Creek.
1978	*Reserve* The cricket oval appears to be complete and a new pavilion building constructed on the western side of the oval. Additional stockpiles appear to the north and south of the oval, consistent with new filling for earthworks. Carparking and two additional courts has been developed north of the tennis club and courts. *Surroundings* Other than the development of a golf course to the west of Dandenong Creek, no changes to the surrounding land since the 1975 aerial photograph.
1991	*Reserve* Development of a second oval to the east of the oval in the 1978 aerial photograph, with a new cricket building on the western boundary of the second oval. Development of the new entrance road from Mountain Highway, two roundabouts and the carpark south of the oval in the 1978 aerial photograph. *Surroundings* No changes to the surrounding land since the 1978 aerial photograph.
2005	*Reserve* Additional vegetation cover in western portion of the site in the low-lying wetland area. Development of the 1978 oval into recreational park land. Two additional tennis courts developed north of the tennis club building. *Surroundings* Gravel cover in the area of the SW Reworked Area and development of the area to the southwest into what appears to be commercial property.
2009	*Reserve* Building to west of 1975 oval is removed. No other changes to the 2005 aerial photograph *Surroundings* New large square industrial building constructed in the area of the SW Reworked Area.

Based on the findings of the aerial photographs, the NE Landfilled Area appears to have been used as a landfill between approximately 1968 and 1975. No evidence of landfilling was observed in the vicinity of the SW Reworked area, although disturbed areas consistent with site development and construction were evident.

4.3 Site History

Design plans were provided by KCC for the Reserve for 1965, 1967 and 1979. A review of these plans is summarised below in Table 7 and copies of the plans are provided in **Appendix F**.

Table 7 Wantirna Reserve Design Plans

Year	Development Plans
1965	The plan titled 'Development Plan' displays the original oval location to the south of the site and two proposed ovals; one 'Proposed Main Oval' in the area of the original oval and a 'Proposed Secondary Oval' to the north in the area of the NE Landfilled Area. A new road to the west of the ovals and an area reserved for a pavilion between the two ovals was also proposed. Topographic contours and marker on the map indicate an open watercourse in the area of the 'Proposed Secondary Oval' was present running from the east to the west of the site.

Year	Development Plans
1967	The plan titled 'Proposed Garbage Disposal Area' was outlined the location of the NE Landfilled Area overlying half of a 'Proposed Future Oval' in the same location as the 1965 main oval plan. The proposed area for disposal is consistent with the area in the 1970 aerial photograph. A new entrance road with topographical drainage to the west of the ovals, a drainage easement to the northwest of the ovals flowing to Dandenong Creek and an open drain on the eastern boundary of the garbage disposal area was proposed. A proposed grade of 1 in 200 from South to North and 1 in 80 from the centre of the landfill area to the eastern and western boundaries was proposed.
1979	The plan titled 'Existing Conditions – July 1979' indicate the site had tennis and basketball courts, a clubhouse and small crushed rock car park in the area of the present tennis club facilities. An existing oval and pavilion on the western side in the location of the NE Landfilled Area is present. An open drain along the access track to the west of the oval connect Mountain Highway to the pavilion. The drain appears to move to the northwest towards Dandenong Creek. There appears to be 'New work in progress' to the north of the oval, consistent with the reworked area and stockpiled material in the 1975 aerial photograph (outlines are provided on **Figures F2** and **F4**, **Appendix A**).

4.4 Previous Environmental Investigations

No previous environmental investigations have been made available to AECOM concerning this site. However, a geotechnical report conducted by A.S. James Pty Ltd (A.S. James) in 2014 was made available to AECOM. In the report, dated 24 March 2014, a geotechnical investigation of the current oval, area directly north of the tennis club Courts 6 -10 and in the vicinity of the oval present between approximately 1975 and 1991 was completed to inform the design for upgrades to the site. The location of these boreholes and the extent of previous fields in presented in **Appendix F**. The findings from a total of 20 boreholes across the site included:

- Sandy silt between 0.1 and 0.6 m thick, encountered where historical landfilling occurred in the NE Landfilled Area, while crushed rock fill (road base) was encountered in the area of the current carpark north of the tennis courts (south of the NE Landfilled Area).
- Waste was encountered between approximately 0.1 and 4.5 m bgl in the NE Landfilled Area. The material classified as historic landfill comprised grey brown/brown grey mottled clays with cloth material, plastic, gravels, metal, glass and brick. No indication of waste percentage was reported although waste was classified as accessory materials.
- A perched groundwater aquifer was encountered at approximately 3.0 m below ground level (m bgl) at two boreholes in the NE Landfilled Area. Three boreholes in the vicinity of the 1975 -1991 oval in the NE Landfilled Area were terminated before 3.0 m bgl, however it was noted to be very moist at the base (approximately 3.0 m bgl). No groundwater was encountered during the investigation.
- It was concluded that due to the unknown and uncontrolled nature of filling that the soil could have the potential to be contaminated.

In several bores natural soils were encountered, comprising primarily of clays.

Materials described as waste was reported in bores BH1-BH4, BH10 and BH11, all located within the NE Landfilled area, however waste of similar thickness was also described in bores BH5 – BH7, BH11, BH12 and BH14 located to the south of it (carpark and vegetated area north of the tennis courts) in the area of the original (1951-1970) oval. This suggests that historical landfill could have extended further south of the NE Landfilled Area, or that landfill marginal materials were used while re-landscaping the original oval area between 1970 and 1975.

D R A F T

Waste thickness of at least 4 m was adopted to estimate the volume of waste filled for the EPA landfill assessment tool.

D R A F T

5.0 Site Reconnaissance

5.1 Site Walkover

A site walkover was conducted on 8 July 2019 by AECOM. The site walkover consisted of a visual assessment of the surface topography, drainage and surface water receptors, including subsidence, differential settlement, capping and vegetation conditions on site.

No visual observations of waste impact during the site walkover was noted, with no exposed waste, odours, surface cracking or obvious displacement/subsidence. No leachate impact was observed at any of the water bodies at the Reserve. No seepage was observed and visual observations indicate the Stormwater Pond to the northwest of the cricket oval does not appear affected by leachate (i.e. no odour, nutrient-rich black or green water).

Drainage channels were observed across the site with open drainage channels and stormwater grates associated with the cricket oval and recreational walking areas park drainage.

The site walkover was conducted after significant rainfall and therefore the monitoring of identified locations could not be completed in the same mobilisation. Surface water was observed on site following the rainfall. All locations identified as likely landfill gas (LFG) emission locations were marked for the subsequent monitoring event.

5.2 Gas Monitoring

The LFG emissions survey was undertaken on 7 August 2019 by AECOM. The purpose of monitoring was to ascertain if any methane emissions occur through the former landfill cover or penetrations through it, and potentially migrating through the subsurface services at the site and in the immediate vicinity.

Monitored locations included buildings, service and drainage pits and other subsurface features marked during the initial site inspection in July 2019. Where additional service pits or features potentially penetrating the cover were identified, these were added to the list during the emissions survey. Other locations included edges of concrete slabs and bike / footpath, noticeable ground cracks, areas of low / cut grass, and other potential cover penetrations such as sign posts, fence posts, wooden posts (bollards) marking the roads or carpark boundaries; coordinates of the selected features only were recorded. Tennis Club buildings and playground locations were not investigated due to lack of access however they are remote from the identified fill extent. Other buildings were monitored outside, with readings taken along the concrete foundation edge / cracks, subfloor vents or pipework penetrating the ground.

Locations are presented on **Figure 3**, **Appendix A**.

Monitoring was undertaken in general accordance with Landfill Gas Fugitive Emissions Monitoring Guidelines – Publication 1684 EPA, 2018). Emissions at each location were measured for 30 to 60 seconds using a low concentrations methane detector (Inspectra Laser).

Ground conditions across the investigated area appeared moist but not boggy, with the apparent cracks relatively open. Soil did not appear to be saturated, however it is possible that available unsaturated gas migration pathways may have been reduced due to clay swelling.

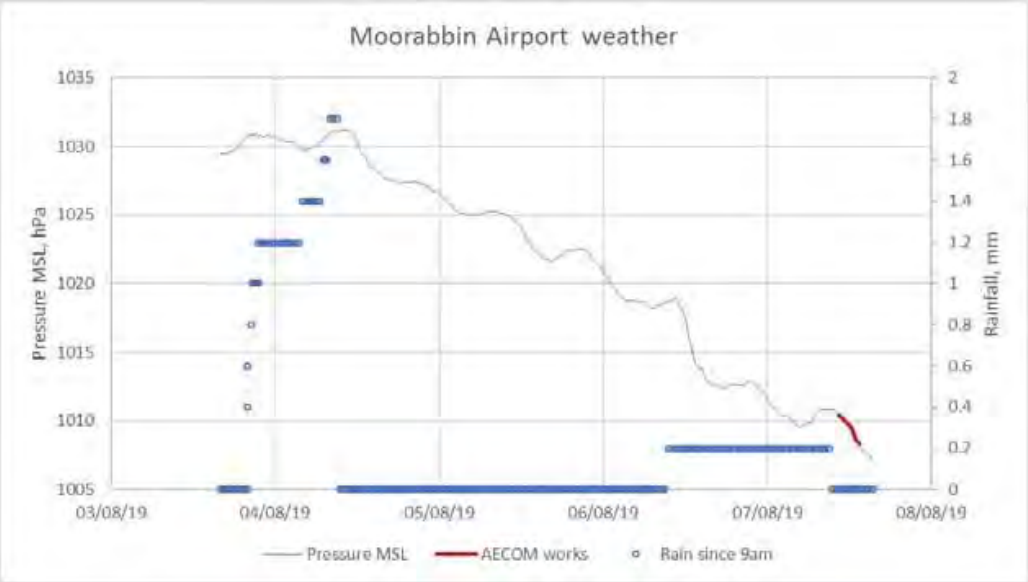
5.2.1 Meteorological Conditions and Atmospheric Pressure

Weather observations including rainfall, temperature and pressure were downloaded for the Scoresby Station for the three days prior to monitoring.

Weather conditions were favourable for gas emissions monitoring. Gas emissions monitoring was conducted following over 3 days of falling barometric pressure conditions and minor precipitation as recorded at BOM station 086077 Moorabbin Airport (refer chart below). At the nearest weather station recording rainfall data (Glen Waverley Golf Course, Station 86303), data for August was not available at the time of preparation of this report. Significant daily precipitation (over 10mm) was reported on 14-16 July, 24 July and the latest on 27 July. During the monitoring the weather was calm and overcast.

D R A F T

Figure 1 Weather at Moorabbin Airport Week Prior to Site Assessment



5.2.2 Methane Emissions Monitoring Results

Tabulated results of field measurements are presented in **Appendix G**.

Methane concentrations recorded in ambient air varied between 0.3 and 1.5 ppm.

Methane concentrations recorded off the ground, cracks and surface penetrations such as bollards, sign posts and fence posts varied between 0.8 and 1.9 ppm. Those recorded at the buildings, structures and service / drainage pits varied between 0.7 and 3.9 ppm. All methane concentrations recorded during the emissions survey were consistent with ambient background, suggesting no emissions from the former landfill.

There were no areas with apparent distressed vegetation that may have been caused by soil oxygen depletion. There were no odours or effervescence observed.

In conclusion, the recorded methane emissions and observations made during the gas emissions survey suggested no methane emissions from the former landfill at Wantirna Reserve and therefore the potential LFG hazards appear low.

However, if future site development involves disturbance of the cover, such as resurfacing or excavations or deep service trenches, it is recommended that LFG hazards are addressed as part of OHS, e.g., using of monitoring equipment such as Lower Explosive Limit (LEL) meter and risk mitigation procedures.

Furthermore, if methane above LEL is recorded at the site of potential building(s), building control measures have to be considered after the risk assessment in accordance with EPA guidelines and international standards (e.g., BS 8485).

5.3 Local Accounts

Tennis Club Members

A site inspection and interview with Mr Daryl Barrett (Tennis Club Member) and Mrs Alison Rogers (Tennis Club Member and Council Contact), was carried out on 22 July 2019 by AECOM and representatives from KCC. It is noted that both Mr Barrett and Mrs Rogers have been members of the club since approximately 1980, and their knowledge of the operation of the site was limited to the final years and closure of the landfill, however no longer term members were available at the time of the

interview. A marked-up plan indicating the extent of the landfill from their memory has been provided in **Appendix D**.

A record of the Tennis club history was provided by Mr Darryl Barrett detailing the development of the site. In 1993 when a light pole to the north of the court 8 was constructed, rubbish and debris were observed at approximately 2 m below ground level. No other refuse was encountered at the tennis club.

An account of the history of the tennis club site was provided by a member of the tennis club to KCC. It detailed that the site was proclaimed a Reserve in 1925 and that the tennis club was built shortly after, with the Wantirna Club commencing in 1934 at the site. It was noted that Melbourne Metropolitan Board of Works (South East Water) took over the lease of the area from KCC in approximately August 1986.

Knox Waste Collection Contractor

A recount of the waste collection for Knox City Council was provided by Richard Lever to KCC on 24 July 2019. He advised that in the KCC area from pre 1950s to approximately 1968 waste collection was carried by a contractor (Cook). This was a pay-per-use service, rather than KCC owned. In 1968 a company (Vantiller and Scott) collected in the area until approximately 1975. Cleanaway then commenced collection. The domestic collection service was not large as the as the area was predominantly orchards still.

At Wantirna Reserve, Koomba Road was possibly the name of the access road to the old tip and from approximately 1975 onwards the area was referred to as the 'old tip'. Mr Lever commented that signage was visible on this old access road in the mid 1970s.

He did not recall the tip itself, but that that Vantiller did tip waste there during it's time collecting waste.

Knox Staff Member involved in Reserve Upgrade Works

A recount of redevelopment of the access road and carparks at the site was provided by a KCC staff member on 203 July 2019. He advised that waste was encountered at approximately 0.5 m bgl at the roundabout west of the carpark. Waste encountered comprised significant volumes of rubber fan belts in and unidentified liquid. No other information could be ascertained.

The location of the roundabout and carpark is outlined on **Figure 1** (**Appendix A**).

Cricket Club Member

A recount of the site history was provided by Bernie Whitney, a cricket player at the Reserve since the late 1960's on 30 July 2019. The original cricket ground was located in the '1951- 1970 oval' location outlined in Figure 2 (Appendix A). He advised that the landfill was located to the north of the original ground in the '1975-1991 Oval' location.

He recalled that the site was a Council tip, but that the public could drive in with trailers to dispose of rubbish and it was freely open. The landfill emitted a strong odour on hot days.

An oval was constructed in the area where the landfill was, and the Council intended to lay turf on the oval, which club members opposed. Therefore, the oval was top dressed and if work was completed at the ground, paper and rubbish were encountered.

The ground experienced variable settlement "like a potato chip" during the period it was used for recreational purposes.

Mt Whitney recalled a deep guttering adjacent to the Reserve's main drive entry (the drive to the tip) always filled with a significant amount of water during rainfall events.

Summary

In conclusion, based on the anecdotal evidence, municipal waste was accepted at the former landfill north of the tennis courts apparently within the NE Landfilled Area. However, other waste may have been accepted, or deposited later during the redevelopment of the site and relocation of the ovals. Also, potentially reworked fill from the margins of the landfill may have been used south of the NE Landfilled Area.

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The volumes of the waste are anticipated to be relatively low due to limited rural population in the region at the time of landfilling.

6.0 Landfill Risk Score – EPA Pub. 1671

6.1 Self-Assessment Tool

For the purpose of informing planning decisions with regards to closed landfills, the EPA Publication 1671 should be incorporated in the assessment of risks to the environment and human health. The Victorian Auditor General's 2014 report on landfill management in Victoria, recommendation number 5, states that "Councils work with the Environment Protection Authority and the regional waste and resource recovery groups to identify closed landfills, assess their risks and prioritise actions at a regional scale to address these".

The findings of this report have been assessed against the closed landfill self assessment tool and provide a rating to the NE Landfilled Area.

The SW Reworked Area is not considered in this assessment as no evidence of landfilling activities has been observed.

A summary of the outcomes of this tool are summarised in Table 8 below. The self assessment tool is attached in **Appendix H**.

Table 8 Closed Landfill Environmental Risk Assessment Tool

Section		Score
1 Location Attributes		
1.1 Distance to nearest sensitive receptor	< 250 m (30m to Dandenong Creek; gathering or meeting places – on site buildings)	0
1.2 Geological sensitivity to landfill activities	Low sensitivity e.g. thick laterally contiguous clay/less fractured hard rocks -Fractured or fissured, aquifers of low to moderate productivity, geology Quaternary Alluvium and basement and Mesozoic and Palaeozoic Bedrock (basement) sedimentary (fractured rock)	3
1.3 Engineered cells	No engineered/lined cells	0
1.4 Groundwater quality (SEPP)	Segment B – the site is not used for drinking water beneficial uses.	3
	Total Score	**6**
2 Management Attributes		
2.1 Volume of waste filled	5,001-10,001 annually (based on estimated area 32,000m^2 , approximately 5-8 years of operation (1967 – 1975), a conservative thickness of 4.0 m of waste and a tonnage conversion factor of approximately 0.3. [1]	4
2.2 Waste types accepted/licensed	Putrescible, solid inert and clean fill (based on personal communications as provided by Council that domestic refuse was deposited)	3
2.3 Gas control	Landfill is not capped (so no landfill gas control)	0
2.4 Leachate control	No leachate extraction and disposal	1
2.5 Stormwater/ surface water control	Conventional capping, surface water diversion from active areas, toe drains and storage dam in use.	3
	Total Score	**11**
3 Monitoring		

[1] http://www.wasteauthority.wa.gov.au/media/files/documents/GN6VoltoTonnes.pdf

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Section		Score
3.1 Groundwater monitoring	None	1
3.2 Gas monitoring	None (except as part of this investigation)	1
3.3 Leachate monitoring	None	1
3.4 Surface water monitoring	None	0
3.5 Cap maintenance program	Some, sufficient grounds maintenance only	2
	Total Score	**5**
4 Gas, Groundwater and Surface Water Risks		
4.1 Groundwater risk	Moderate	3
4.2 Gas risk	Insignificant – based on LFG site walkover	5
4.3 Surface water risk	Insignificant	5
	Total Score	**13**
5.0 Off-site management		
Are there community complaints regarding this site?		No
Are there signs of litter beyond the boundaries?		No
6 Cells, Rehabilitation and Monitoring		
6.1 Does Council know how many cells have been created at this site?		No
6.2 Have there been any rehabilitation works undertaken?	Well covered (soil / grass)	4
	Total Score	**4**
	Section 1	**6**
	Section 2	**11**
	Section 3	**5**
	Section 4	**13**
	Section 6	**4**
	OVERALL ASSESSMENT SCORE	**39**

Based on the overall score of 39, the site falls within the >37 band, for which EPA guidelines (Pub. 1671, 2018) recommend that the site is potentially low risk based on the assessment. Consider when future reassessment should be undertaken.

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7.0 Findings

7.1 Potential Sources of Contamination

The findings of the potential sources of contamination are summarised below:

- While earthworks appear to have been undertaken in the SW Reworked Area, no evidence of landfilling activities were obtained (with the exception of the historical Melways map). On this basis it is considered unlikely that the SW Reworked Area is impacted by disposal of municipal waste;
- Based on the information obtained, the NE Landfilled Area is confirmed to have operated as a municipal landfill. This area is confirmed to have relatively shallow cover (0.6m);
- No information regarding types of landfill waste was obtained, although anecdotal evidence suggested the landfill comprising primarily of putrescible waste;
- Based on anecdotal evidence landfilling may have occurred south of the NE Landfilled Area over the site of the original 1951 -1970 oval area;
- Information for the NE Landfilled Area being used as a municipal landfill indicate that the soils in the area are contaminated with waste. The soil between the NE Landfilled area and the tennis courts also has potentially contaminated soils based on the historical filling observed in aerial photographs and tennis club recounts;
- Visual observations during the site walkover noted no exposed waste, odours, surface cracking or obvious displacement/subsidence; while during the LFG walkover, no methane emissions were reported above ambient air levels;
- No seepage or impact to the beneficial uses which is classified as Urban, highly modified was observed. Visual observations indicate the Stormwater Pond to the northwest of the cricket oval does not appear affected by leachate (i.e. no odour, nutrient-rich black or green water); and
- Groundwater at the site was noted at shallow depths in the NE Landfilled Area (approximately 3 m bgl) during previous investigation by A.S James (2014), which was within the extent of the historical fill (approximately 4 m bgl). Therefore, there is a high potential for leachate generation in the landfilled area.

8.0 Conclusions and Recommendations

Conclusions

The following conclusions are based on the information obtained from KCC and sources of information as noted in this report:

- The site historical review indicates that the NE Landfilled Area at the Wantirna Reserve was operated as a landfill area between approximately 1968 and 1975 (based on aerial photographs, Melways maps and anecdotal evidence);
- The SW Reworked area, located on private land, has evidence of reworking for drainage and nearby development only and no evidence of landfill activites;
- Soil in the NE Landfilled area and the area between the current tennis courts and the NE Landfilled area has the potential for contaminated soils to be present;
- Surface water at Reserve does not appear impacted by leachate. There is an extensive stormwater drainage network associated with the sporting grounds and surface water is collected in the Stormwater Pond, which does not show impact of leachate;
- Groundwater is potentially 3 m bgl and waste is up to 4 m bgl, therefore there is a high potential for leachate generation in the landfilled area. However, given the site has been closed for approximately 44 years, generation of leachate is likely to have reduced; and
- The recorded methane emissions and observations made during the gas emissions survey suggested no methane emissions from the former landfill at Wantirna Reserve and therefore the potential LFG hazards appear low.
- Based on the EPA Local Council closed landfill self-assessment tool, the site represents a low risk. However, future risk reassessment should not be excluded, particularly if site redevelopment involves soil disturbance.

Recommendations

- If future site development involves the excavation of material from the site or stockpiling of material from the Reserve, soil management including soil testing and classification for reuse and/or disposal should be undertaken. Stormwater management should be considered and managed accordingly on site during redevelopment to prevent potentially contaminated soil entering the waterways and Dandenong Creek though on site drainage channels.
- If future site development involves disturbance of the cover, such as resurfacing or excavations or deep service trenches, it is recommended that LFG hazards are addressed as part of OHS, e.g., using of monitoring equipment such as LEL meter and risk mitigation procedures. Furthermore, if methane above LEL is recorded at the site of potential building(s), building control measures have to be considered after the risk assessment in accordance with EPA guidelines and international standards (e.g., BS 8485).

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9.0 Standard Limitation

AECOM Services Pty Limited (AECOM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Knox City Council and only those third parties who have been authorised in writing by AECOM to rely on this Report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

It is prepared in accordance with the scope of work and for the purpose outlined in the contract 2229 dated 2017.

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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

D R A F T

Appendix A

Figures

PROJECT ID 60548185
CREATED BY BM
LAST MODIFIED BM 16 AUG 2019

AECOM
www.aecom.com

DATUM: GCS_WGS_1984

0 30 60 120
Meters

1:2,500 (when printed at A3)

Legend

- Wantirna Reserve Cadastral Parcel
- Cadastral Parcel

Melway Maps

- Northeast Reworked/Landfilled Area Extent
- Southwest Reworked Area Extent
- Potential Addition to Northeast Area
- Buildings
- Site Infrastructure
- Waterbodies
- Dandenong Creek

Data sources:
Base Data: (c) 2019 (NearMaps)

SITE INFRASTRUCTURE

Knox City Council

Wantirna Reserve Desktop Assessment
Wantirna Reserve, Wantirna, VIC 3152

Figure
F1

A3 size

Map Document: (P:\605X\60548185\4. Tech work area\4.99 GIS\02_Maps\Wantirna_Res_2019\F1_Wantirna_Reserve_Site.mxd)

PROJECT ID 60548185
CREATED BY BM
LAST MODIFIED BM 16 AUG 2019

AECOM
www.aecom.com

DATUM: GCS_WGS_1984
0 30 60 120
Meters
1:2,500 (when printed at A3)

Legend

- Wantirna Reserve Cadastral Parcel
- Cadastral Parcel

Melway Maps

- Oval Locations
- 1970 Melway Tip Extent
- 1971-72 Melway Tip Extent
- Northeast Reworked/Landfilled Area Extent (Approximate)
- Southwest Reworked Area Extent
- Potential Addition to Northeast Area
- Waterbodies
- Dandenong Creek

Data sources:
Base Data: (c) 2019 (NearMaps)

LANDFILL EXTENTS

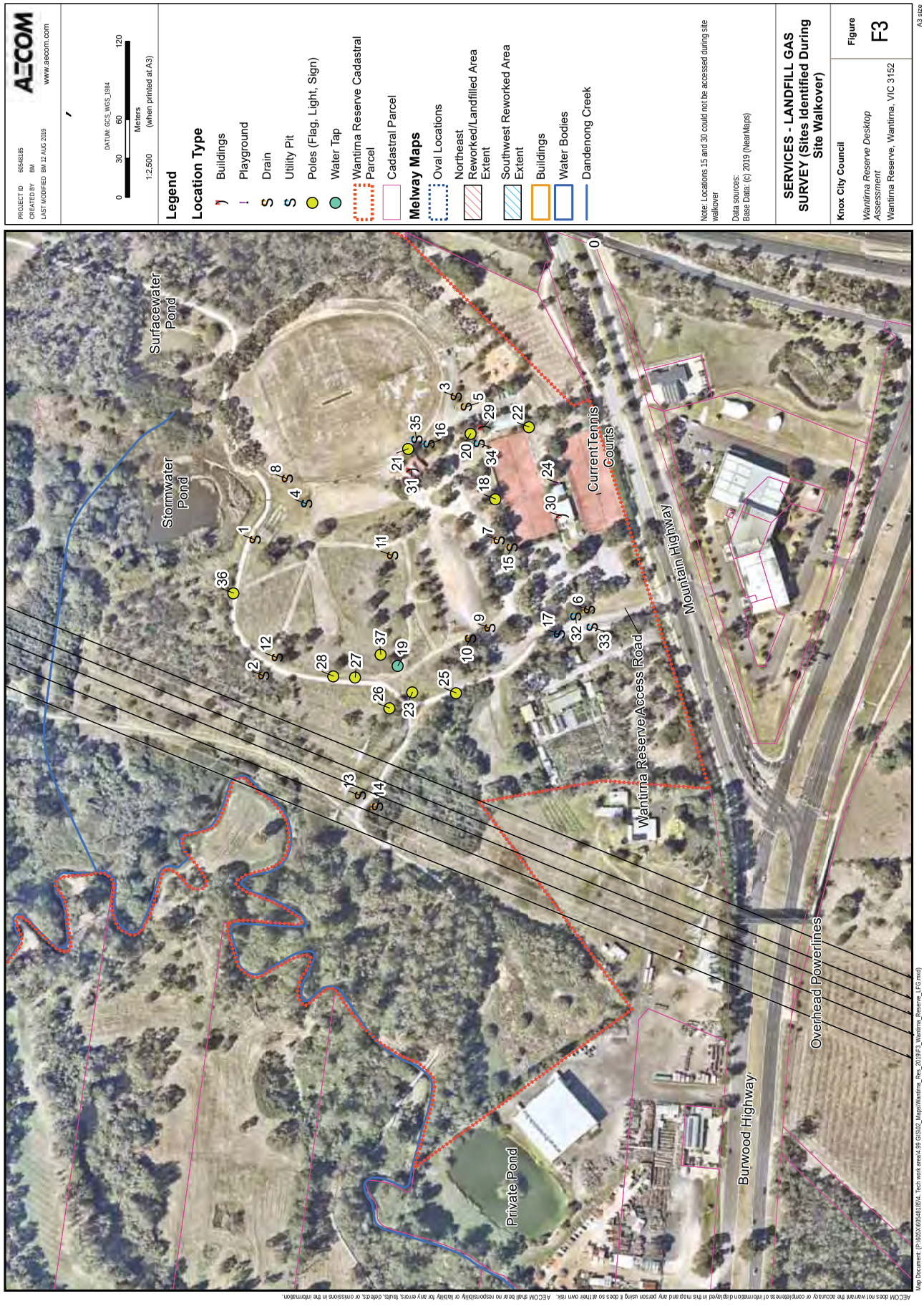
Knox City Council

Wantirna Reserve Desktop Assessment
Wantirna Reserve, Wantirna, VIC 3152

Figure
F2

A3 size

Map Document: (P:\605X\605481854. Tech work area\4.99 GIS\02_Maps\Wantirna_Res_2019\F2_Wantirna_Reserve_Landfill_Locations.mxd)


AECOM
PROJECT ID 60548185
CREATED BY BM
LAST MODIFIED BM 12 AUG 2019
www.aecom.com
DATUM: GCS_WGS_1984
0 30 60 120
Meters
1:2,500 (when printed at A3)
Legend
Location Type
Buildings
Playground
Drain
Utility Pit
Poles (Flag, Light, Sign)
Water Tap
Wantirna Reserve Cadastral Parcel
Cadastral Parcel
Melway Maps
Oval Locations
Northeast Reworked/Landfilled Area Extent
Southwest Reworked Area Extent
Buildings
Water Bodies
Dandenong Creek
Note: Locations 15 and 30 could not be accessed during site walkover
Data sources:
Base Data: (c) 2019 (NearMaps)
SERVICES - LANDFILL GAS SURVEY (Sites Identified During Site Walkover)
Knox City Council
Wantirna Reserve Desktop Assessment
Wantirna Reserve, Wantirna, VIC 3152
Figure
F3
A3 size
Surfacewater Pond
Stormwater Pond
Private Pond
Current Tennis Courts
Wantirna Reserve Access Road
Mountain Highway
Burwood Highway
Overhead Powerlines
AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.
Map Document: (P:\605\X60548185\4. Tech work area\4.99 GIS\02_Maps\Wantirna_Res_2019\F3_Wantirna_Reserve_LFG.mxd)

PROJECT ID 60548185
CREATED BY BM
LAST MODIFIED BM 16 AUG 2019

AECOM
www.aecom.com

DATUM: GCS_WGS_1984

0 35 70 140
Meters
1:3,000 (when printed at A3)

Legend

Location Type

- Buildings
- Playground
- Drain
- Utility Pit
- Poles (Flag, Light, Sign)
- Water Tap
- Cadastral Parcel

Melway Maps

- Oval Locations
- Northeast Reworked/Landfilled Area Extent (Approximate)
- Southwest Reworked Area Extent
- Potential Addition to Northeast Area
- Buildings
- Water Bodies
- LotSearch Aerial Map Extent
- Dandenong Creek

Data sources:
Base Data: (c) 2019 (NearMaps)

1970 AERIAL- LANDIFLLED AREA EXTENT

Knox City Council

Wantirna Reserve Desktop Assessment
Wantirna Reserve, Wantirna, VIC 3152

Figure
F4

A3 size

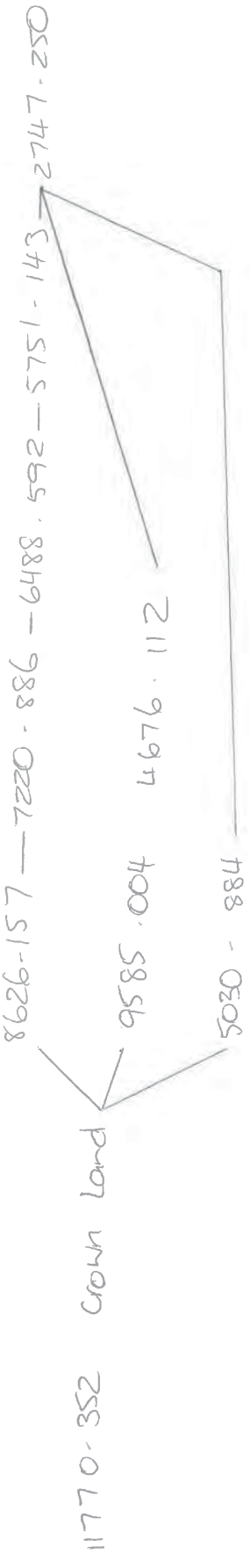
Map Document: (P:\605X\605481854. Tech work area\4.99 GIS\02_Maps\Wantirna_Res_2019\F4_Wantirna_Reserve_1975_Aerial.mxd)

D R A F T

Appendix B

Certificates of Title

	FEIGL & NEWELL TITLE SEARCHERS		
	Property Reference		
	61 Mountain Highway, Wantirna		
Volume Folio	**Registered Proprietors**	**Date**	**Status**
V.11770 F.352	Crown Land Temporarily Reserved for Recreation Leisure And Tourism	04.12.2001	Current
V.8626 F.157	Transferred to Crown	30.11.2001	History
	Melbourne Parks & Waterways	13.03.1996	History
	Melbourne Metropolitan Board Of Works	27.09.1977	History
	The President Councillors And Ratepayers Of The Shire Of Knox	28.06.1966	History
	William Nest (Butcher)	12.07.1966	History
V.7220 F.886	William Nest (Butcher)	18.08.1949	History
	Elsie McLean	07.05.1947	History
V.6488 F.592	Frederick McDowall (Contractor)	03.10.1940	History
V.5751 F.143	John Sanders (Farmer)	02.12.1930	History
V.2747 F.250	John Sanders (Farmer)	06.04.1911	History
	Edward Ford (Butcher)	04.03.1903	History
	The Equity Trustees Executors and Agency Company Ltd	04.03.1903	History
	Allan Williamson (Market Gardener)	31.10.1899	History
V.9585 F.004	Transferred to Crown	30.11.2001	History
	Melbourne Parks & Waterways	13.03.1996	History
	Melbourne And Metropolitan Board Of Works	10.10.1984	History
V.4676 F.112	Country Roads Board	16.07.1974	History
	Frederick Finger (Orchardist)	31.08.1944	History
	Norman Taintor (Orchardist)	23.10.1936	History
	Archibald Sanders (Orchardist)	15.03.1923	History
V.5030 F.884	Transferred to Crown	30.11.2001	History
	Melbourne Parks & Waterways	13.03.1996	History
	Melbourne And Metropolitan Board Of Works	27.09.1977	History
	The President Councillors And Ratepayers Of The Shire Of Fern Tree Gully	03.09.1925	History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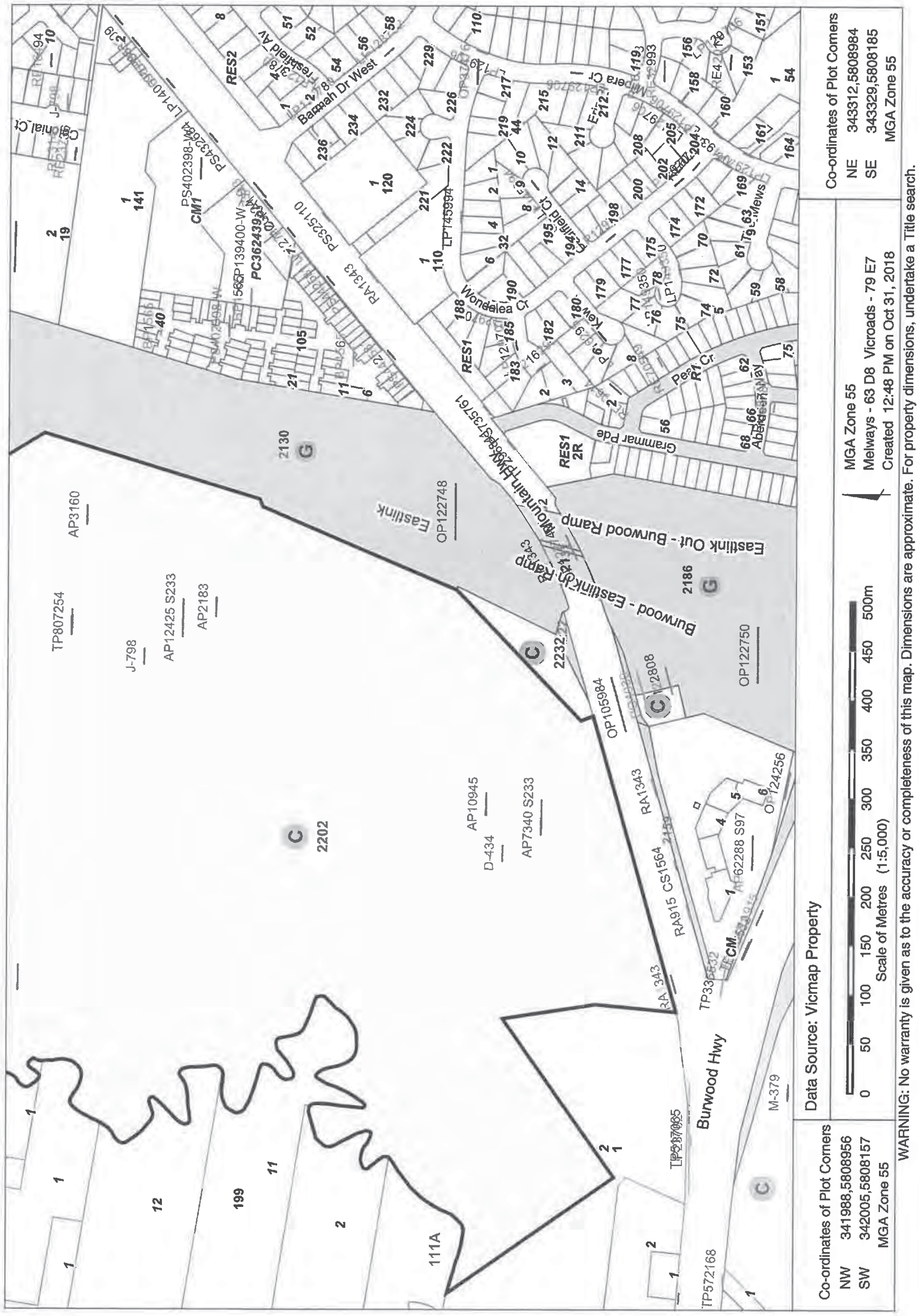
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MGA Zone 55
Melways - 63 D8 Vicroads - 79 E7
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Scale of Metres (1:5,000)
Co-ordinates of Plot Corners
NE 343312,5808984
SE 343329,5808185
MGA Zone 55
Co-ordinates of Plot Corners
NW 341988,5808956
SW 342005,5808157
MGA Zone 55
WARNING: No warranty is given as to the accuracy or completeness of this map. Dimensions are approximate. For property dimensions, undertake a Title search.
Burwood Hwy
Eastlink
Eastlink Out - Burwood Ramp
Burwood - Eastlink In Ramp
Grammar Pde
Wondalea Cr
Barmah Dr West
Mountain Hwy

CROWN FOLIO STATEMENT

VOLUME 11770 FOLIO 352 Security no : 124074647726V
No CofT exists Produced 29/10/2018 02:17 PM

CROWN FOLIO

LAND DESCRIPTION

Crown Allotment 2202 Parish of Scoresby.
PARENT TITLE Volume 11705 Folio 190
Created by instrument MI191393X 06/08/2016

CROWN LAND ADMINISTRATOR

SECRETARY TO THE DEPARTMENT OF ENVIRONMENT, LAND, WATER AND PLANNING of 8 NICHOLSON STREET EAST MELBOURNE VIC 3002
MI191393X 06/08/2016

STATUS, ENCUMBRANCES AND NOTICES

RESERVATION MI191395T 06/08/2016
TEMPORARY
CONSERVATION RECREATION LEISURE AND TOURISM

DIAGRAM LOCATION

SEE CD074434G FOR FURTHER DETAILS AND BOUNDARIES

ACTIVITY IN THE LAST 125 DAYS

NIL

DOCUMENT END

Delivered from the LANDATA® System by InfoTrack Pty Ltd.

The information supplied by Feigl & Newell Pty. Ltd. has been obtained from InfoTrack Pty Limited by agreement between them. The information supplied has been obtained by InfoTrack Pty Limited who is licensed by the State to provide this information.

CROWN DIAGRAM

CD074434G

Location of Land

Parish : SCORESBY
Allotment : 2202

This plan has been created to assist in locating a Crown Land parcel

Warning - No warranty is given as to the accuracy or completeness of this plan

Any derived dimensions are approximate

Standard Parcel Identifier (SPI) : 2202\PP3478
Vicmap Parcel PFI : 213817323

Coordinate Position
MGA : 342500, 5809060 (55)
Melways Directory Reference : 63 C6 (ed. 37)

Compiled from VICMAP cadastral mapping data
Date: 18/01/2010

SCALE
0 400 800 1200 1600 2000
METRES

Sheet 1 of 1 Sheets

Historical Search

HISTORICAL SEARCH STATEMENT Land Use Victoria

Produced 31/10/2018 02:08 PM

Volume 11770 Folio 352
Folio Creation: Created as crown land continued as computer folio
Parent title Volume 11705 Folio 190

RECORD OF HISTORICAL DEALINGS

Date Lodged for Registration	Date Recorded on Register	Dealing	Imaged	Dealing Type and Details
06/08/2016	06/08/2016	MI191394V	N	CROWN LAND STATUS REPORT

RECORD OF VOTS DEALINGS

Date Lodged for Registration	Date Recorded on Register	Dealing	Imaged

STATEMENT END

HISTORICAL REPRINT(S)

Historical Crown Parcel Report

This is a report on the parcel from 1 October 2001. It is a statement of the historic legal status of the parcel.For historical research further documentation is available through Land Use Victoria.

Land Description
Allotment: 2202 Section:
Township:
Parish: Scoresby

Standard Parcel Identifier (SPI): 2202\PP3478

End Of Land Description Details

Status Details-
Number of Status:1

Status: 1 of 1
Currency of Status: CURRENT
Parcel Status: Crown land (reserved)
Reserve Type: Temporary
Reserve Purpose: CONSERVATION RECREATION LEISURE AND TOURISM
Park:

Administrator: Department of Environment Land Water and Planning

Related instruments

Gazette	Year:	Page:	Number:
Act	Year:		Number:
Special Gazette	Date: 04-DEC-2001	Page: 1	Number: 220

Order in Council Date: 04-DEC-2001
Reference Plan:
Title Reference: Volume Folio:
Status Remark:

Standard Parcel Identifiers (SPI) that contain land excised from the parcel:
None

End Of Status Details

This SPI derived from Source SPI(s):
20B\PP3478

End Of Report

Delivered from the LANDATA® System by InfoTrack Pty Ltd.

ORIGINAL

NOT TO BE TAKEN FROM THE OFFICE OF TITLES

CANCELLED

VOL. 8626 FOL. 157

VICTORIA

Certificate of Title

UNDER THE "TRANSFER OF LAND ACT"

SCORESBY INDEX 1 PARCEL 309

VOL. 8626 FOL. 157

WILLIAM THOMAS NEST of Mountain Highway Wantirna Butcher is the - - -- proprietor of an estate in fee simple subject to the encumbrances notified- hereunder in ALL THAT piece of land coloured on the map on the sheet - - -- annexed hereto being Lot 2 on Plan of Subdivision No.71819 Parish of - - Scoresby County of Mornington -

Issued under Regulation 12 on the approval of the above Plan of Subdivision

OFFICE OF TITLES VICTORIA

Assistant Registrar of Titles

ENCUMBRANCES REFERRED TO

As to any land coloured green, purple, blue-hatched, green-hatched, - - - - - purple-hatched and blue cross-hatched-

THE EASEMENT to State Electricity Commission created by Instrument C.484259 - - - - - - -

As to any land coloured blue-hatched- and blue cross-hatched - - - - - - --

THE EASEMENT to State Electricity Commission created by Instrument A.856480 - - - - - - -

As to any land coloured green and--- green-hatched - - - - - - - - - - - --

THE EASEMENT to State Electricity Commission created by Instrument 1116547 - - - - - - --

As to any land coloured blue,-- blue-hatched, green-hatched and purple-hatched - - - - - - - --

ANY EASEMENTS implied under Section 98 of -- the Transfer of Land Act - - - - - - - - - -

DERIVED FROM
VOL. 7220 FOL. 886
12/7/'66.

THE PRESIDENT COUNCILLORS AND RATPAYERS OF THE SHIRE OF KNOX is now the proprietor
Registered 28th June 1966
No.C525623

OFFICE OF TITLES R. L. VICTORIA

MELBOURNE AND METROPOLITAN BOARD OF WORKS is now the proprietor
Registered 27th September 1977
No.G801502

OFFICE OF TITLES L.A.R. VICTORIA

PROPRIETOR
MELBOURNE PARKS & WATERWAYS
378 COTHAM RD. KEW 3101

U127325H 13/3/96

OFFICE OF TITLES I.M.S. VICTORIA

TRANSFER TO HER MAJESTY QUEEN ELIZABETH II

CANCELLED

X918186R 30/11/01

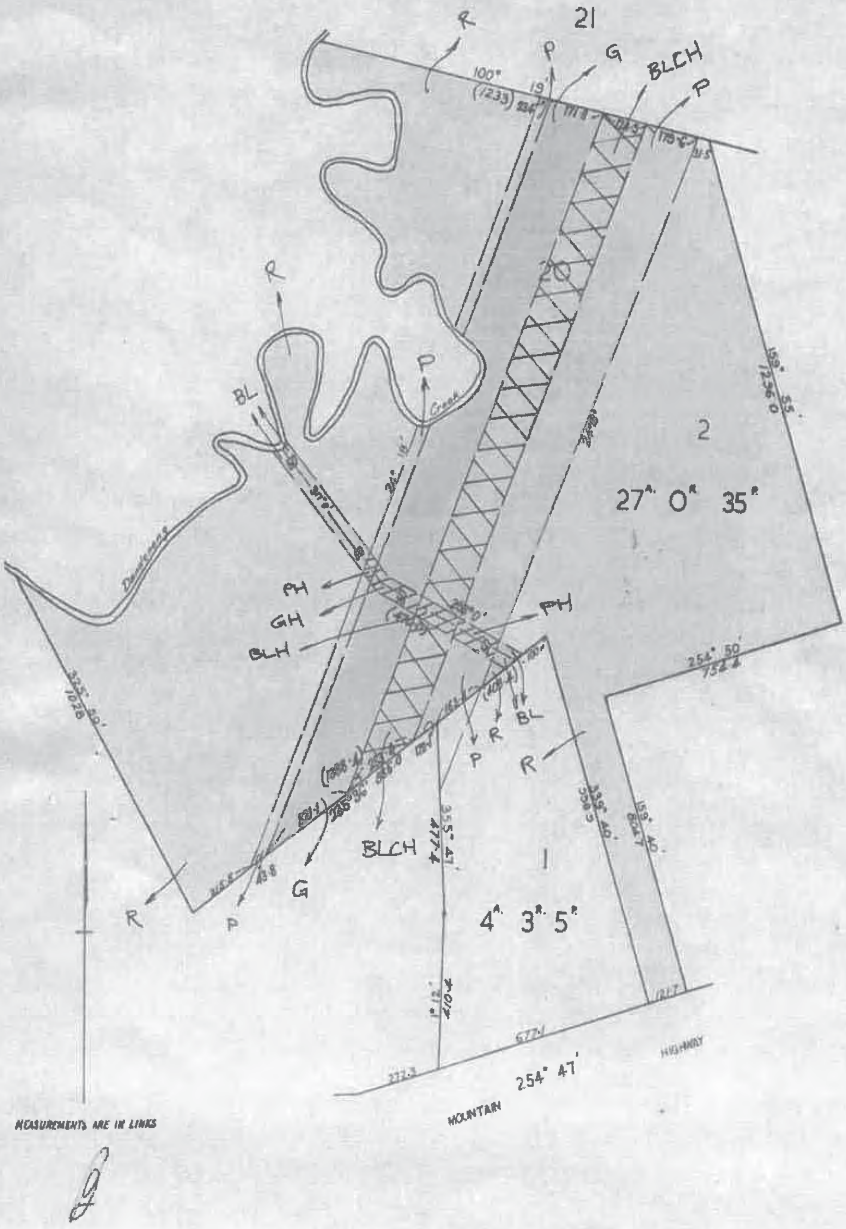
OFFICE OF TITLES W.C.H. VICTORIA

CANCELLED

T08626-157-1-0

V.8626 F.157

ANNEXED SHEET REFERRED TO IN
CERTIFICATE OF TITLE VOL. 8626 FOL. 157
ASSISTANT REGISTRAR OF TITLES



Entered in the Register Book CANCELLED

Vol 7220 Fol 1443886

VICTORIA.

PAROELS INDEX
SECONDARY STORAGE

Certificate of Title,

UNDER THE "TRANSFER OF LAND ACT 1928."

Elsie May McLean of 48 Lleneast Street Malvern Widow is - - - - - - - - - -
now the proprietor of an Estate in Fee-simple subject to the Encumbrances
notified hereunder in All that piece of Land delineated and coloured
red and blue on the map in the margin containing thirty-two acres or thereabouts-
being part of Crown Portion Twenty Parish of Scoresby County of Mornington ---

ORIGINAL CERTIFICATE.
Not to be dealt with outside the Titles Office.

Dated the Seventh day of May
thousand nine hundred and forty-seven.

Assistant Registrar of Titles.

OFFICE OF TITLES VICTORIA

ENCUMBRANCES REFERRED TO

As to the land coloured blue ---
THE EASEMENT to State Electricity Commission
of Victoria created by Instrument No.1146647-
in the Register Book - - - - - - - - - -

T07220-886-1-1

Vol. 6488 Fol. 129 592 Transfer. 2071944 Application.

William Thomas Nest of 145 Boran Road Caulfield Butcher is now the proprietor of the within described estate in transfer registered on 18th August 1949 and numbered 2231865

W.P. Fitzgerald
Assistant Registrar of Titles

CREATION OF EASEMENT

Registered 17th November 1959
Numbered A856480

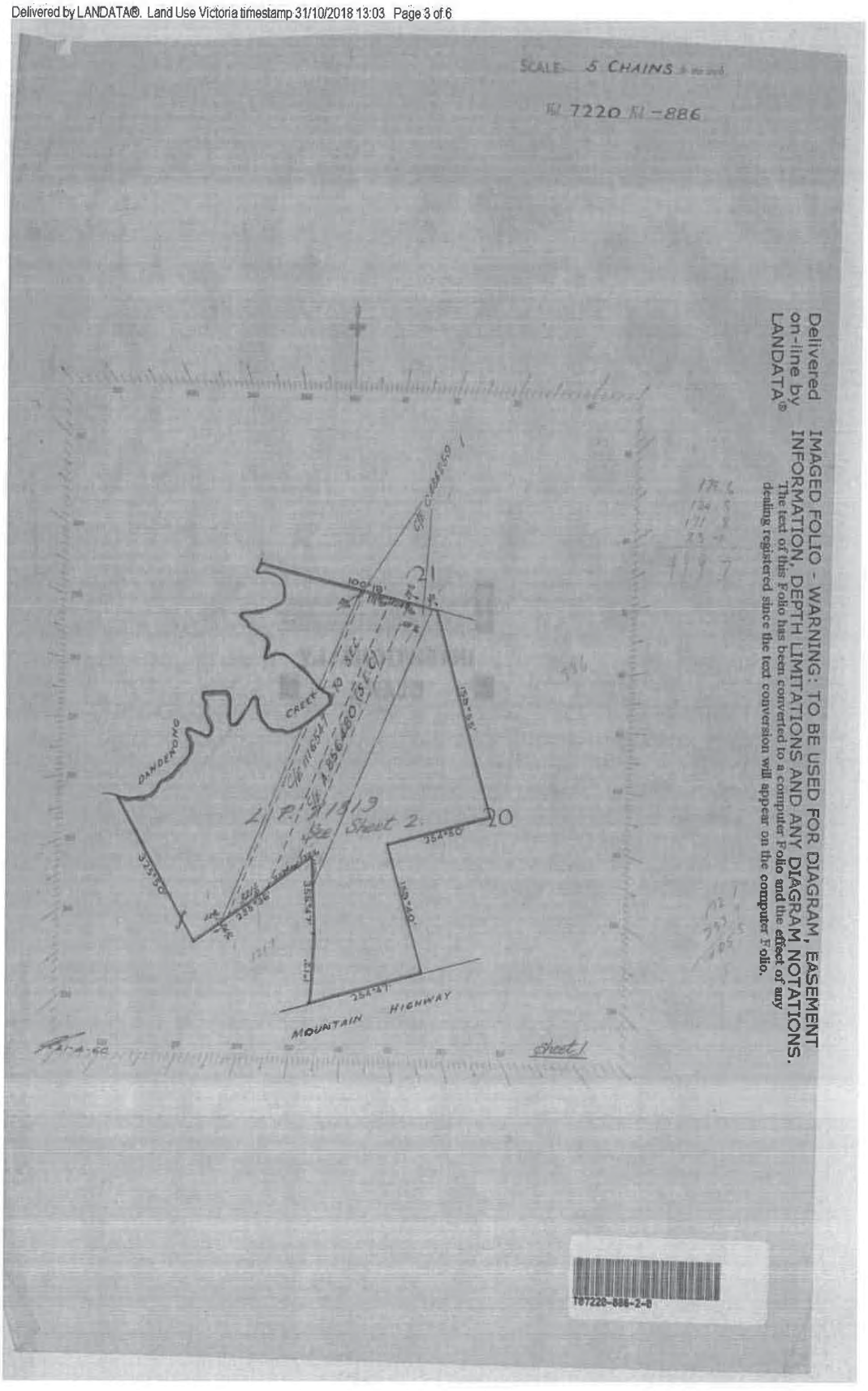
STATE ELECTRICITY COMMISSION has pursuant to section 57 of Transfer of Land Act served a Notification relating to the compulsory acquisition of AN EASEMENT OVER PART of the land comprised herein.
Dated 26 MAR. 1969
Corrs. No. CA/4205 (PLAN WITH LETTER)

CREATION OF EASEMENT

registered 10th May 1966
No. C484259

CANCELLED
Pursuant to Regulation 12 and Titles issued as set out hereunder on 12TH JULY 1966
LOTS ONE AND 2 IN VOL 8626 FOL. 156
AND 8626 157
L.P. 7919

CANCELLED

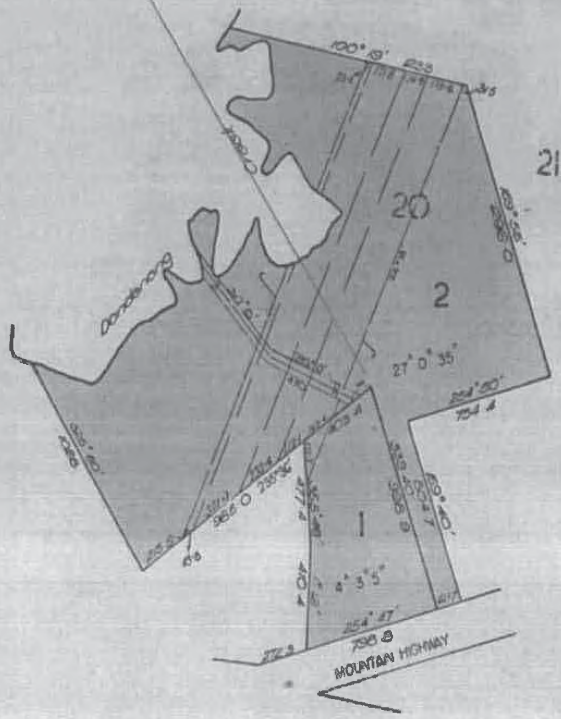


SCALE

Volume 7220 Folio 886

T87220-886-3-8

L.P. 71819 CANCELS THIS TITLE
BEING BOTH LOTS ON SAID L.P.
2 CERTS TO ISSUE



19

L.P. 71819
Sheet 2

A 7.66

Entered in the Register **CANCELLED**

Vol. 6488 Fol. 1297592

VICTORIA.

Certificate of Title,

UNDER THE "TRANSFER OF LAND ACT 1928."

PARCELS INDEX

ORIGINAL CERTIFICATE.
Not to be dealt with outside the Titles Office.

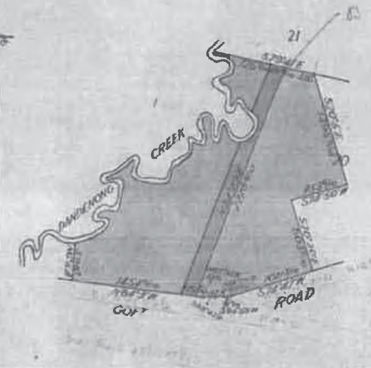
Frederick George McDowall of 41 St.George's Road Elsternwick Contractor is now the proprietor of an Estate in Fee simple subject to the Encumbrances notified hereunder in All that piece of Land delineated and coloured red and blue on the map in the margin containing Forty-nine acres and One rood or thereabouts being part of Crown Portion Twenty Parish of Scoresby County of Mornington

Dated the Third day of October One thousand nine hundred and forty.

Assistant Registrar of Titles.

ENCUMBRANCES REFERRED TO.

As to the land colored blue ---
THE EASEMENT to State Electricity Commission of Victoria created by Instrument No.1116547 in the Register Book



PART OF THE WITHIN LAND IS SHOWN AS A ROAD ON LP.25762

T06488-592-1-4

The Measurements are in Links.

Vol. 5751 Fol. 115014 3 Transfer. 175957 Application

TRANSFER AS TO PART to
Elsie May McLean registered
on 7th May 1947 numbered 207777
CANCELLED AS TO PART See Certificate of Title
Vol. 7220 Fol. 143886
Area A R P
32-0-0 Assistant Registrar of Titles

TRANSFER AS TO PART to
Thomas Keith Keogh registered
on 17th Dec. 1951 numbered 462765
CANCELLED AS TO PART See Certificate of
Title Vol. 7819 Fol. 157
Area A R P
1 3 7 Assistant Registrar of Titles

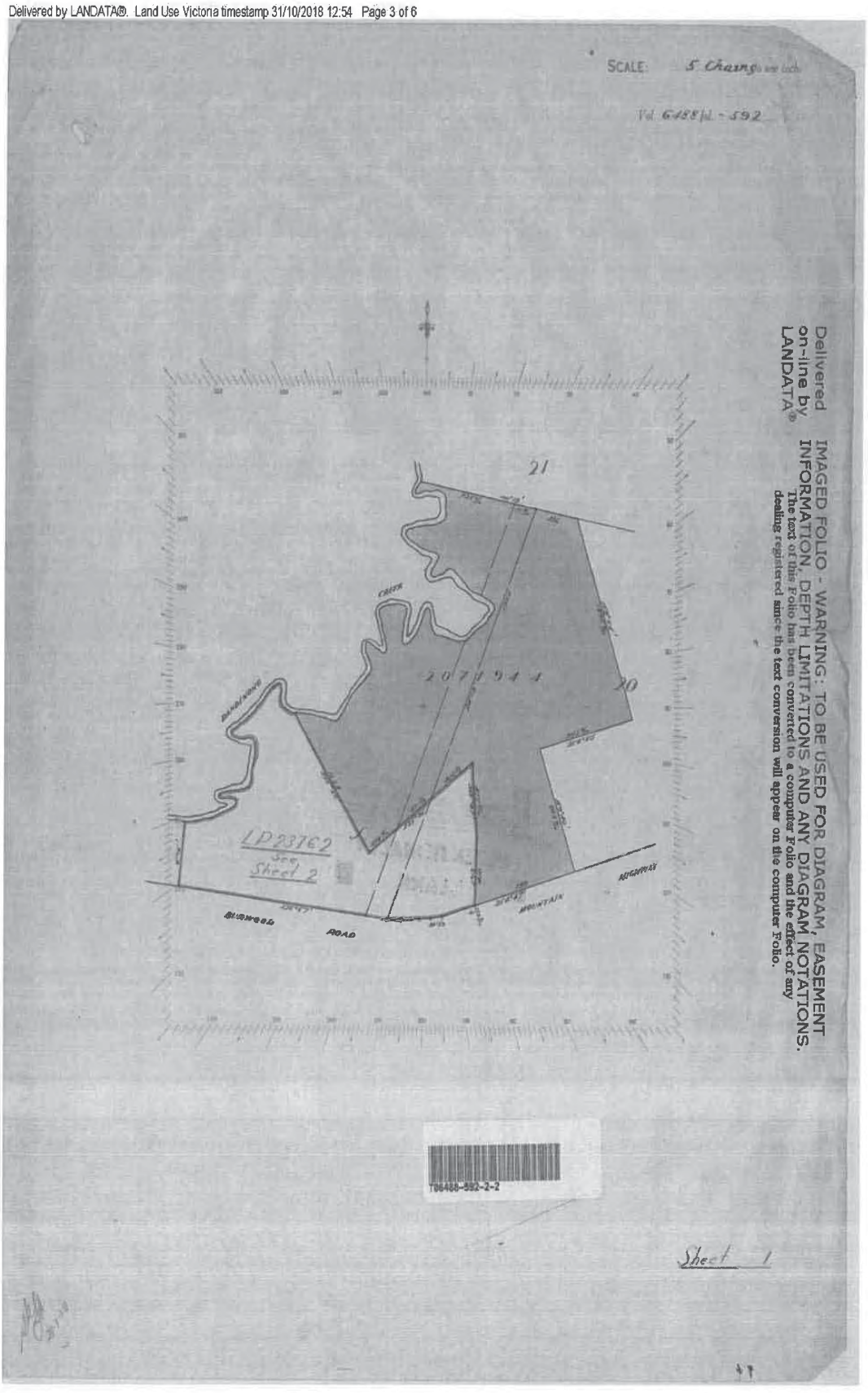
CREATION OF EASEMENT
registered
on 21st January 1959 numbered A675800

CAVEAT No. 238522 LODGED 18 AUG 1960
Affecting part of the land herein
CAVEAT LAPSED 31 JAN 1963

TRANSFER AS TO BALANCE No. B465576
registered 19th July 1962
CANCELLED See Vol. 8394 Fol. 462

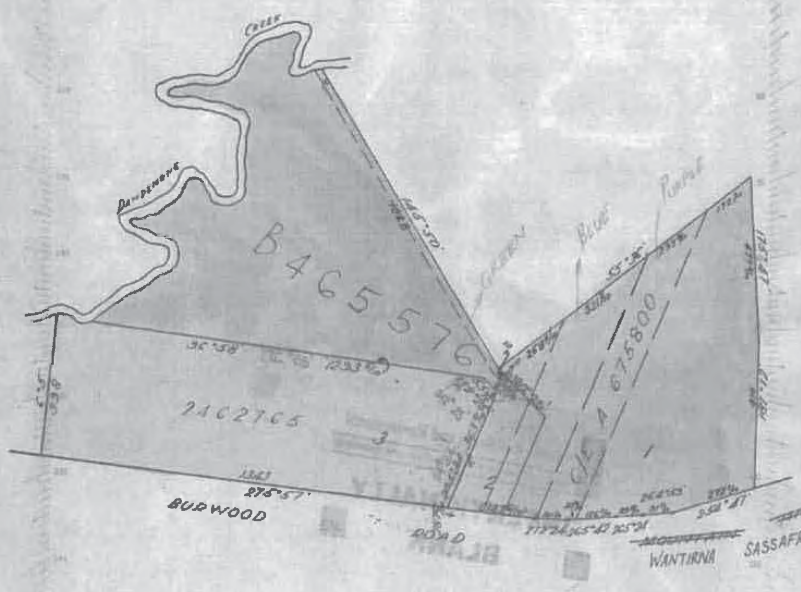
CANCELLED

15 MAR 1963



SCALE: 3 Chains to one inch.

Vol. 6188 fol. 592



T06488-592-3-1

LP 23762

Sheet 2

CANCELLED

Entered in the Register Book

Vol. 5751 Fol. 115013

VICTORIA.

PARCELS INDEX
SECONDARY STORAGE

Certificate of Title,

UNDER THE "TRANSFER OF LAND ACT 1928."

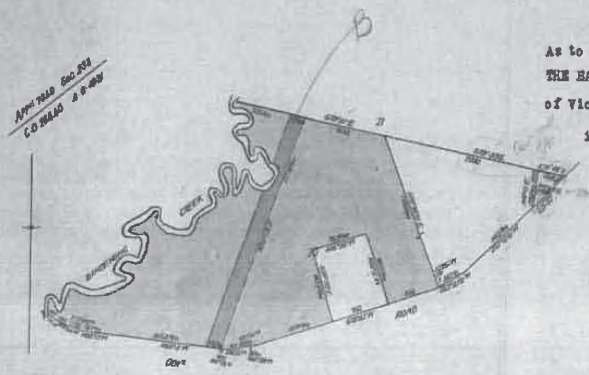
ORIGINAL CERTIFICATE.
Not to be dealt with outside the Titles Office.

John Richard Sanders of Baywater Farmer is -
now the proprietor of an Estate in Fee simple subject to the Encumbrances
notified hereunder in All those pieces of Land delineated and coloured
red and blue on the map in the margin containing Sixty-three acres three roods and-
Fourteen perches or thereabouts being parts of Crown Portion Twenty Parish of - - - -
Scoresby County of Mornington -

Dated the second day of December One
thousand nine hundred and thirty.

L. Kennedy.
Assistant Registrar of Titles.

ENCUMBRANCES REFERRED TO:
As to the land colored blue - - -
THE EASEMENT to State Electricity Commission
of Victoria created by Instrument No.1116547
in the Register Book - - - - - - - - - -



All Measurements are links

T05751-143-1-0

Vol. 2747 Fol. 549250 Transfer. Application.
Red Ink No 3170773 (7340 233)

TRANSFER AS TO PART to
Albert Thomas Watkins
registered
on 24th December 1930 numbered H38693.
CANCELLED AS TO PART See Certificate of Title
Vol 5751 Fol. 1150144 L. Kennedy
Area 1-3-33 Assistant Registrar of Titles

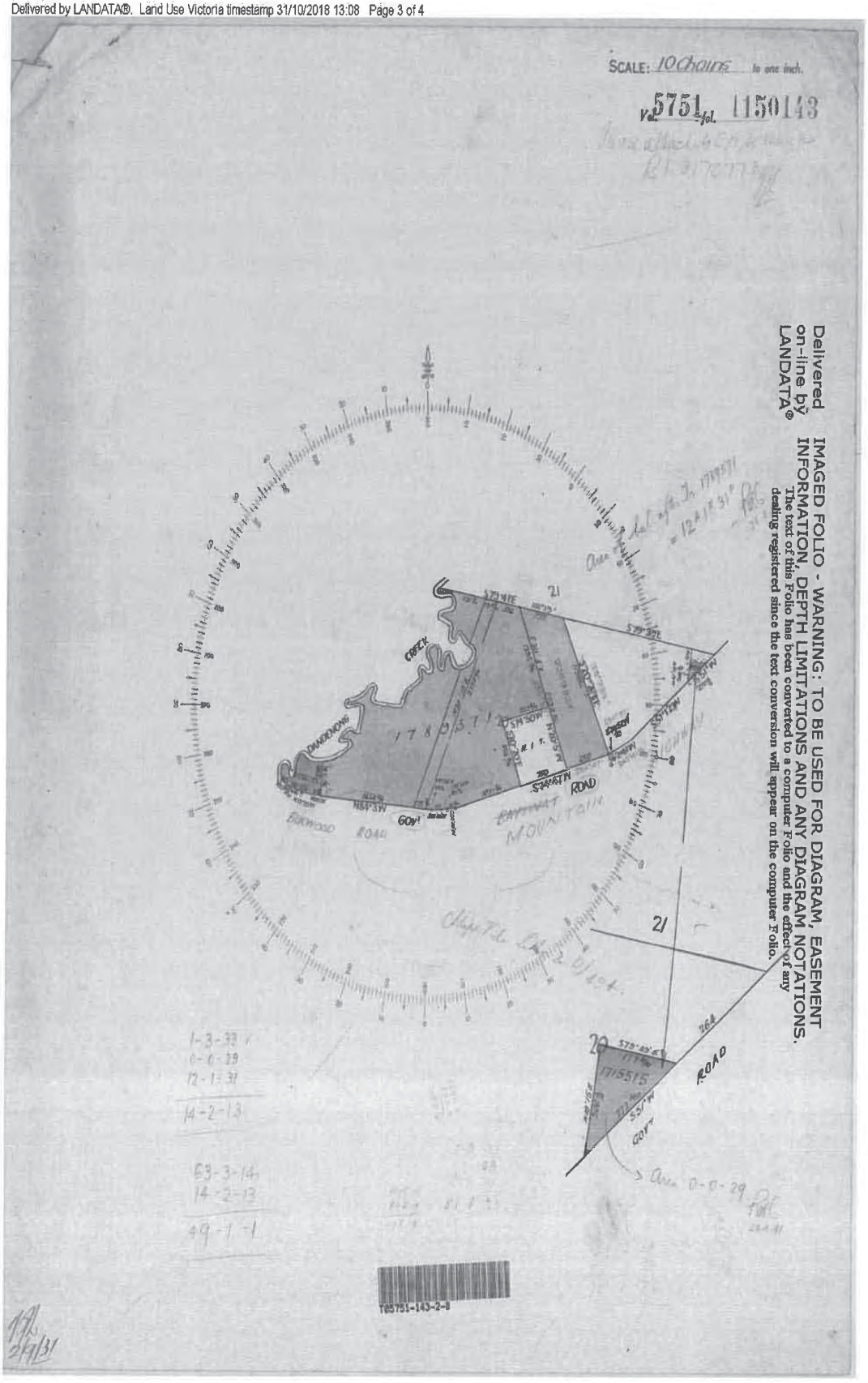
Red Ink No. 358477 John Richard Sanders died
on 19th November 19[illegible] Probate of his Will
has been granted to Archibald Sanders of
Boronia Road Bayswater Orchardist
Dated
15th January 1937 L.T. Hale
Assistant Registrar of Titles

TRANSFER AS TO PART to
Donald Ernest Finger
registered
on 21st December 19[illegible] numbered [illegible]
CANCELLED AS TO PART See Certificate of Title
Vol 6261 1252008 A. Forbes
Assistant Registrar of Titles

TRANSFER AS TO PART to
Frederick George McGowan registered
on 1st October 19[illegible] numbered 1789571
CANCELLED AS TO PART See Certificate of Title
Vol 6488 Fol. 1297592 J.O. Newson
Area 4-1-5 Assistant Registrar of Titles

TRANSFER AS TO BALANCE to
Geoffrey Archibald Sanders registered
on 30th March 1950 numbered 2349824
CANCELLED See Certificate of Title
Vol 7392 1478278 E.J.W. Tardon
Assistant Registrar of Titles

CANCELLED DUP. WITH
[illegible] JAN 1951



CANCELLED

Vol. 2747 Fol. 549250

VICTORIA.

Certificate of Title,

UNDER THE "TRANSFER OF LAND ACT 1890."

ORIGINAL CERTIFICATE
Not to be dealt with outside the Titles Office.

Allan Williamson of Burwood Road Mitcham Market Gardener is now the proprietor of an Estate in Fee-simple, subject to the Encumbrances notified hereunder in All that piece of Land, delineated and coloured on the Map in the margin, containing eighty acres or thereabouts being Crown Portion twenty Parish of Jeeralby County of Moira

Dated the thirty first day of October One thousand eight hundred and ninety nine.

Assistant Registrar of Titles.

ENOUMBRANCES REFERRED TO.

T310
233

T02747-250-1-6

Vol. 2390 Fol. 469 Transfer 414047 Application

Nature of Instrument.	Day and Hour of its Production.	Names of the Parties to it.	Number or Symbol thereon.
DISCHARGED A. T. Bruce Assistant Registrar of Titles 4 March 1903	The 31st October 1899 at 10.30 a.m.	Allan Williamson to Peter Booth A. T. Bruce Assistant Registrar of Titles.	194302

Memo No 29846 The Equity Trustees Executors and Agency Company Limited of Queen Street Melbourne is registered as proprietor of the within described land as Administrator to wholm Administration of the Estate of Allan Williamson (who died on 25th August 1900) was granted on the 26th November 1900

Dated the 4th March 1903 A. T. Bruce Assistant Registrar of Titles.

Edward James Ford of 338 Lygon Street Carlton Butcher is now the proprietor of the within described Estate and Land by Transfer from the above-named The Equity Executors and Agency Company Limited registered 4th March 1903 at 2.2 pm and numbered 68370

A. T. Bruce Assistant Registrar of Titles.

Caveat No 38103 lodged 26 November 1910 at 2.21 pm

Caveat No 38103 Lapsed 6 April 1911 at 11.12 am

Assistant Registrar of Titles.

John Richard Sanders of Bayswater Farmer is now the Proprietor of the within described Estate and Land by Transfer from the above named Edward James Ford registered 6th April 1911 at 11 12 o'clock in the fore noon, and Numbered 647265

Assistant Registrar of Titles.

Transfer as to part Cancelled as to the land in Certificate of Title. Vol. 3723 Fol. 744459

The 18th August 1913 at 2.29 pm.

582 97951

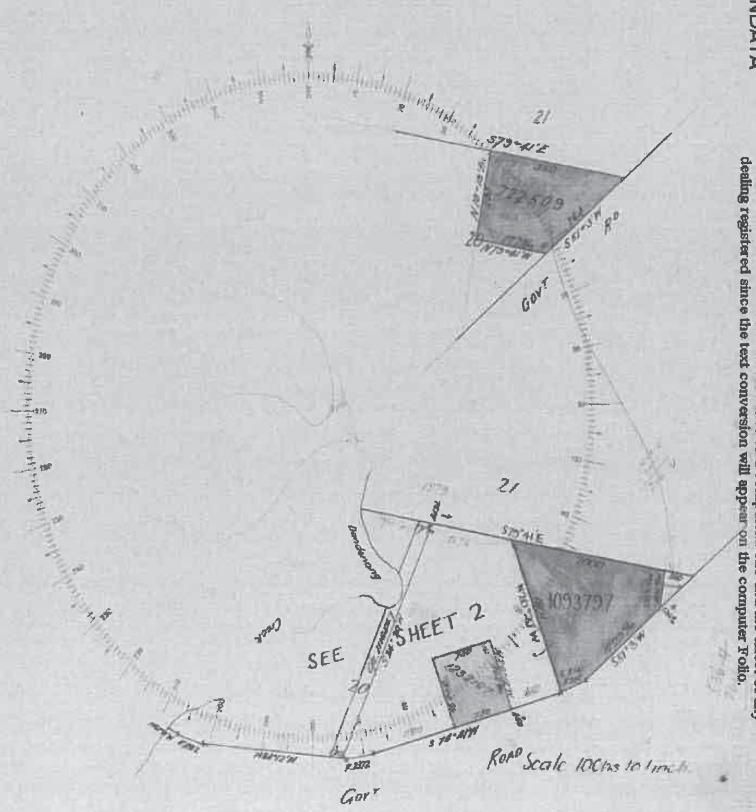
John Richard Sanders to Charles Henry Finger, James Edward Nathaniel Finger, Alfred John Edmund Finger, Oliver Boulton, Edward Victor Robert Bankhaneer, Robert Ernest Bankhaneer and Arthur Albert Bankhaneer

Assistant Registrar of Titles.

SCALE 10 Chains to one inch

Titles Office Record of Subdivision

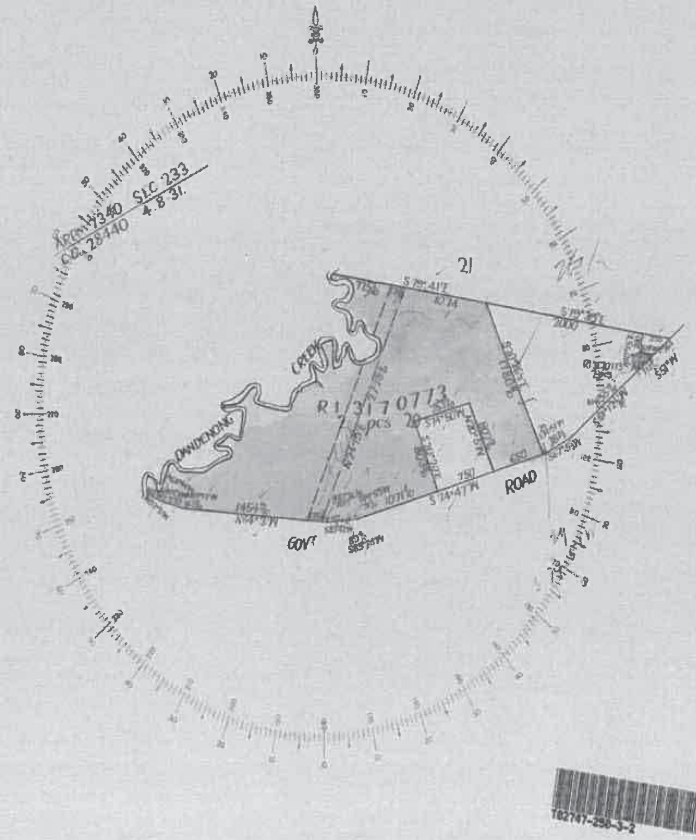
Vol. 2747 Fol. 250



SHEET 1

SCALE:_10 Chains to one inch.

Vol. 2147 fol. 250



SHEET 2

2/9/31

This is the Sheet marked "A" referred to in Certificate of Title entered in the Register Book Vol. 2747 Fol. 549250

Assistant Registrar of Titles.

ORIGINAL

TRANSFER as to part to Archibald Sanders
registered on 15th March 1923
and numbered 1093797
as to part See Certificate of Title
Vol. 4676 Fol. 935112
Area 16.0.13P
Assistant Registrar of Titles.

CREATION OF EASEMENT
to [illegible]
registered on 8th March 1924 and numbered
1116547 Assistant Registrar of Titles.

TRANSFER as to part to Fernihyde Gulley
registered on 3rd September
1925 and numbered 1232127
CANCELLED as to part See Certificate of Title
Vol. 5030 Fol. 1005884
Area 6 Acres Assistant Registrar of Titles.

CANCELLED See Certificate of Title
Vol. 5751 Fol. 1150113
Dealing No. 3170773.1 (7340/255) L. Kennedy.
Assistant Registrar of Titles.

CANCELLED

L 305247W

ORIGINAL

NOT TO BE TAKEN FROM THE OFFICE OF TITLES

CANCELLED

REGISTER BOOK

VOL. 9585 FOL. 004

VICTORIA

Certificate of Title

SCORESBY
INDEX 1 PARCEL 1156

UNDER THE "TRANSFER OF LAND ACT"

MELBOURNE AND METROPOLITAN BOARD OF WORKS is the proprietor of an estate in fee simple subject to the encumbrances notified hereunder in all that piece of land in the Parish of Scoresby County of Mornington being part of Crown Portion 20 which land is shown enclosed by continuous lines on the map hereon

FOL.

VOL.

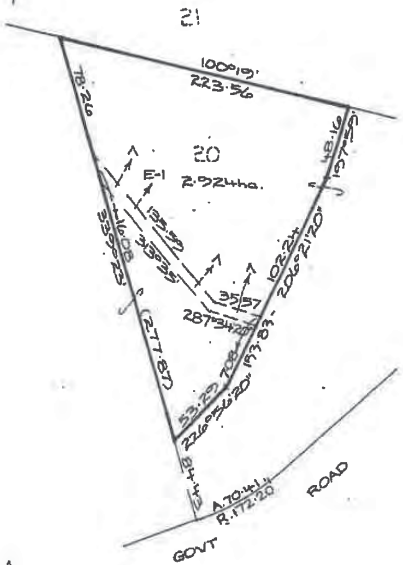
DATED the 10th day of October 1984

P L Matthews
Assistant Registrar of Titles

OFFICE OF TITLES VICTORIA

ENCUMBRANCES REFERRED TO

As to the land shown marked E-1
THE DRAINAGE EASEMENT reserved by Transfer L305247W



MEASUREMENTS ARE IN METRES

T09585-004-1-3

Derived from Vol.4676 Fol.112
L305247W

VOL 9585 FOL 004

PROPRIETOR
MELBOURNE PARKS & WATERWAYS
378 COTHAM RD. KEW 3101

U127325H 13/3/96

OFFICE OF TITLES J.M.S. VICTORIA

TRANSFER TO HER MAJESTY QUEEN ELIZABETH II

CANCELLED

X918186R 30/11/01

OFFICE OF TITLES W.C.M. VICTORIA

CANCELLED

1648(F4)

Entered in the Register Book

Vol. 4676 Fol. 935112

INDEX 1 PARCEL 306

VICTORIA.

Certificate of Title,

UNDER THE "TRANSFER OF LAND ACT 1915."

Archibald Sanders of Wantirna Orchardist is ——————
now the proprietor of an Estate in Fee-simple, subject to the Encumbrances notified hereunder in All that piece of Land, delineated and coloured red on the map in the margin containing Eighteen acres and Thirteen perches or ——— thereabouts being part of Crown Portion Twenty Parish of Scoresby County of —— Mornington ——————

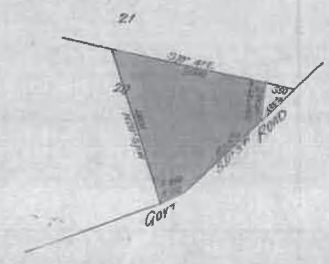
Dated the Fifteenth day of March One thousand nine hundred and twenty-three.

Assistant Registrar of Titles.

ENCUMBRANCES REFERRED TO.

LINKS	METRES
350.0	70.409
406.4	81.755
536.4	107.907
856.0	172.200
1223.6	246.149
1801.0	362.304
2000.0	402.336

A	R	P	HECTARES
18	0	13.0	7.3472

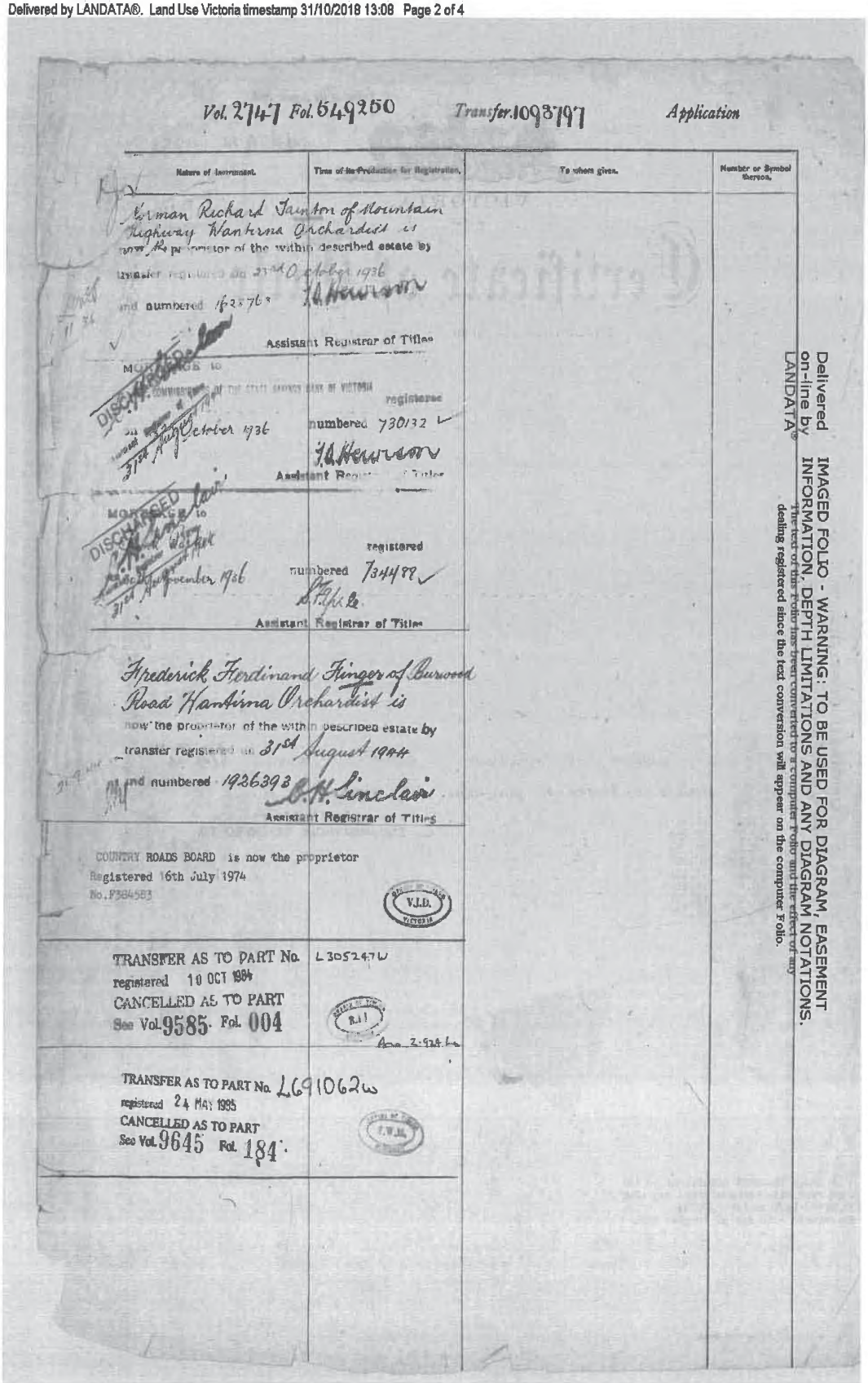


A Drainage Easement appurtenant to the land remaining untransferred has been reserved by Transfer L305247V Registered 10th day of October 1984

T04676-112-1-1

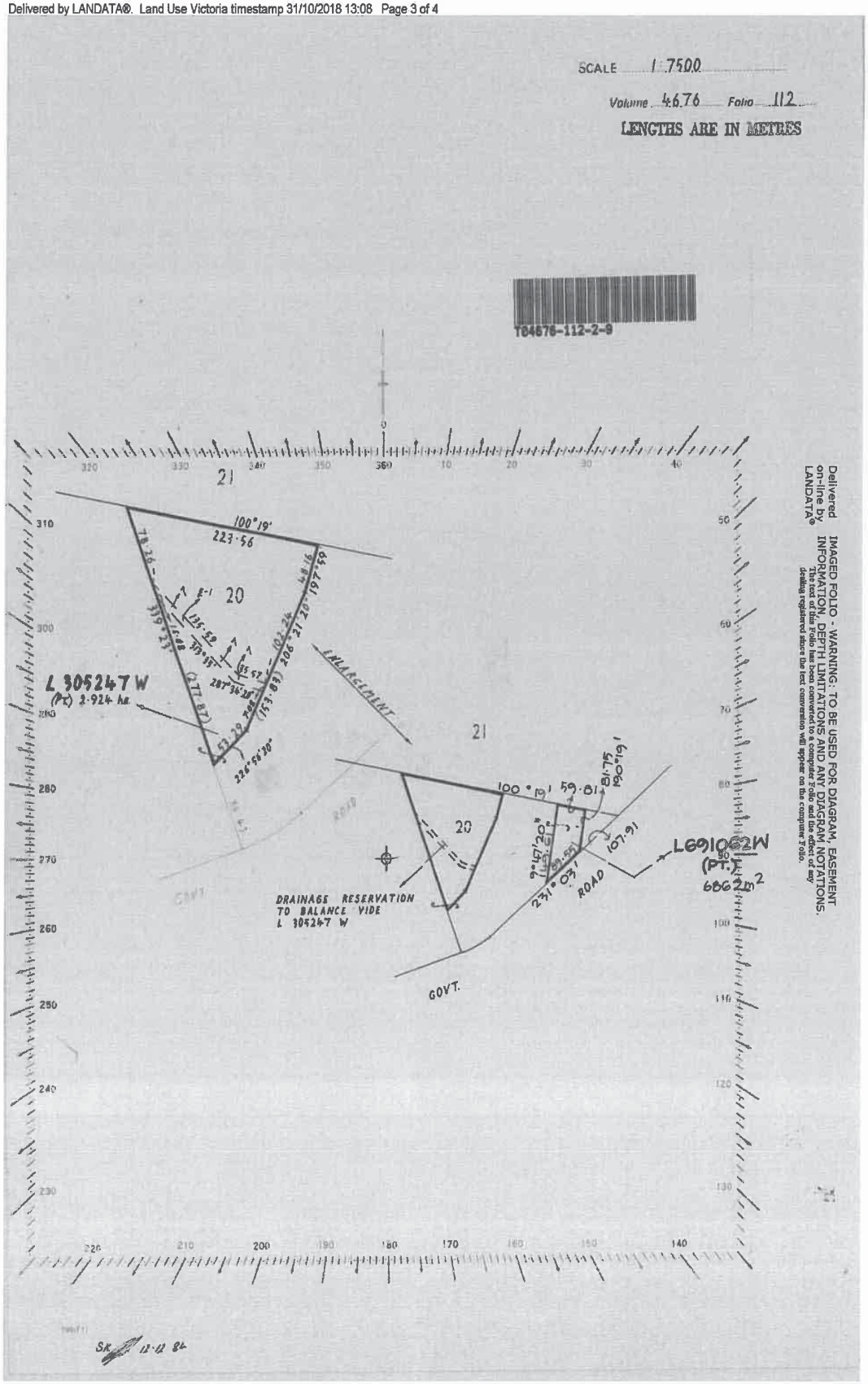
The Measurements are in links

ORIGINAL CERTIFICATE.
Not to be dealt with outside the Titles Office.



Vol. 2747 Fol. 649250 Transfer 1093197 Application

Nature of Instrument.	Time of the Production for Registration.	To whom given.	Number or Symbol thereon.
Herman Richard Taunton of Mountain Highway Wantirna Orchardist is now the proprietor of the within described estate by transfer registered on 21st October 1936 and numbered 162876 J.A. Newsom Assistant Registrar of Titles			
MORTGAGE to [illegible] DISCHARGED [illegible] 31st August 1937	registered numbered 730132 J.A. Newsom Assistant Registrar of Titles		
MORTGAGE to [illegible] DISCHARGED [illegible] 31st November 1936	registered numbered 734489 J.A. Newsom Assistant Registrar of Titles		
Frederick Ferdinand Finger of Burwood Road Wantirna Orchardist is now the proprietor of the within described estate by transfer registered on 31st August 1944 and numbered 1926393 C.H. Sinclair Assistant Registrar of Titles			
COUNTRY ROADS BOARD is now the proprietor Registered 16th July 1974 No. P384583 V.I.D.			
TRANSFER AS TO PART No. registered 10 OCT 1984 CANCELLED AS TO PART See Vol. 9585 Fol. 004	L305247U		
TRANSFER AS TO PART No. registered 24 MAY 1985 CANCELLED AS TO PART See Vol. 9645 Fol. 184	L691062W		



Entered in the CANCELLED

Vol. 5030 Fol. 100588

Scoresby
Index 1 Parish 308

2.10.25

VICTORIA.

Certificate of Title,

UNDER THE "TRANSFER OF LAND AOT 1915."

The President Councillors and Ratepayers of the Shire of Fern Tree Gully is now the proprietor of an Estate in Fee-simple, subject to the Encumbrances notified hereunder in All that piece of Land, delineated and coloured red on the map in the margin containing Six acres or thereabouts being part of-----

Crown Portion Twenty Parish of Scoresby County of Mornington- - - - - - - - - - -

Dated the Third day of September One thousand nine hundred and twenty-five.

M.W. Peterson
Assistant Registrar of Titles.

ENCUMBRANCES REFERRED TO.

ORIGINAL CERTIFICATE.
Not to be dealt with outside the Titles Office.

LINKS	METRES
350.0	70.409
650.0	130.759
750.0	150.876
802.9	161.518
856.0	172.200

A	R	P	HECTARES
6	0	0.0	2.4281

247-250

The Measurements are in links

T05030-884-1-2

Vol. 2747 Fol. 549250. Transfer. 1232127. Application

MELBOURNE AND METROPOLITAN BOARD OF WORKS is now
the proprietor
Registered 27th September 1977
No.G801502

PROPRIETOR
MELBOURNE PARKS & WATERWAYS
378 CUTHAM RD. KEW 3101

U127325H 13/3/96

TRANSFER TO HER MAJESTY QUEEN
ELIZABETH II

CANCELLED

X918108R 30/11/01

CANCELLED

D R A F T

Appendix C

Lotsearch Report

D R A F T

Appendix D

Property Planning Report

PLANNING PROPERTY REPORT

From www.planning.vic.gov.au on 26 July 2019 10:08 AM

PROPERTY DETAILS

Address:	61 MOUNTAIN HIGHWAY WANTIRNA 3152	
Crown Description:	Allot. 2202 PARISH OF SCORESBY	
Standard Parcel Identifier (SPI):	2202\PP3478	
Local Government Area (Council):	KNOX	www.knox.vic.gov.au
Council Property Number:	More than one - not listed.	
Planning Scheme:	Knox	planning-schemes.delwp.vic.gov.au/schemes/knox
Directory Reference:	Melway 63 C8	

UTILITIES

Rural Water Corporation:	Southern Rural Water
Melbourne Water Retailer:	Yarra Valley Water
Melbourne Water:	inside drainage boundary
Power Distributor:	UNITED ENERGY, AUSNET

STATE ELECTORATES

Legislative Council:	EASTERN METROPOLITAN
Legislative Assembly:	FERNTREE GULLY, FOREST HILL

Planning Zones

PUBLIC CONSERVATION AND RESOURCE ZONE (PCRZ)

SCHEDULE TO THE PUBLIC CONSERVATION AND RESOURCE ZONE (KNOX) (PCRZ)

PUBLIC PARK AND RECREATION ZONE (PPRZ)

SCHEDULE TO THE PUBLIC PARK AND RECREATION ZONE (KNOX) (PPRZ)

ROAD ZONE - CATEGORY 1 (RDZ1)

C1Z - Commercial 1	C2Z - Commercial 2	CDZ - Comprehensive Development
GRZ - General Residential	IN1Z - Industrial 1	IN3Z - Industrial 3
LDRZ - Low Density Residential	MUZ - Mixed Use	NRZ - Neighbourhood Residential
PCRZ - Public Conservation & Resource	PPRZ - Public Park & Recreation	PUZ1 - Public Use - Service & Utility
PUZ2 - Public Use - Education	PUZ3 - Public Use - Health Community	PUZ4 - Public Use - Transport
PUZ6 - Public Use - Local Government	PUZ7 - Public Use - Other Public Use	RDZ1 - Road - Category 1
RDZ2 - Road - Category 2	RGZ - Residential Growth	RLZ - Rural Living
SUZ - Special Use	UFZ - Urban Floodway	

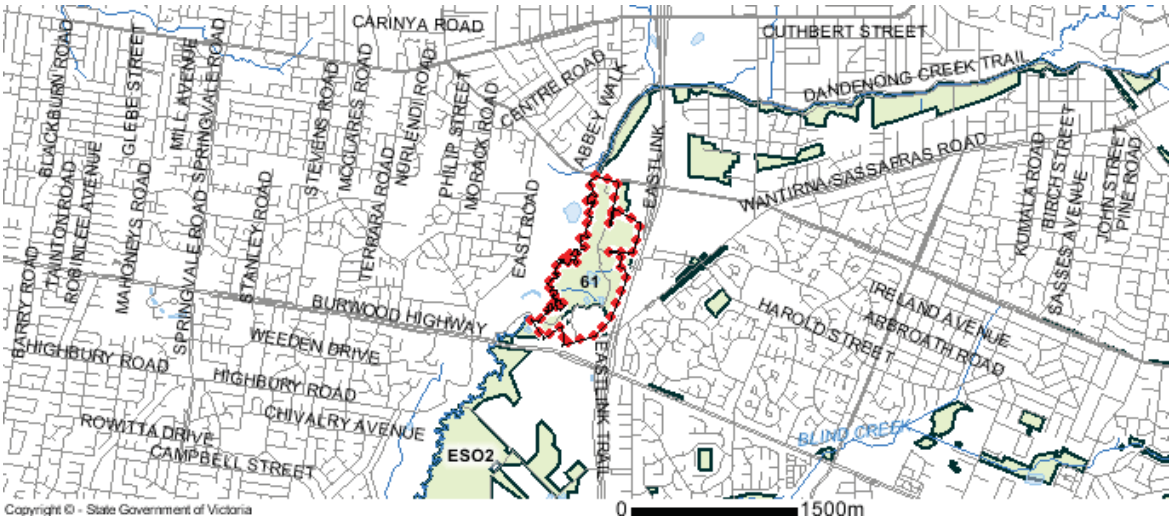
Note: labels for zones may appear outside the actual zone - please compare the labels with the legend.

PLANNING PROPERTY REPORT

Planning Overlays

ENVIRONMENTAL SIGNIFICANCE OVERLAY (ESO)

ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 2 (ESO2) (KNOX)

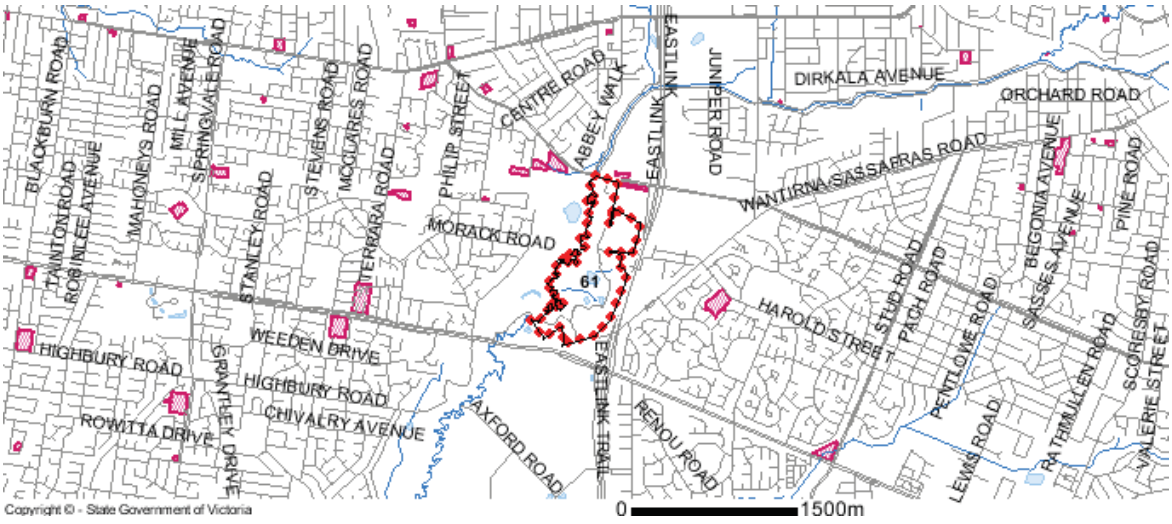


ESO - Environmental Significance

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

HERITAGE OVERLAY (HO)

HERITAGE OVERLAY SCHEDULE (HO50) (KNOX)



HO - Heritage

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

PLANNING PROPERTY REPORT

Planning Overlays

LAND SUBJECT TO INUNDATION OVERLAY (LSIO)

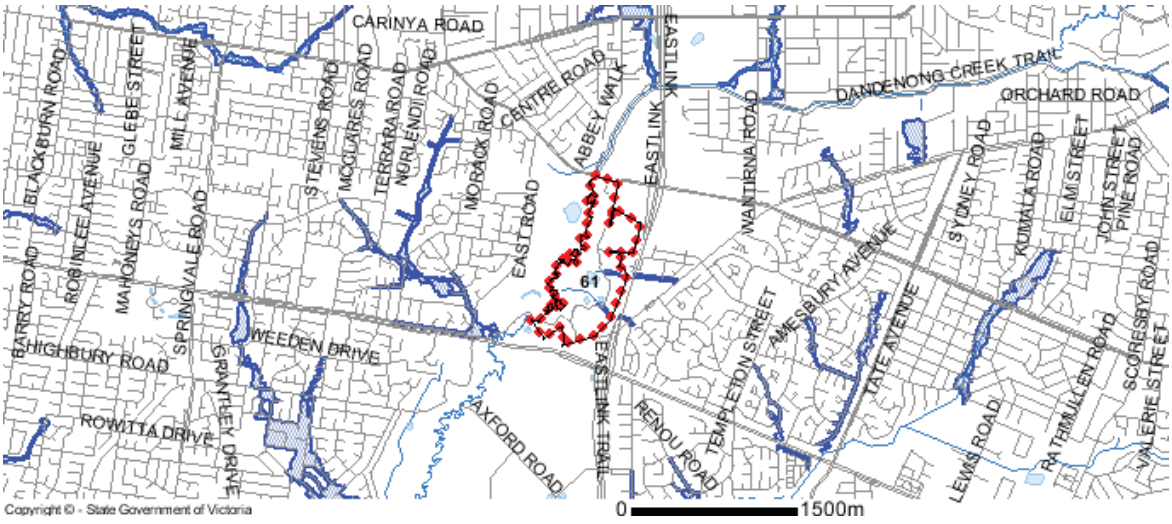
LAND SUBJECT TO INUNDATION OVERLAY SCHEDULE (LSIO) (KNOX)

LSIO - Land Subject to Inundation

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

SPECIAL BUILDING OVERLAY (SBO)

SPECIAL BUILDING OVERLAY SCHEDULE (SBO) (KNOX)



SBO - Special Building

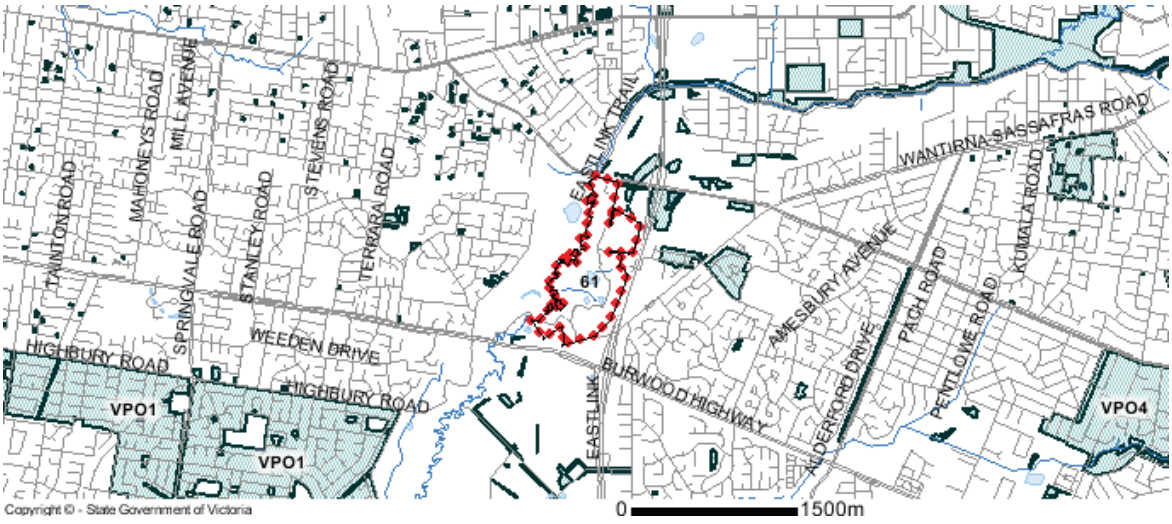
Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

PLANNING PROPERTY REPORT

Planning Overlays

VEGETATION PROTECTION OVERLAY (VPO)

VEGETATION PROTECTION OVERLAY - SCHEDULE 2 (VPO2) (KNOX)



VPO - Vegetation Protection

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

PLANNING PROPERTY REPORT

Planning Overlays

OTHER OVERLAYS

Other overlays in the vicinity not directly affecting this land

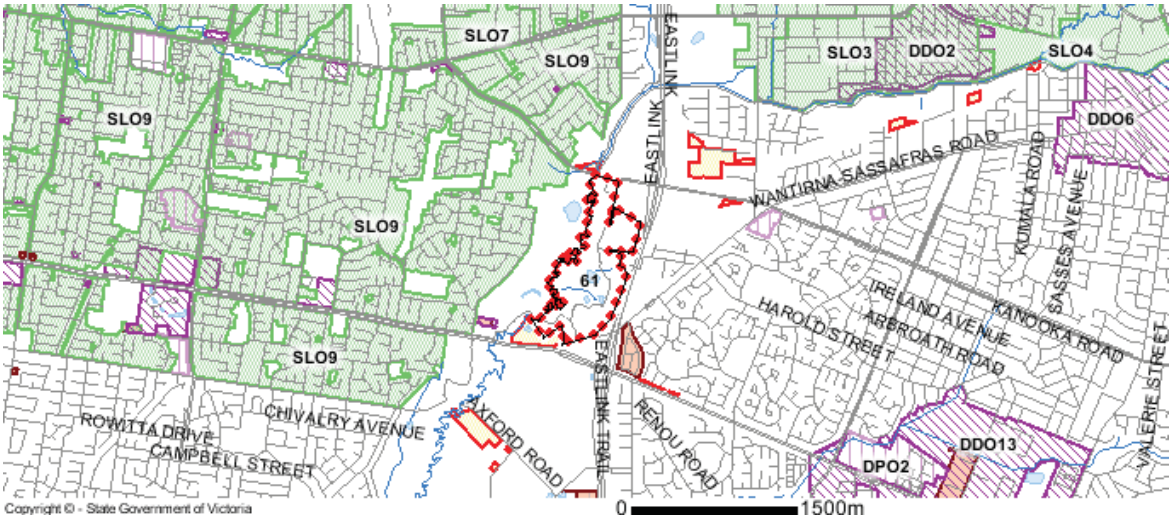
DESIGN AND DEVELOPMENT OVERLAY (DDO)

DEVELOPMENT PLAN OVERLAY (DPO)

ENVIRONMENTAL AUDIT OVERLAY (EAO)

PUBLIC ACQUISITION OVERLAY (PAO)

SIGNIFICANT LANDSCAPE OVERLAY (SLO)



DDO - Design and Development
DPO - Development Plan
EAO - Environmental Audit
PAO - Public Acquisition
SLO - Significant Landscape

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

PLANNING PROPERTY REPORT

Areas of Aboriginal Cultural Heritage Sensitivity

All or part of this property is an 'area of cultural heritage sensitivity'.

'Areas of cultural heritage sensitivity' are defined under the Aboriginal Heritage Regulations 2018, and include registered Aboriginal cultural heritage places and land form types that are generally regarded as more likely to contain Aboriginal cultural heritage.

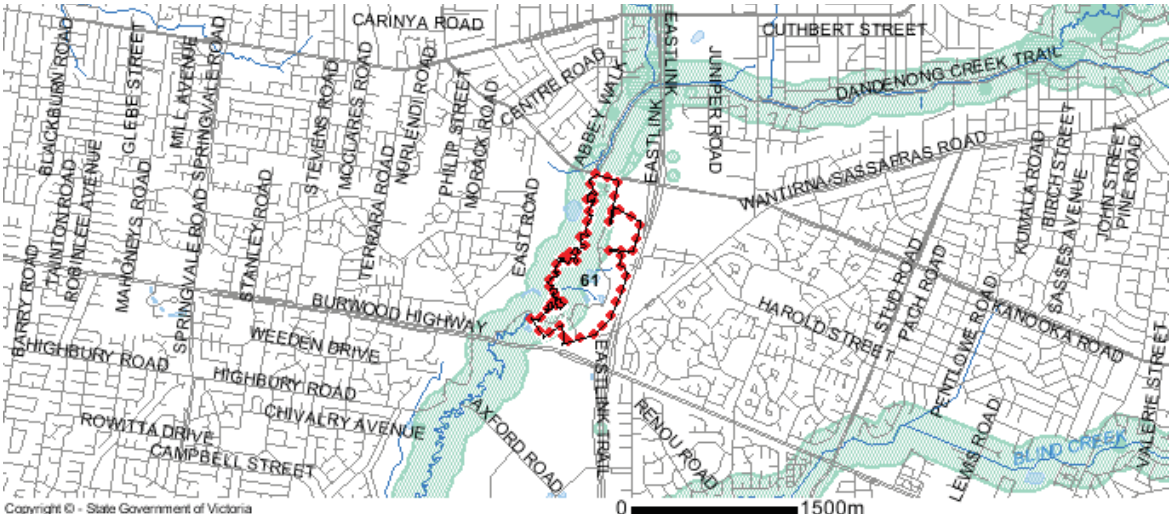
Under the Aboriginal Heritage Regulations 2018, 'areas of cultural heritage sensitivity' are one part of a two part trigger which require a 'cultural heritage management plan' be prepared where a listed 'high impact activity' is proposed.

If a significant land use change is proposed (for example, a subdivision into 3 or more lots), a cultural heritage management plan may be triggered. One or two dwellings, works ancillary to a dwelling, services to a dwelling, alteration of buildings and minor works are examples of works exempt from this requirement.

Under the Aboriginal Heritage Act 2006, where a cultural heritage management plan is required, planning permits, licences and work authorities cannot be issued unless the cultural heritage management plan has been approved for the activity.

For further information about whether a Cultural Heritage Management Plan is required go to http://www.aav.nrms.net.au/aavQuestion1.aspx

More information, including links to both the Aboriginal Heritage Act 2006 and the Aboriginal Heritage Regulations 2018, can also be found here - https://www.vic.gov.au/aboriginalvictoria/heritage/planning-and-heritage-management-processes.html



Aboriginal Heritage

PLANNING PROPERTY REPORT

Further Planning Information

Planning scheme data last updated on 25 July 2019.

A planning scheme sets out policies and requirements for the use, development and protection of land.
This report provides information about the zone and overlay provisions that apply to the selected land.
Information about the State and local policy, particular, general and operational provisions of the local planning scheme that may affect the use of this land can be obtained by contacting the local council or by visiting https://www.planning.vic.gov.au

This report is NOT a Planning Certificate issued pursuant to Section 199 of the *Planning and Environment Act 1987.*
It does not include information about exhibited planning scheme amendments, or zonings that may abut the land.
To obtain a Planning Certificate go to Titles and Property Certificates at Landata - https://www.landata.vic.gov.au

For details of surrounding properties, use this service to get the Reports for properties of interest.

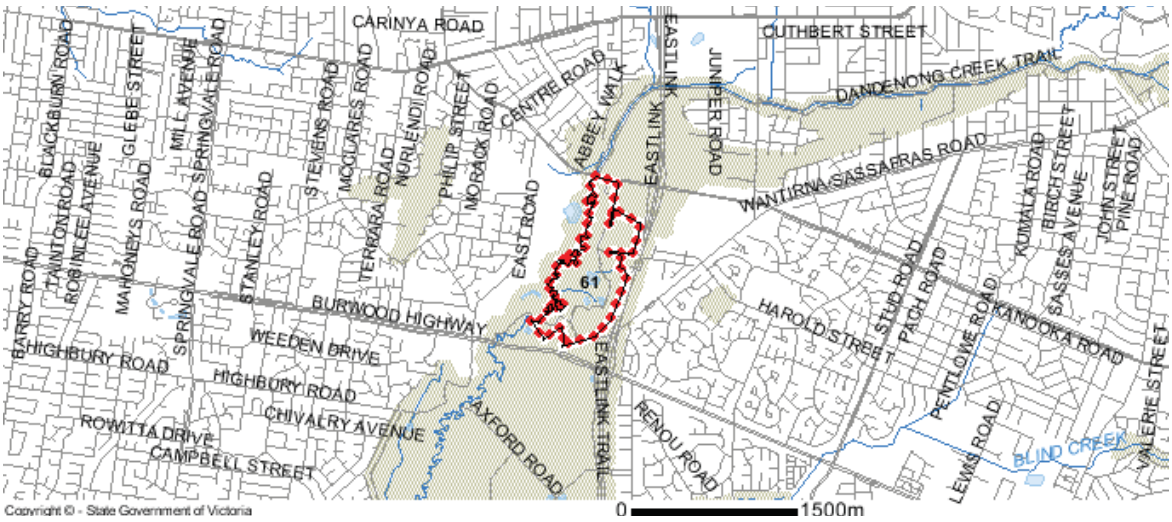
To view planning zones, overlay and heritage information in an interactive format visit http://mapshare.maps.vic.gov.au/vicplan

For other information about planning in Victoria visit https://www.planning.vic.gov.au

PLANNING PROPERTY REPORT

Designated Bushfire Prone Area

This property is in a designated bushfire prone area.
Special bushfire construction requirements apply. Planning provisions may apply.



Designated Bushfire Prone Area

Designated bushfire prone areas as determined by the Minister for Planning are in effect from 8 September 2011 and amended from time to time.

The Building Regulations 2018 through application of the Building Code of Australia, apply bushfire protection standards for building works in designated bushfire prone areas.

Designated bushfire prone areas maps can be viewed on VicPlan at http://mapshare.maps.vic.gov.au/vicplan or at the relevant local council.

Note: prior to 8 September 2011, the whole of Victoria was designated as bushfire prone area for the purposes of the building control system.

Further information about the building control system and building in bushfire prone areas can be found on the Victorian Building Authority website www.vba.vic.gov.au

Copies of the Building Act and Building Regulations are available from www.legislation.vic.gov.au

For Planning Scheme Provisions in bushfire areas visit https://www.planning.vic.gov.au

D R A F T

Appendix E

Groundwater Resource Report

Groundwater Resource Report

Groundwater catchment: East Port Phillip Bay **VICGRID94 Easting: 2518275 Northing: 2404907**

Depth to water table: < 5m **Water table salinity (mg/L): 1001 - 3500**

Groundwater layers (Aquifers and Aquitards)	Depth below surface (m)	Groundwater salinity (mg/L)
QA Quaternary Aquifer sand, gravels, clay, silts	0 - 7	1001 - 3500
BSE Mesozoic and Palaeozoic Bedrock (basement) sedimentary (fractured rock): Sandstone, siltstone, mudstone, shale. Igneous (fractured rock): includes volcanics, granites, granodiorites.	7 - 207	1001 - 3500

There are no GMUs at this location

For further information about this report contact:
Department of Environment, Land, Water & Planning
Email: ground.water@delwp.vic.gov.au

For further information on groundwater licensing in this area contact:
Southern Rural Water Corporation
Phone: 1300 139 510
Email: srw@srw.com.au
Website: www.srw.com.au

Printed: 22 July 2019
Date Updated: 11 January 2019

How to read this report

Introduction

Groundwater is part of the water cycle. When rain or snow falls on land, some of it evaporates, some flows to streams and rivers, and some seeps into the soil. Some of the water in the soil is used by plants but some continues to move down through the soil and rock until all the pores and cracks are full of water. This is known as the water table and this water is called groundwater.

Groundwater is a finite resource that, like surface water, is allocated under the Water Act (1989). A Bore Construction Licence is required to drill for groundwater including for domestic and stock purposes. Taking and using groundwater for commercial or irrigation purposes requires an additional licence.

Purpose of this report

This report has been prepared to provide potential groundwater users with basic information about groundwater beneath their property. This includes the different geological layers, the depths of the layers and the salinity of groundwater in the layers. Information on the groundwater management units (GMU) and any associated caps on the volume that can be licensed (the PCV) are also provided.

Definitions and context

Term	Description
Groundwater Catchment	An identified area of the State within which groundwater resources are connected.
Easting / Northing	The VICGRID 94 coordinates of the spot that was selected on the interactive map.
Groundwater Salinity	Indicates the possible concentration of salts within the groundwater. The salt content indicates the possible uses of the water (see the Beneficial Use Table below). Fertilisers and other contaminants can also enter groundwater and affect its use. It is up to you to make sure that the groundwater you use is suitable for your purpose.
Aquifer	An aquifer is a layer of soil or rock which stores usable volumes of groundwater. Aquifers are generally limestones, gravels and sands, as well as some fractured rocks where the cracks in the rock are open and connected (some basalts, sandstones and limestones). How much water can be pumped from an aquifer depends on how much water is stored in pores and cracks, how well connected the pores and cracks are, and how thick the layer is. It is more likely that volumes of water for irrigation and urban water supply will come from gravels, sands, limestones and basalts that are at least 30 metres thick. Low volumes of water for domestic and stock use are likely from any aquifer greater than 10 metres thick. The advice above is a guide only, as the amount of water available can be highly variable. Actual pumping volumes can only be determined from drilling, appropriate construction and testing of a bore.
Aquitard	An aquitard is a layer of rock or soil that does not allow water to move through it easily, limiting its capacity to supply water. Aquitards are generally silts, clays and fractured rocks (where there are few cracks in the rock or the cracks are poorly connected).
Groundwater Management Unit (GMU)	A collective term for groundwater management areas (GMAs) and water supply protection areas (WSPAs). GMAs and WSPAs are defined areas and depths below the surface where rules for groundwater use may apply. WSPAs often have caps on groundwater use and plans describing how the resource is managed. GMAs usually have caps on groundwater use and may have local plans and rules. All other areas are managed directly through the Water Act (1989). Always check with your local Rural Water Corporation to be sure that the information on the GMU is correct for your specific location.
Permissible Consumptive Volume (PCV)	A cap that is set under the Water Act (1989) declaring the total volume of groundwater that may be taken from the area. Once the PCV is reached, no additional extraction can be licensed for use within the area unless traded from another groundwater licence holder.
Depth to Water Table	This is an indication of the depth at which groundwater might first be encountered when drilling a bore. The depth can vary from year to year, and from place to place and may vary significantly from that indicated in this report.

Beneficial Use Table

Salinity range (mg/L TDS)	Beneficial use as described by State Environment Protection Policy (Groundwaters of Victoria) s160							
	Potable water - preferred	Potable water - acceptable	Potable mineral water	Irrigation	Stock water	Industry	Ecosystem protection	Buildings and structures
<500	✓	✓	✓	✓	✓	✓	✓	✓
501-1000		✓	✓	✓	✓	✓	✓	✓
1001-3500			✓	✓	✓	✓	✓	✓
3501-13000					✓	✓	✓	✓
13001+						✓	✓	✓

Accessibility

If you would like to receive this publication in an alternate format, please telephone or email the DELWP Customer Service Centre 136 186, email customer.service@delwp.vic.gov.au, or via the National Relay Service on 133 677 www.relayservice.com.au.

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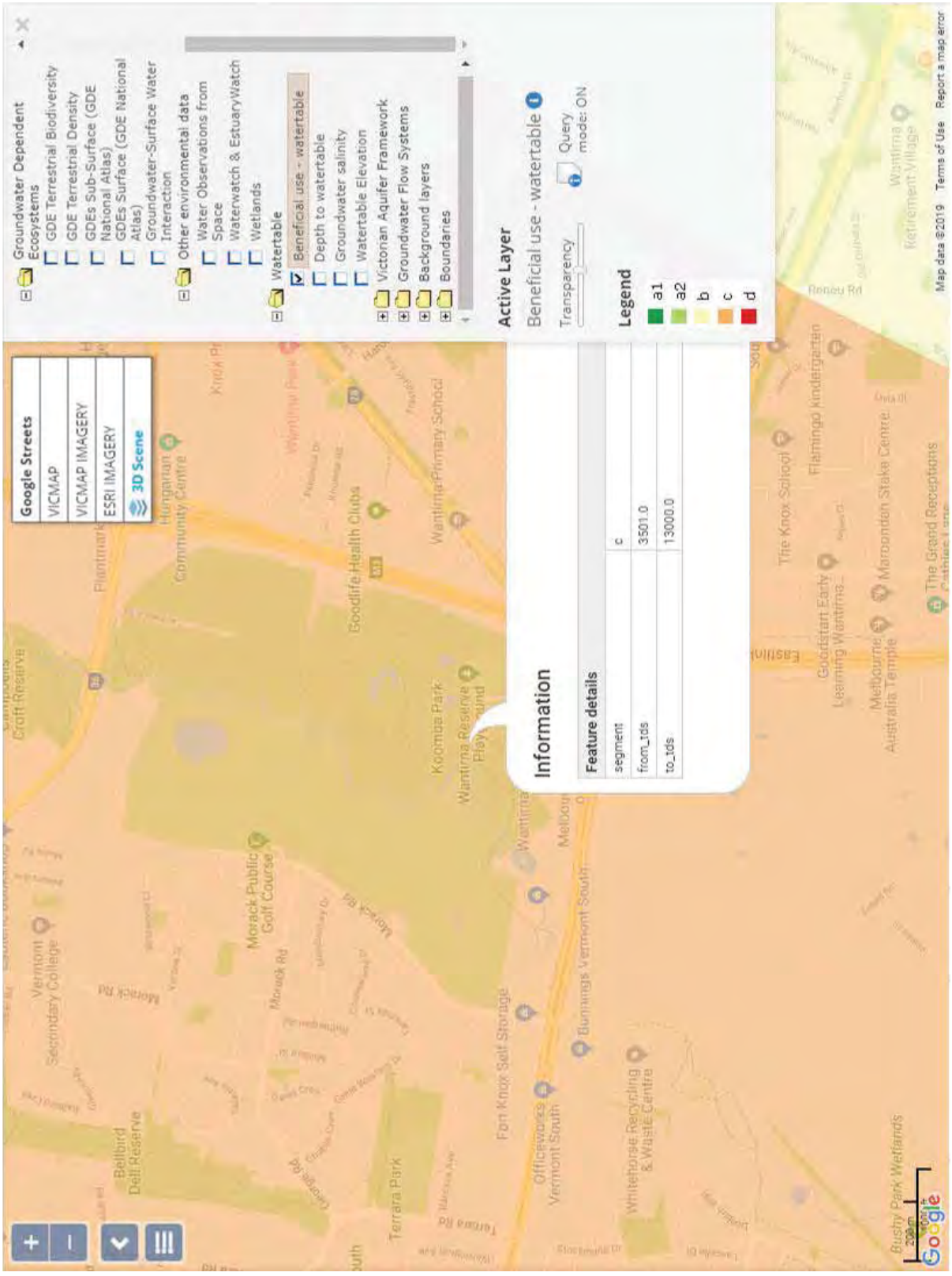
Date Updated: 11 January 2019

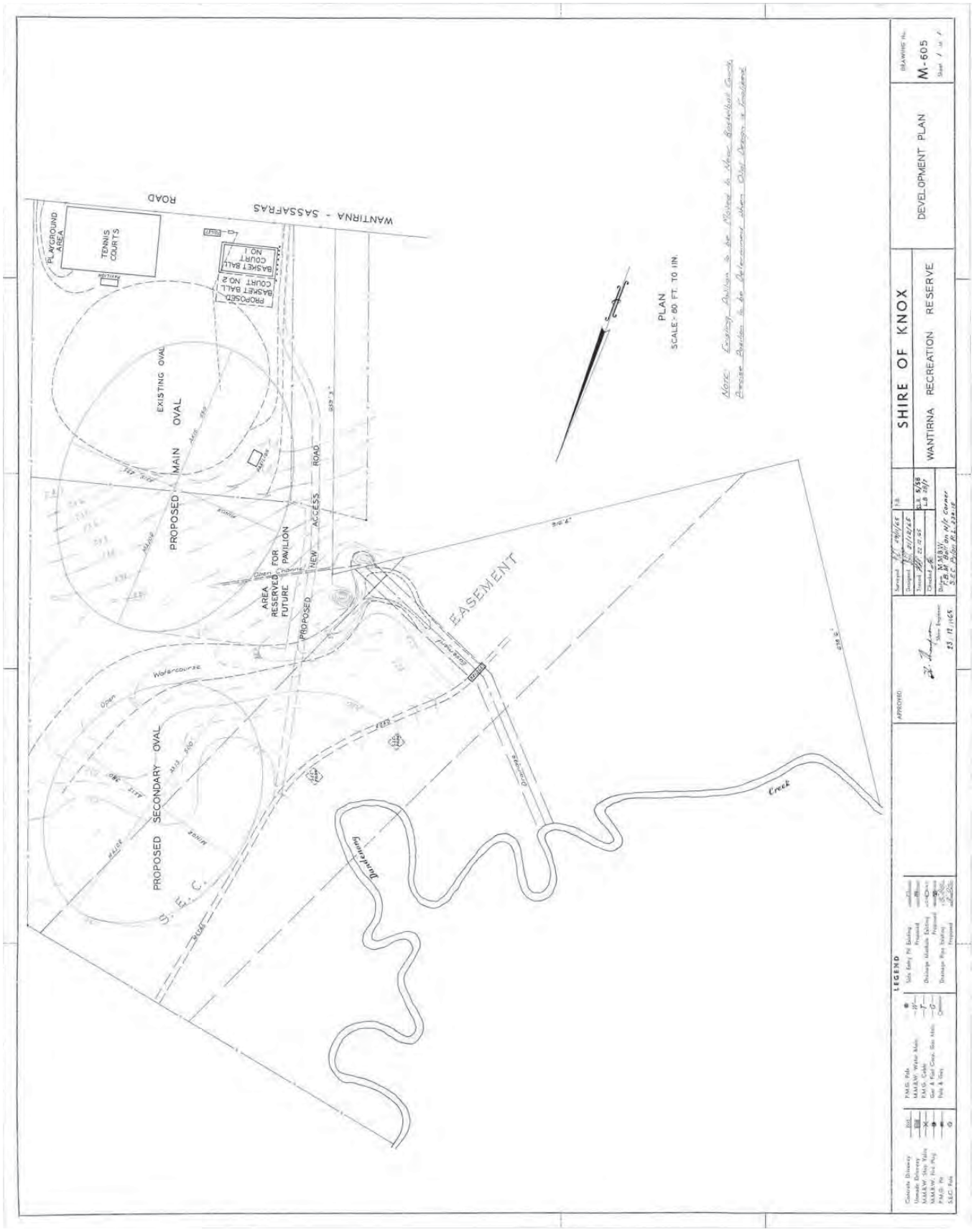
VICTORIA State Government | Environment, Land, Water and Planning

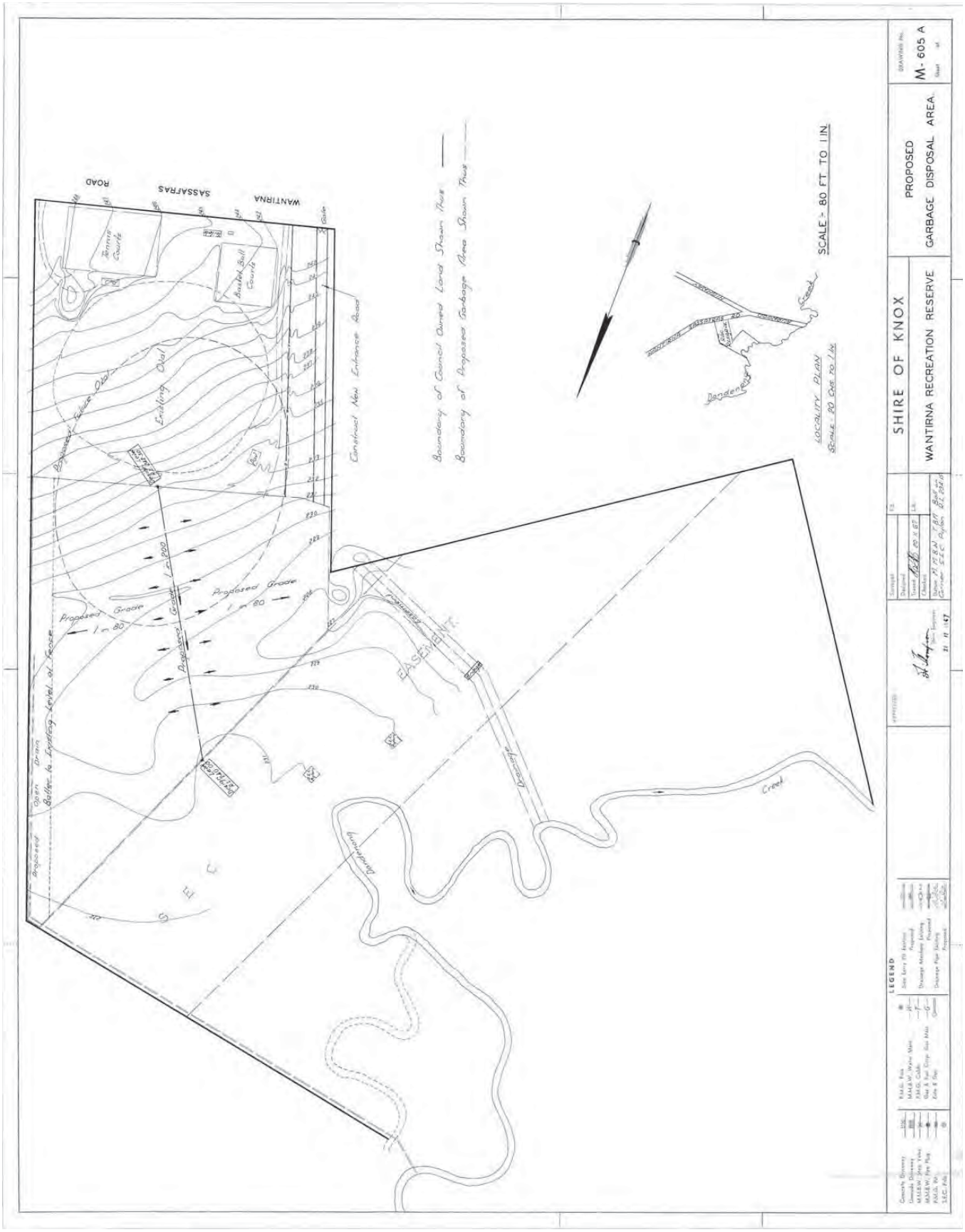

Groundwater Dependent Ecosystems
GDE Terrestrial Biodiversity
GDE Terrestrial Density
GDEs Sub-Surface (GDE National Atlas)
GDEs Surface (GDE National Atlas)
Groundwater-Surface Water Interaction
Other environmental data
Water Observations from Space
Waterwatch & EstuaryWatch
Wetlands
Watertable
Beneficial use - watertable
Depth to watertable
Groundwater salinity
Watertable Elevation
Victorian Aquifer Framework
Groundwater Flow Systems
Background layers
Boundaries
Active Layer
Beneficial use - watertable
Transparency
Query mode: ON
Legend
a1
a2
b
c
d
Google Streets
VICMAP
VICMAP IMAGERY
ESRI IMAGERY
3D Scene
Information
Feature details
segment c
from_tds 3501.0
to_tds 13000.0
Hungarian Community Centre
Goodlife Health Clubs
Wantirna Primary School
Koomba Park
Morack Public Golf Course
Vermont Secondary College
Bellbird Dell Reserve
Terrara Park
Fort Knox Self Storage
Officeworks Vermont South
Bunnings Vermont South
Whitehorse Recycling & Waste Centre
Bushy Park Wetlands
The Knox School
Flamingo Kindergarten
Goodstart Early Learning Wantirna
Melbourne Australia Temple
Maroondah Stake Centre
The Grand Receptions
Wantirna Retirement Village
Renou Rd
Map data ©2019 Terms of Use Report a map error
Google

D R A F T

Appendix F

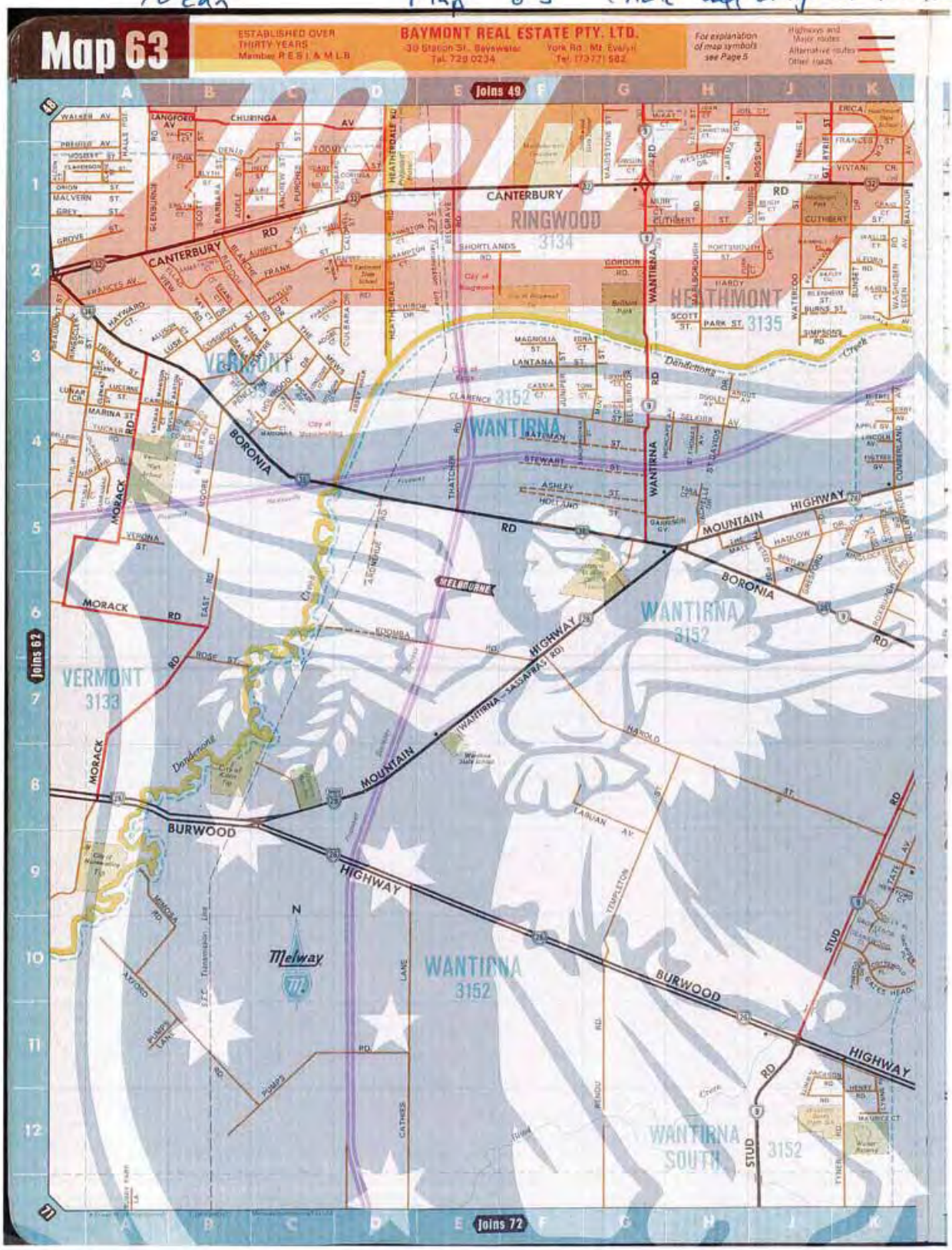
Knox City Council Historic Development Plans


SHIRE OF KNOX
WANTIRNA RECREATION RESERVE
DEVELOPMENT PLAN
M-605
PLAN
SCALE: 80 FT. TO 1IN.
WANTIRNA - SASSAFRAS ROAD
PLAYGROUND AREA
TENNIS COURTS
BASKET BALL COURT NO 1
PROPOSED BASKET BALL COURT NO 2
EXISTING OVAL
MAIN OVAL
PROPOSED
NEW ACCESS ROAD
AREA RESERVED FOR FUTURE PAVILION
PROPOSED
EASEMENT
Watercourse
Open
PROPOSED SECONDARY OVAL
S. E. C.
Creek
LEGEND

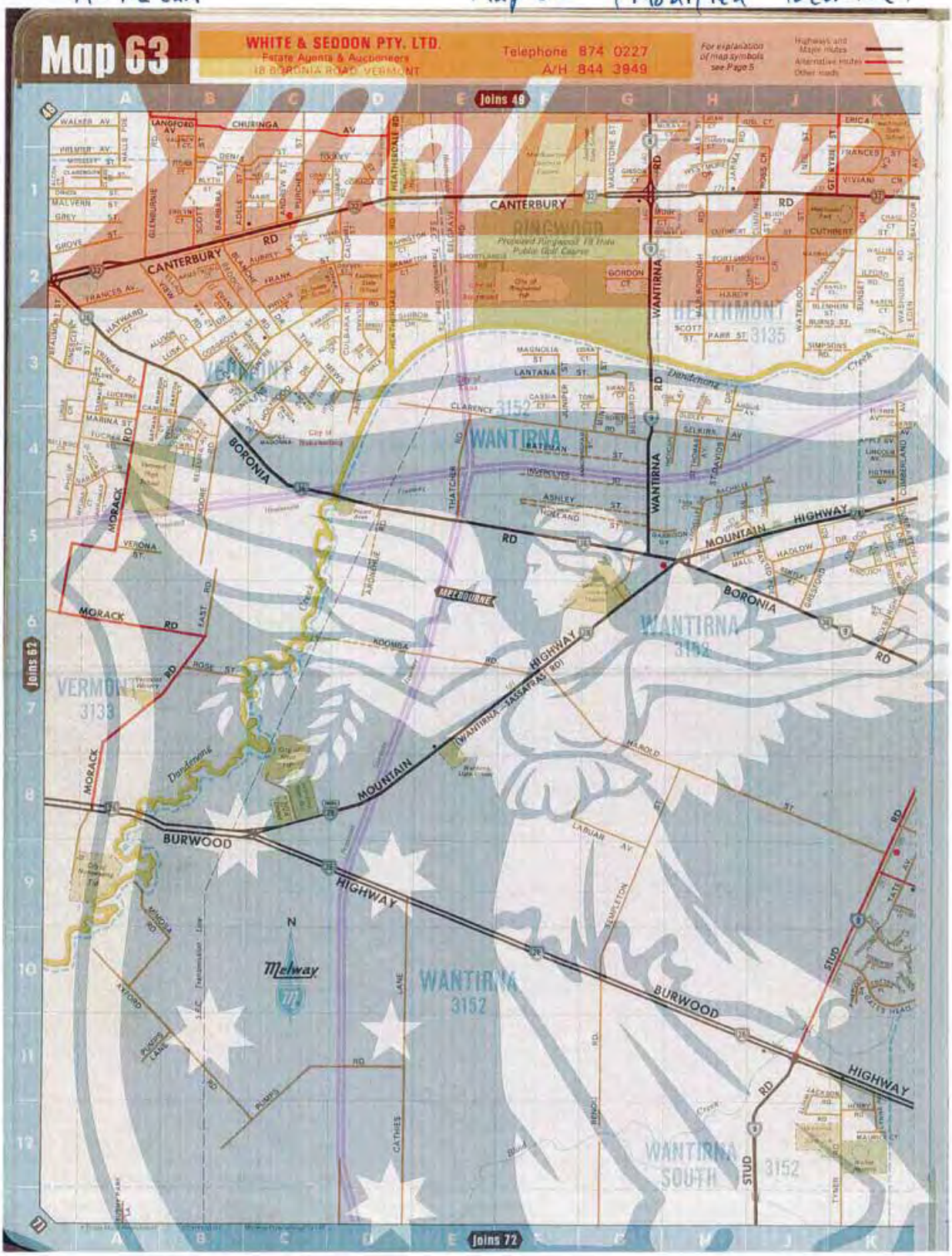

PROPOSED
GARBAGE DISPOSAL AREA
M-605 A
SHIRE OF KNOX
WANTIRNA RECREATION RESERVE
SCALE - 80 FT TO 1 IN
LOCALITY PLAN
SCALE : 20 CHS TO 1 IN
Boundary of Council Owned Land Shown Thus
Boundary of Proposed Garbage Area Shown Thus
Construct New Entrance Road
Existing Old
Proposed Grade
1 in 80
Proposed Grade
1 in 200
Proposed Grade
1 in 80
Proposed Open Drain
Batter to Existing Level of Fence
WANTIRNA
SASSAFRAS
ROAD
Tennis Courts
Basket Ball Courts
Footpath
EASEMENT
Creek
Dandenong
LEGEND


WANTIRNA - SASSAFRAS RD
Playground
Tennis Courts
Basketball Courts
Crushed Rock Car Park
Toilets
Parking
ACCESS
Open drain
FENCE
OVAL
EXISTING
NEW TOWER 18m bob
Existing Pavilion
Cricket Practice Nets
New Work in Progress
DANDENONG
CITY OF KNOX
WANTIRNA RECREATION RESERVE
EXISTING CONDITIONS
JULY 1979
163—A1
AMENDMENTS
Pavilion and Earthworks
APPROVED
CHECKED
DATUM
LEGEND
1:1000

'70 cds' Map 63 (note original location)



'71-72 edn Map 63 (Modified location)



INSIDE EDGE SPORT AND LEISURE PLANNING

PROPOSED EASTERN FOOTBALL HUB

WANTIRNA SOUTH RECREATION RESERVE

50 MOUNTAIN HIGHWAY

WANTIRNA

Report No: 115706

Date: 24 March 2014

GEOTECHNICAL INVESTIGATION (PRELIMINARY)

By

A.S. JAMES PTY LIMITED
15 Libbett Avenue,
Clayton South Vic. 3169
Tel: 613 9547 4811
Fax: 613 9547 5393
E-mail: melb@asjames.com.au

X:\James\Geotechnical\Commercial\115706 Eastern Football Hub, WANTIRNA\FINAL REPORT DOCUMENTS\115706 Proposed Eastern Football Hub.docx

A.S.JAMES PTY LTD
A.C.N. 004 584 534 A.B.N. 40 004 584 534
Geotechnical Engineers
SINCE 1963

15 Libbett Avenue
Clayton South Vic 3169
Tel: (613) 9547 4811
Fax: (613) 9547 5393
E-mail: melb@asjames.com.au

1. INTRODUCTION

1.01 **Investigation Requested By**: The geotechnical investigation was commissioned by Mr Michael Bodman Bolton of Inside Edge Sport and Leisure Planning via email correspondence dated 21st February 2014.

1.02 **Purpose of Investigation**: The scope for this investigation is as follows:

General: It was proposed to develop the Wantirna South Recreation Reserve into an Australian Rules Football training and administration hub. In doing so, bringing together training and development functions of the Eastern Football League, Eastern Rangers TAC, Eastern Region Umpires, AFL Victoria and Hawthorn Football Club.

Proposed Infrastructure: The proposed developments to the site are as follows:

- The conversion of the existing playing field (eastern oval) from grass to an AFL/CA approved synthetic oval
- The development of disused open space (current picnic/play area) to premier quality natural turf, sand based oval of MCG size and quality
- The development of a 1500m2 (double story) office administration, social and change room complex
- The development of roadways and car parking to meet the demands of the upgraded site

Information provided indicates the site was believed to be a landfill pre 1968 and the existing road ways were developed in 1998. The likely specifications for the proposed main natural grass playing field or (Western Oval) are in accordance with the '*Colac Central Reserve*' document provided. Specifications for the proposed synthetic oval (Eastern Oval) are understood to be in accordance with the '*Australian Football League and Cricket Australia Handbook of Testing for Synthetic Turf*' also provided by the client.

Discussions: The following are requested aspects of the site to be discussed.

- Key issues associated with the sub-surface conditions and how they may impact the proposed infrastructure
- Earthworks

1.03 **Geology:** At least part of the site, as previously indicated, was historically used as a landfill before being converted into parklands and recreational space. The Geological Survey of Victoria, 1:63,360 Series, Ringwood Sheet, indicates the subject site to be underlain by sedimentary deposits which are of the Silurian age and form part of the Dargile Formation. Typically, these deposits comprise of laminated and current bedded sandstones, interbedded with massive siltstones and shales. Some alluvial deposits may exist in the lower elevations.

1.04 **Field Methods**: As part of the geotechnical investigation the following field methods were incorporated:

i) **Auger Drilling:** All boreholes were drilled using a truck mounted Gemco HP 7 rotary drilling rig equipped with continuous flight 125 millimetre diameter augers fitted with tungsten carbide drill bits.

ii) **In-situ Vane Shear Strength Testing:** In-situ vane shear strength testing was carried out within the cohesive soils at shallow depths using a Pilcon hand vane tester. The tests were conducted in accordance with the test procedure outlined in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes". Test Method F2. 1, June 1977.

iii) **Standard Penetration Testing:** Standard penetration testing was conducted at regular intervals within the boreholes in accordance with the test procedure outlined in Australian Standard 1289, "Methods of Testing Soils For Engineering Purposes," Test Method 6.3.1, June 1993.in accordance with Australian Standard AS 1726 - 1993, "Geotechnical Site Investigations."

i**v)** **Logging of Soil Profiles:** The soil profile encountered in the borehole was logged in accordance with Australian Standard AS 1726 - 1993, "Geotechnical Site Investigations."

1.05 **Laboratory Test Methods:** All soil samples were transferred to A.S. James' National Association of Testing Authorities (NATA) registered Clayton South laboratory, where mechanical testing was undertaken by a team of trained laboratory technicians. All laboratory testing was performed in strict accordance with the test methods outlined in Australian Standard AS 1289, "Method of Testing Soils for Engineering Purposes," as follows:

Suggested testing in the brief was modified too.

	AS 1289 Test Method
• Atterberg Limits	3.1.1, 3.2.1, 3.3.1.3.4.1

2. RESULTS

2.1 FIELD TESTING

2.1.1 **Bore Locations:** Twenty (20) boreholes were drilled at the locations indicated on Figures 1 and the logs of these boreholes are given on Figures 2 – 17. The results of standard penetration tests are given on the logs.

2.1.3 **Sub-Surface Soil Profile:** The results of the borehole drilling program conducted at the site, have been summarised in Table 1 & 2 below.

Borehole	Depth Range of crushed rock (m) (FILL)	Depth Range of Filling (Sandy silt) (m) (FILL)	Depth Range of Silt/ Clay Cap (m) (FILL)	Depth Range of Historic Tip (m) (FILL)	Depth Range of Reworked Natural Material (m) (FILL)	Depth Range of Natural Clayey Silt (m) (SILT) (MH)	Dargile Formation Depth Range of Natural Silty Clay (m) (CLAY) CH /CL
1	-	0-0.2	0.2-0.6	0.6-4.0	-	-	4.0-4.5
2	-	0-0.6	-	0.6-2.0	-	-	-
3	-	0-0.2	-	0.2-3.0	-	-	-
4	-	0-0.1	-	0.1-2.0	-	-	-
5	0-0.1	-	-	0.1-2.0	-	-	-
6	0-0.1	-	0.1-0.6	0.6-2.0	-	-	-
7	-	-	0-2.2	2.2-3.0	-	-	-
8	0-0.15	-	-	-	0.15-1.7	-	1.7-3.0
9	0-0.1	-	-	-	0.1-3.0	-	3.0-3.4
10	0-0.05	-	0.05-1.0	1.0-1.4	-	1.4-1.6	1.6-6.4
11	0-0.05		0.05-1.6	1.6-3.5	-	-	3.5-6.4
12	0-0.05	-	0.05-1.7	1.7-4.0	-	-	4.0-6.4
13	0-0.05	-	-	-	0.05-2.5	-	2.5-6.0
14	-	-	1.4-1.8	1.8-4.5	0-1.4	-	4.5-4.6

Table 1: Summary of Sub-surface Soil Profiles within Depths Investigated (Bores 1-14).

Borehole	Depth Range of Filling (Silty Sand) and (Sand / Silt / Gravel) (m) (FILL) Playing Surface	Depth Range of Reworked Natural Material (m) (FILL)	Depth Range of Natural Silt (m) (SILT) (MH)	Dargile Formation Depth Range of Natural Silty Clay or Silty Sand (m) (CLAY) CH /CL, (SAND) (SM)
15	0-0.3	-	-	0.3-2.0
16	0-0.3	0.3-1.0	-	0.3-1.0
17	0-0.3	-	-	0.3-2.0
18	0-0.3	0.3-1.3	-	1.3-2.0
19	0-0.1	-	0.1-0.3	0.3-2.0
20	0-0.3	0.3-1.0	-	0.3-1.0

Table 1: Summary of Sub-surface Soil Profiles within Depths Investigated (Existing Sporting Oval).

Bores 1-4 were carried out at the picnic / play area of the site, bores 5, 6, 7, 8, 9 & 14 were carried out in the car-park area of the site and bores 10-13 were carried out within the proposed new double story building envelope. Bores 15-20 were carried out on the existing sports oval.

A summary of each of the soil units encountered at the subject site is provided as follows:

- Crushed Rock Fill: ***Car Park Areas:*** Within the car parking areas, a layer of dry, medium dense silty and sandy crushed rock fill of thickness ranging from 0.05-0.15m generally was encountered. **The suitability for re-use around the site or as future sub-base has not yet been determined.**

- Sandy Silt: ***Picnic / Play Area***: A layer of generally brown, dry, medium dense sandy silt with an organic content was encountered within the picnic / play area of the site, ranging in depths of 0.1-0.6 m.

- Sand: ***'Capping' Fill used to develop the playing surface of the existing sports oval***: A thin layer of moist brown silty sand in medium dense condition was encountered approximately 0.1 m in depth over the existing sports oval to the east. Underlying this a layer of brown sand / silt / gravels was encountered of medium density, 0.2 m thick.

- Silt / Clay Capping: Predominantly within the existing car parking areas and accessible locations of the proposed double story building envelope. A likely reworked natural material was encountered, mostly a yellow brown / orange brown occasionally mottled red silty clay however

appearing as a clayey silt at times. This layer was typically of stiff consistency or medium dense, dry tending moist with a gravel content.

- Historic Landfill: Underlying much of the site in particular the proposed western natural grass oval is the historic tip. This unit typically presented as a grey brown / brown grey moist silty clay of medium density. Accessory materials encountered includes, glass, brick, plastic, metal, gravels and other miscellaneous items such as the sole of a shoe encountered in BH14. Within the depths investigated this unit ranged from 0.1 m up to 4.0 m below ground surface. Typically over the picnic / play area the sandy silt was overlying the historic land fill and within the car park and proposed building envelope where encountered, the historic landfill was underlying the silt / clay capping. Perched water tables were encountered at BH1 and BH14 at approximately 3.0 m above the underlying clay.

- Reworked Natural Material: Encountered at boreholes in close proximity to the existing sporting oval and eastern parts of the sporting oval. Reworked natural materials were encountered of characteristics to those similar to the natural undisturbed materials underlying the site in addition to what appears to be a crushed siltstone fill. This profile generally appeared as a dry to moist yellow brown / orange brown / grey occasionally mottled red stiff silty clay, in medium dense condition.

- Natural Clayey Silt (MH): Observed in BH10 below the historic tip profile a thin layer of pale grey moist, loose to medium dense clayey silt was encountered. It is possible this was the original ground surface level before filling associated with the historic tip began.

- Natural Silurian Age Dargile Formation: Encountered underlying historic tip fill, natural clayey silts or reworked natural materials, a grey / orange brown stiff silty clay in moist condition was encountered. At deeper depths greater than 5.0 m sub-angular ironstones were encountered including variably ferruginous occasional grit and gravel bands. Of note, the silty clay tended to a sandy / silty clay at approximately 5.0 m within BH11.

2.1.5 **Discussion of possible historic earthworks:** With reference to the attached Cross Section A-A', the following is observed site notes regarding the possible previous earthworks at the site. The bore logs indicate that a possible earthworks program previously conducted at the site included the cutting of natural materials from the eastern areas of the existing oval and subsequent benching by filling of the remaining areas, westwards over the oval. In addition, placement of natural materials over the historic landfill, predominantly over the car park areas and existing

building area. It appears the materials were also placed in a somewhat uncontrolled manner. The historic landfill appears to reduce in depth as it approaches the existing oval however, relatively significant depths of landfill were still recorded west of the existing pavilion adjacent to the sports oval.

2.1.6 **Ground Water:** No permanent free ground water was encountered at the time of the site investigation and none would normally be expected within the depths investigated. However at two locations a perched water table was encountered within the historic landfill profile at approximately 3.0 m. It should be noted, however, that following prolonged periods of rainfall the surface fills, historic landfill and reworked natural materials, clayey silt and shallow silty clay may be susceptible to moisture ingress, thereby significantly reducing the workability and strength of both the surface fill and the underlying sands at shallow depths.

2.2 LABORATORY TESTING

2.2.1 **Test Program:** Upon receipt in the laboratory, the disturbed soil samples retrieved from Boreholes were prepared as necessary before Atterberg limit testing was carried out.

2.2.2 **Test Results:** The results of the laboratory Atterberg limits are given attached.

3. DISCUSSION & RECOMMENDATIONS

3.1 PROPOSED STRUCTURE: Double storey, well-articulated and able to accommodate minor movement.

3.1.1 **Site Classification:** In selecting an appropriate foundation arrangement the following factors have been taken into account:

- Sub-surface soil profiles and results of visual site observations
- Local geological conditions;
- Knowledge of the site and previous likely earthworks on this development.

If required the site should be classified as Class 'P' in accordance with AS 2870 – 2011 and fully suspended construction will be necessary.

3.1.2 **Piled Footings:** Pile footings should be adopted. Considering the variation of historic landfill depths, the piles need to extend into the silty clay below any clayey silt, reworked natural material or historic fill.

3.1.3 **Bored Piers:** Bored piers could be considered although some instability may be encountered and temporary liners will be necessary.

If required for a preliminary design a bearing pressure of 300 kPa could be adopted subject to a penetration of 1.0 m into the underlying clay. A skin friction of 30 kPa could be adopted below this level.

3.1.4 Provided that adequate protection is provided against the possibly aggressive ground conditions that may prevail with the historic fill profile, the use of precast concrete piles appears appropriate for the proposed development.

Pile Load Capacity: Provided that adequate protection is provided against the possibly aggressive ground conditions that may prevail within the historic fill profile, the use of precast concrete piles appears appropriate for the proposed development.

Considering the potential for variation of the subsurface profile across the site the piles will need to be driven into the "Dargile Formation" layer and piles need to be driven until the required set is achieved.

The load carrying capacity of driven piles in the stiff clay will significantly be shaft resistance. In this site, it is expected significant load development will not occur until up to in all likelihood 4.0 metres due to the historic landfill and possibly uncontrolled fill. Obviously, variability in both the depth of historic fill and the properties of the Dargile Formation across the site will influence final piling depths and embedment depth variation will exist.

As per our calculations, based on a conservative depth of fill at 4.0m a 350 sq. smooth pile driven 3.0 metres into the Dargile Formation will provide a working load of 160 kN. That is a total pile depth of approximately 7.0m, although site variation and density will determine ultimate depths, and increased pile sizes could be considered. Greater bearing pressures can be provided subject to further geotechnical investigation to deeper depths within the 2-story building envelope until rock is encountered, this is estimated in the order of 8-10 m below ground surface level.

Piling contractors should make their own assessment of piling conditions and load carrying capacities of proprietary pile types. Design geotechnical strength is the calculated design ultimate geotechnical strength multiplied by a geotechnical strength reduction factor. As per the piling code (Revision of AS 2159-1995) the geotechnical strength reduction factor should be determined considering the site, design and installation of piles.

We emphasise that the historic landfill depths are variable up to 4.0 m recorded within the building envelope and variable depths can be expected and will occur.

3.1.5 The use of CFA (Continuous Flight Auger) or driven piles could be considered and the logs should be referred to proprietary piling contractors.

3.1.6 **Pile Settlements:** Pile settlements could be assessed using a Young's Moduli (E) for the stiff silty tending sandy clay of 50 MPa.

3.1.7 **Pile Groups:** The total working load for the pile will be developed by a combination of end bearing and shaft friction into the silty tending sandy clay.

It is recommended that the following precautionary measures be taken during the pile driving operations.

- Continuous monitoring of pile heads during installation to ensure eccentricities do not develop.
- A construction sequence be developed to minimise potential interaction (suggest three diameters) of piles and drive central, inner and outer.
- Pre-bore (with casing, if necessary) to remove material and obstructions in the historic landfill.
- Ensure the use of a proprietary tensile capacity joint or during monitoring (both laterally and vertically) have the capacity to 'reset' piles lifting.

It is recommended the driven piles be initially checked using dynamic pile testing (Pile Driving Analyser) and confirmed using CAPWAP analysis or similar on selected piles (10% in Number, but subject to Quality Risk Factors).

3.1.8 **Pile Downdrag:** The down-drag stress at any point on the pile within the historic landfill could be calculated using the following equation:

$$f_{nf}=0.3\sigma'_v$$

where f_{nf} is the downdrag stress

σ'_v is the effective overburden stress (adopt a bulk unit weight of 15 kN/m^3 for the fill including capping, reworked natural materials and historic landfill)

Pile down drag should be considered to a depth 1.0m above the base of the stiff clay. Based on the information this can be considered at approximately 3.0 m in depth.

3.1.9 **Protection of Piles:** The possibility remains of the fill to be of aggressive nature to concrete, in all likelihood it will be necessary to provide an appropriate level of protection for the proposed precast concrete piles. Such protection should include the use of cement rich, high quality, very dense, impervious concrete, which should be placed with a high degree of vibration. As a guide the concrete should contain not less than 425 kg/m3 cement and 50 kg/m3 flyash placed with a super-plasticiser at a water cement ratio of 0.30. Care will also need to be taken to ensure that the steel segmented pile joints are not located within the uppermost 4.0 m. Other proprietary options could also be considered.

3.1.10 **Earthquake Loading:** In accordance with Australian Standard 1170.4-2007, Part 4, "Earthquake Actions in Australia", site sub-soil class of C_e – shallow soil site and Hazard Factor (Z) of 0.09 should be adopted for the design of the proposed structure at the subject site.

3.1.11 **Discussion of Settlements of proposed premier quality natural turf, sand based oval (Proposed Western Oval):** In accordance with the provided likely specifications for the proposed premier quality natural turf sand based oval taken from the Colac Central Reserve, it is stated within Section 8.1 of the document that the 'soil rootzone layer' will be to a consolidated depth of 250 mm so that the finished surface has a tolerance of + or – 10 mm.'

Given the ongoing settlement that will occur underlying the site and the relatively poor engineering quality of the landfill materials, it is envisioned that due to these inevitable settlements / differential settlements that will take place at the proposed location, the tolerance of + or - 10mm will be significantly exceeded. Drainage in particular is likely to be affected due to the differential settlement of the oval.

Significant cost will be expended in remediating this area of the site and in fact would likely be cost prohibitive. A 'use and maintain' approach would appear all that is reasonable.

3.1.12 **Discussion of Settlements of Australian Football League and Cricket Australia Grade Synthetic Turf Oval (Eastern Oval):** After reviewing the provided handbook, regarding the specifications for a synthetic oval. Settlement tolerances were not provided, however it is assumed that this type of construction, similar to the natural turf, sand based oval is sensitive to movements and drainage is critical.

As the synthetic turf oval is proposed to be located at the existing sports oval. Given the presence of reworked natural fill materials, particularly from the centre of the existing sporting oval heading westwards. The likely resulting consolidation settlements are expected to be outside + or – 10 mm, if the proposed synthetic turf oval was to be located at the existing ovals location. The use of an impact roller on this existing fill may be sufficient to reduce the settlements in the fill to acceptable limits. However, more and intrusive investigation is required with test pits.

3.1.13 **Discussion of Environmental Condition of Site:** Given the site history as to a landfill. It is understood there are no available records to the type and quantity of material that was bought on site. Due to the uncontrolled nature of the filling, it is possible and likely that the soil is contaminated to some degree, however to what degree at this stage is largely unknown and until firm proposals exist no testing is warranted.

Landfills can be typically heterogeneous in both physical and chemical composition. As such, environmental preliminary sampling and analytical testing can be misleading as both the physical and chemical composition can change over relatively short distances. Therefore, more detailed environmental investigations are recommended as follows; however, this is outside the scope of this investigation.

A preliminary phase 1 environmental assessment focuses on site history in the aim of determining possible environmental impacts by ascertaining possible contaminants of concern related to the sites previous use.

Upon the completion of a site history study, a limited sampling and analysis program can be completed testing for contaminants of concern using a specific sampling strategy. Collection of ecological information on background inorganic element and organic compounds present would also be completed. In doing so, this gathered information would aid in reviewing results and determining if possible impacts may be imposed on ecological receptors. Contaminant threshold concentration levels can be adopted for human health and ecological receptors in accordance with the current '*National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No.1).'*

A preliminary off-site disposal categorisation can be provided in accordance with Victorian EPA Publication IWRG-621-June 2009 '*Soil Hazard Categorisation and Management'. Along* with any necessary details and recommended practices for disposing the soil off-site. It should be noted as above, given the likely heterogeneous nature of landfill material a conservative approach is likely to be adopted.

The production of landfill gases will also require investigation at the social and change room complex.

Note: Given the high content of municipal/domestic waste and industrial wastes in the historic landfill profile, the fill cannot be used as engineered / structural fill. A prescribed industrial waste category will need to be assigned to the landfill material and if required disposed of at a licenced facility.

Upon the completion of the preliminary Phase 1 environmental assessment, a further phase 2 investigation may be recommended to further explore / delineate any contamination found or determine an appropriate remediation strategy in line with a hierarchy of control.

In the case construction was to commence at the site, a site specific environmental management plan should be completed addressing any contamination on site to inform any contractors of the conditions, and how to manage them for both safety, and compliance.

3.2 PAVEMENT CONSTRUCTION & GROUND FLOOR SLAB

3.2.1 **Pavements:** All building pavements should be fully suspended.

3.2.2 **External Pavements Constructed on Fill:** Some ongoing settlements within the fill underlying the subject site will result in distortion and maintenance requirements to pavements constructed on the existing ground surface level. Recognising this, any proposed pavements should be constructed on an adequately prepared subgrade with maximum possible grades to minimise future maintenance and ponding of water. Settlements are difficult to assess however may be as much as 50mm. (Except for the landfill area)

Flexible pavements and floor slabs constructed on an adequately prepared fill subgrade may be designed using a Design CBR value of 2.0 % Rigid pavements, on the other hand, constructed on a similar subgrade, may be designed using a Modulus of Subgrade reaction value of 20 kPa/mm.

Alternatively, rigid pavements may be designed in accordance with the Cement and Concrete Association of Australia, 1997 publication, "Industrial Pavements - Guidelines for Design, Construction and Specification" using long and short term Young's Moduli of 10 and 12 MPa respectively.

The effects of movements on any proposed rigid pavements can be minimised by incorporation of positive load transfer devices such as dowels.

It should be pointed out, however, that the pavement design parameters recommended above are given subject to the subgrade preparation outlined in Clause 3.2.2 and 3.2.3 being carried out, in addition to adequate subgrade drainage control, as outlined in Clause 3.2.4.

3.2.3 **Preparation Fill Subgrade:** The fill subgrade should be compacted with a heavy weight vibrating sheepsfoot roller. A minimum dry density ratio of 98% of the maximum dry density value determined by the Standard Compaction Test in accordance with Australian Standard AS1289 5.1.1 - 1993 should be achieved.

Under extreme conditions, if the subgrade exists in a saturated state, it may be necessary to strip the saturated clays and replace these with suitable granular fill compacted to a dry density not less than 98% of the maximum dry density value determined by the Standard compaction test in accordance with AS1289 5.1.1.

It should be appreciated that the long term performance of the proposed pavements constructed on a fill subgrade significantly depends on the subgrade moisture conditions at the time of construction.

If very wet conditions are prevalent at the time of construction then there is the risk of some subsequent shrinkage occurring as the clay dries out. On the other extreme, if very dry conditions have prevailed for a significant period then there could be a risk of some resulting heave as the clays wet up.

As outlined above, impact rolling could be considered to improve performance.

3.2.4 **Long Term Subgrade Moisture Control:** It is considered essential for the long term performance of the proposed pavements at the subject site that both an effective surface and lateral cut-off drainage system be provided and maintained to minimise the risk of moisture migration into both the pavement sub-base and subgrade layers. Under no circumstances should the pavement and subgrade layers be permitted to remain in a saturated condition.

3.2.5 **Earthworks:** It is pointed out that the clay/silt fills including the capping layer over much of the site are notoriously difficult to work and if not compacted at or very close to the optimum moisture content, can exhibit measurable volume change with time. As such, the use of these clays will require close supervision.

Any imported structural fill should essentially be of a granular nature. All fill material should have a nominal particle size of 75 millimetres or less and, if required, a guide for selecting an appropriate material would be as follows:

- Plasticity Index. x Percentage Passing 0.425 millimetres (AS Sieve) less than or equal to 600

Structural fill should be compacted in layers not greater than 200 millimetres when loose and should be compacted to a dry density not less than 98% of the maximum dry density value determined by the Standard Compaction Test in accordance with Australian Standard AS 1289 5.1.1 - 1993 using an appropriate heavy weight vibrating roller.

During compaction, the fill material should have moisture content within the range 85% to 115% of the optimum moisture content as determined by the Standard Compaction Test in accordance with AS 1289 E1.1 - 1993.

3.2.6 **Fully Suspended Construction:** If the anticipated pavement settlements cannot be tolerated it will be necessary to fully suspend the proposed pavements on a series of piles.

3.3 GENERAL

3.3.1 **Underground Services:** Ongoing settlements within the significant depths of fill underlying the subject site will result in distortion and maintenance requirements to underground services at the subject site. Recognising this, the following precautions should be taken for any proposed underground services at the subject site:

- All services should be laid with maximum possible grades to minimise future maintenance requirements.
- Flexible joints should be incorporated for all services.
- Services connecting to the proposed structure should be appropriately sleeved at the point of connection to allow for differential settlements where the structure is suspended.

3.3.2 **Inspection of Footing Excavations:** All footing excavations must be examined to ensure that the required founding soil has been exposed. Any unusual features must be reported to this office immediately in order to ensure that the recommendations outlined in this report remain relevant.

3.3.3 **General:** The Modulus of Subgrade reactions specified throughout the report are referred to as the K(0.3) value in most literature on the subject. As such, they are directly relevant where point loads are critical, but otherwise will require amendment depending on the value of the loading and geometry of the structural element involved. We would be pleased to advise further once relevant details are available.

Conditions may change with the seasons. In particular, the surface silts and residual clays underlying the site at shallow depths may become saturated and unworkable following prolonged periods of rainfall.

The above recommendations are based on the bore and test results, together with experience of similar conditions and are expected to be typical of the area or areas being considered. Nevertheless, all excavations should be examined carefully and any unusual feature reported to us in order to determine whether any changes might be advisable.

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REVIEWED BY
T .J. HOLT MIEAust CPEng EC-1022
A.S. JAMES PTY LTD

J .T. HOLT BEng
Grad Inst of Engineers
A.S. JAMES PTY LTD

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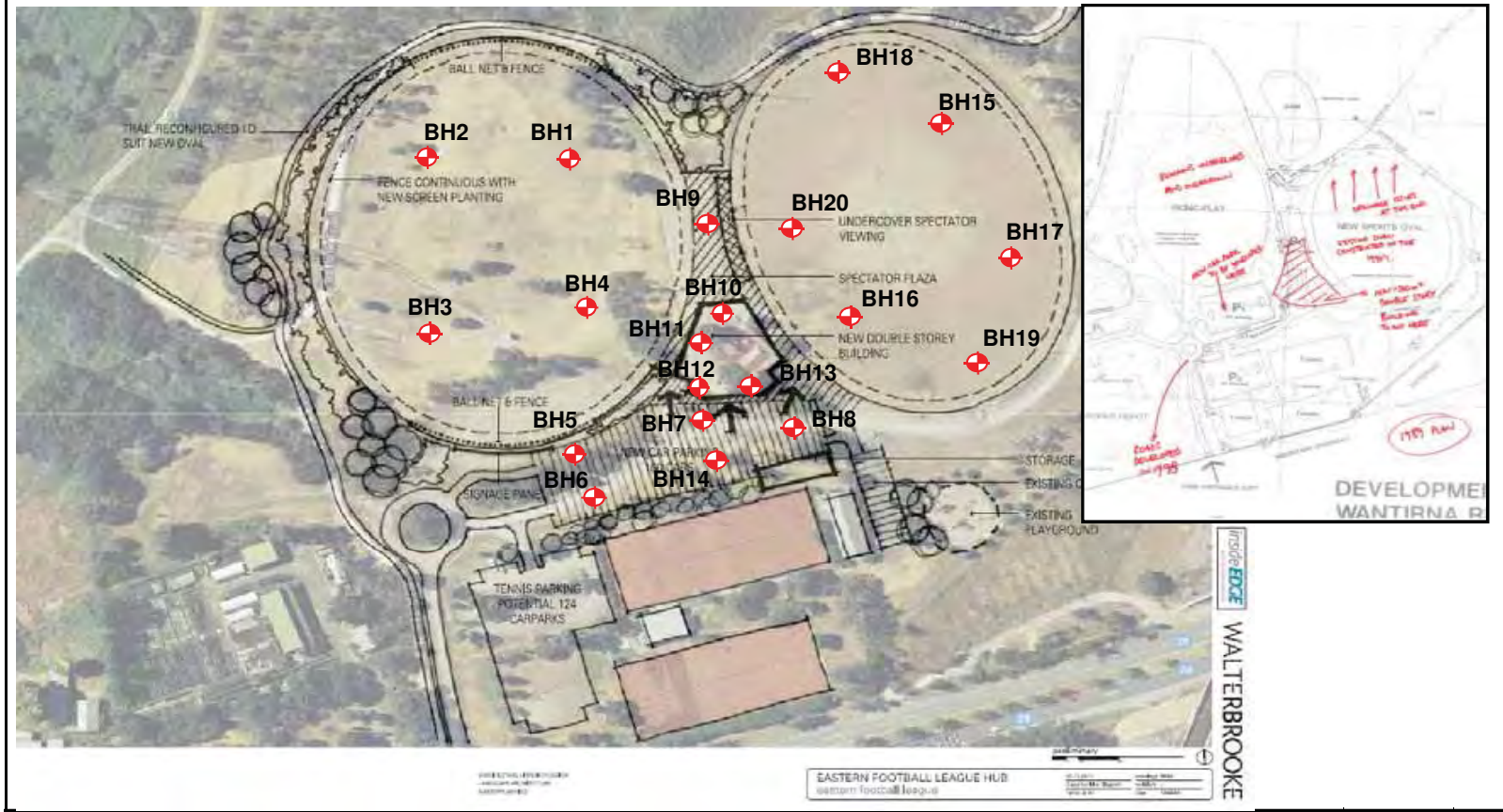

A.S. JAMES PTY LTD
Geotechnical Engineers

JOB: PROPOSED EASTERN FOOTBALL HUB
50 Mountain Hwy,
WANTIRNA, VIC

JOB No: 115706 **DATE: Mar '14**

Denotes Approximate Bore Hole Locations

BORE MAP

CHECKED: T. HOLT
DRAWN: J. HOLT

N

SOURCE: Plans Provided by InsideEDGE Sport and Leisure Planning

FIGURE 1

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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 1
Job No. 115706 **Date:** Mar '14
Ground Water: Perched water table at approximately 3.0 m.

Soil Type	Description	Depth	Tests	Results
FILL	Brown Silt	0		
	Accessory Materials: Trace sand and grass roots			
	Dry, medium dense	0.2		
FILL	Yellow brown / orange brown stiff clay			
	Accessory Materials: Gravels, silt			
	Dry, medium dense			
	Likely Reworked Natural Material	0.6		
	(Capping Layer)			
FILL	Brown grey / grey brown firm clay			
	Accessory Materials: Silt, plastic, brick fragments, glass, gravels			
	Moist, medium dense			
	Historic Landfill			
CLAY (CH/CL)	Grey / orange brown	4.0		
	Silty			
	Moist, stiff			
	Dargile Formation			
	BOREHOLE TERMINATED	4.5		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 2

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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 2
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth
FILL	Grey brown silt Accessory Materials: Trace gravels Dry, medium dense	0
		0.6
FILL	Brown grey / yellow brown / grey firm clay Accessory Materials: Silt, plastic, gravels Dry to moist, medium dense **Historic Landfill**	
	BOREHOLE TERMINATED Note: This bore was terminated still within the historic landfill profile	2.0

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 3

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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 3
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown silt	0		
	Accessory Materials: Gravels			
	Dry, medium dense	0.2		
FILL	Brown grey / orange brown / grey firm clay			
	Accessory Materials: Silt, plastic, gravels, copper			
	Dry to moist, medium dense			
	Historic Landfill			
	Note: Very Moist at the bottom of the borehole			
	BOREHOLE TERMINATED	3.0		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 4**
l Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 4 & 5
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown silt	0		
	Accessory Materials: Gravels, grass roots	0.1		
	Dry, medium dense			
FILL	Grey brown / orange brown / grey firm clay			
	Accessory Materials: Silt, plastic, gravels, glass			
	Dry to moist tending very moist, medium dense			
	Historic Landfill			
	BOREHOLE TERMINATED	2.0		
BH5				
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.1		
	Dry, medium dense			
FILL	Grey brown / orange brown / grey stiff clay			
	Accessory Materials: Silt, cloth, gravels, steel			
	Dry to moist, medium dense			
	Historic Landfill			
	BOREHOLE TERMINATED	**2.0**		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 5**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 6
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.1		
	Dry, medium dense			
FILL	Yellow brown / orange brown mottled red			
	stiff clay			
	Accessory Materials: Gravels, silt			
	Dry, medium dense	0.6		
	Likely Reworked Natural Material			
	(Capping Layer)			
FILL	Grey tending dark grey firm clay			
	Accessory Materials: Silt, plastic, glass, steel			
	Moist, medium dense			
	Historic Landfill			
	BOREHOLE TERMINATED	2.0		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 6**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 7
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Yellow brown silt	0		
	Accessory Materials: Silt, sand, tending clayey			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
	(Capping Layer)			
		2.2		
FILL	Dark grey brown firm clay			
	Accessory Materials: Silty, plastic, glass, steel,			
	brick fragments			
	Moist, medium dense			
	Historic Landfill			
	BOREHOLE TERMINATED	3.0		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 7**
l Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

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Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 8
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand			
	Dry, medium dense	0.15		
FILL	Yellow brown / orange brown mottled red			
	stiff clay / silt			
	Accessory Materials: Gravels			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
FILL / CLAY	Orange brown stiff clay	1.3		
(CH/CL)	stiff clay			
	Accessory Materials: Silty			
	Dry to moist, medium dense			
	Possibly Reworked Natural Material	1.7		
CLAY	Grey / orange brown			
(CH/CL)	Silty			
	Moist, stiff			
	Ironstone (Sub-angular) gravels present at deeper			
	depths including occasional grit and gravel			
	bands, variably ferruginous			
	Dargile Formation			
	BOREHOLE TERMINATED	3.0		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 8

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 9
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.1		
	Dry, medium dense			
FILL	Yellow brown / orange brown / grey mottled red			
	stiff clay / silt			
	Accessory Materials: Gravels			
	Dry to moist, medium dense			
	Note: tending to clay			
	Likely Reworked Natural Material			
FILL	Dark grey / orange brown firm clay	1.6		
	Accessory Materials: Silty			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
FILL	Dark brown / orange firm clay	2.3		
	Accessory Materials: Silty			
	Moist, medium dense, Note: Auger grabbing			
	Possibly Reworked Natural Material	2.6		
FILL / CLAY	Dark brown / orange / grey stiff clay			
(CH/CL)	Accessory Materials: Silty			
	Moist, medium dense			
	Possibly Reworked Natural Material	3.0	+	N = 3 / 5 / 6
CLAY	Grey / orange brown			
(CH/CL)	Silty			
	Moist, stiff			
	Dargile Formation	3.4		
	BOREHOLE TERMINATED			

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 9**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 10
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.05		
	Dry, medium dense			
FILL	Orange brown / grey stiff clay			
	Accessory Materials: Gravels, silty			
	Dry to moist, medium dense, **Likely Reworked**	1.0		
	Natural Material (Capping Layer) (0.05-1.0 m)			
FILL	Brown gravels / silt	1.4		
	Accessory Materials: Clay, plastic, brick fragments,	1.6	+	N = 3 / 3 / 4
	glass, steel			
	Dry to moist, medium dense			
	Historic Landfill (1.0-1.4 m)			
SILT	Pale grey			
(MH)	Clayey	2.5		
	Moist, loose to medium dense (1.4-1.6 m)			
CLAY	Dark Brown mottled orange /grey		+	N = 2 / 3 / 4
(CH/CL)	Silty			
	Moist, stiff (1.6-2.5 m)			
CLAY	Grey / orange brown			
(CH/CL)	Silty			
	Moist, stiff			
	Ironstones (Sub-angular) present and deeper		+	N = 4 / 6 / 7
	depths including occasional grit and gravel			
	bands, variably ferruginous			
	Dargile Formation			
			+	N = 5 / 9 / 10
	BOREHOLE TERMINATED	6.4		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 10

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 11
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.05		
	Dry, medium dense (0-0.05 m)	0.3		
FILL	Red mottled grey / brown orange stiff clay			
	Accessory Materials: Silty			
	Dry, medium dense, (0.05-0.3 m)			
FILL	Orange brown / grey stiff clay			
	Accessory Materials: Gravels, silty			
	Dry to moist, medium dense, **Likely Reworked**	1.6		
	Natural Material (Capping Layer) (0.3-1.6 m)			
FILL	Grey brown / orange brown / dark grey firm clay			
	Accessory Materials: Silt, plastic, gravels, glass			
	Moist, loose to medium dense			
	Historic Landfill (1.6-3.5 m)			
	Note: Silty Clay lenses			
CLAY	Orange brown /grey	3.5		
(CH/CL)	Silty			
	Moist, stiff			
			+	N = 4 / 6 / 7
CLAY	Grey / orange brown	5.0		
(CH/CL)	Silty, tending sandy			
	Moist, stiff			
	Ironstone (Sub-angular) gravels present at deeper depths including occasional grit and gravel bands, variably ferruginous		+	N = 6 / 7 / 9
	Dargile Formation			
	BOREHOLE TERMINATED	6.4		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 11

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 12
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.05		
	Dry, medium dense (0-0.05 m)			
FILL	Orange brown / grey stiff clay			
	Accessory Materials: Gravels, silty			
	Dry to moist, medium dense, **Likely Reworked**			
	Natural Material (Capping Layer)			
		1.7		
FILL	Dark Grey brown firm clay			
	Accessory Materials: Silt, plastic, gravels, sand			
	Moist, loose to medium dense			
	Historic Landfill			
CLAY	Grey / orange brown	4.0		
(CH/CL)	Silty			
	Moist, stiff			
	Ironstone (Sub-angular) gravels present at deeper		+	N = 4 / 6 / 8
	depths including occasional grit and gravel			
	bands, variably ferruginous			
	Dargile Formation			
			+	N = 11 / 13 / 14
	BOREHOLE TERMINATED	6.4		

+ Standard Penetration Test - N blows/150mm. incr.
I Undisturbed Sample - Diameter Stated
s Vane Shear Strength
p Pocket Penetrometer Resistance

c Apparent Cohesion
Ø Friction Angle
P Wet Density
w Moisture Content

L.L. Liquid Limit
P.L. Plastic Limit
P.I. Plasticity Index
L.S. Linear Shrinkage

Figure 12

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 13
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
FILL	Grey brown crushed rock	0		
	Accessory Materials: Silt, sand	0.05		
	Dry, medium dense (0-0.05 m)			
FILL	Orange brown / red / grey stiff clay			
	Accessory Materials: Trace gravels, silty			
	Dry to moist, medium dense, **Likely Reworked**			
	Natural Material	1.6		
FILL / CLAY	Orange brown /grey			
(CL / CH)	Silty			
	Moist, stiff			
	Possibly Reworked Natural Material	2.5		
			+	N = 7 / 9 / 12
CLAY	Grey / orange brown			
(CH/CL)	Silty, tending sandy			
	Moist, stiff			
	Ironstone (Sub-angular) gravels present at deeper			
	depths including occasional grit and gravel		+	N = 7 / 9 / 10
	bands, variably ferruginous			
	Dargile Formation			
			+	N = 9 / 12 / 22
	BOREHOLE TERMINATED	6.4		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 13**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 14
Job No. 115706 **Date:** Mar '14
Ground Water: Perched water table at approximately 3.0 m.

Soil Type	Description	Depth	Tests	Results
FILL	Orange brown silt	0		
	Accessory Materials: Gravels , clayey			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
	Note: Tending to silty clay			
FILL	Orange brown / grey stiff clay	1.4		
	Accessory Materials: Gravels , silty			
	Dry to moist, medium dense			
	Likely Reworked Natural Material			
	(Capping Layer)	1.8		
FILL	Grey brown firm clay			
	Accessory Materials: Silt, plastic, glass, steel			
	sand, sole of shoe			
	Moist, loose to medium dense			
	Historic Landfill			
		4.5		
CLAY	Orange /grey	4.6		
(CH / CL)	Silty			
	Moist, stiff			
	Dargile Formation			
	BOREHOLE TERMINATED			

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 14**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 15 & 16
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth			
BH15	**Grass Playing Surface**				
FILL	Brown Sand	0			
	Accessory Materials: silt, organics	0.1			
	Moist, Medium Dense (0 - 0.1 m)				
FILL	Brown Sand / Silt / Gravels	0.3			
	Moist, Medium Dense (0.1 - 0.3 m)				
					s > 140 kPa
CLAY	Orange / grey / red				
(CH / CL)	Silty				
	Moist, very stiff				
	Dargile Formation				s > 140 kPa
					s = 120 kPa
	BOREHOLE TERMINATED	2.0			
BH16	**Grass Playing Surface**				
FILL	Brown Sand	0			
	Accessory Materials: silt, organics	0.1			
	Moist, Medium Dense (0 - 0.1 m)				
FILL	Brown Sand / Silt / Gravels	0.3			
	Moist, Medium Dense (0.1 - 0.3 m)				
FILL	Orange brown / yellow brown silt				
	Accessory Materials: Clay				
	Dry to moist, medium dense, **Likely Reworked**				
	Natural Material				
		1.0			s = 114 kPa
CLAY	Orange /grey				
(CH / CL)	Silty				
	Moist, very stiff				s = 136 kPa
	Dargile Formation				
	BOREHOLE TERMINATED	2.0			

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 15**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 17 & 18
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
BH17	**Grass Playing Surface**			
FILL	Brown Sand	0		
	Accessory Materials: silt, organics	0.1		
	Moist, Medium Dense (0 - 0.1 m)			
FILL	Brown Sand / Silt / Gravels	0.3		
	Moist, Medium Dense (0.1 - 0.3 m)			
			.	s > 140 kPa
CLAY	Orange /grey			
(CH / CL)	Silty			
	Moist, very stiff			
	Dargile Formation		.	s > 140 kPa
		1.3		
SAND	Fine to Medoum Grained			
(SM)	Grey Brown / yellow brown mottled red		.	s > 140 kPa
	Silty			
	Moist			
	Dense			
	BOREHOLE TERMINATED	2.0		
BH18	**Grass Playing Surface**			
FILL	Brown Sand	0		
	Accessory Materials: silt, organics	0.1		
	Moist, Medium Dense (0 - 0.1 m)			
FILL	Brown Sand / Silt / Gravels	0.3		
	Moist, Medium Dense (0.1 - 0.3 m)			
FILL	Orange brown / yellow brown silt			
	Accessory Materials: Clay			
	Dry to moist, medium dense, **Likely Reworked**			
	Natural Material			
		1.3		
CLAY /	Orange / grey brown mottled red			
FILL	Silty		.	s = 102 kPa
(CH / CL)	Moist, stiff			
	Note: Possibly reworked Natural Materials			
	BOREHOLE TERMINATED	2.0		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 16**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

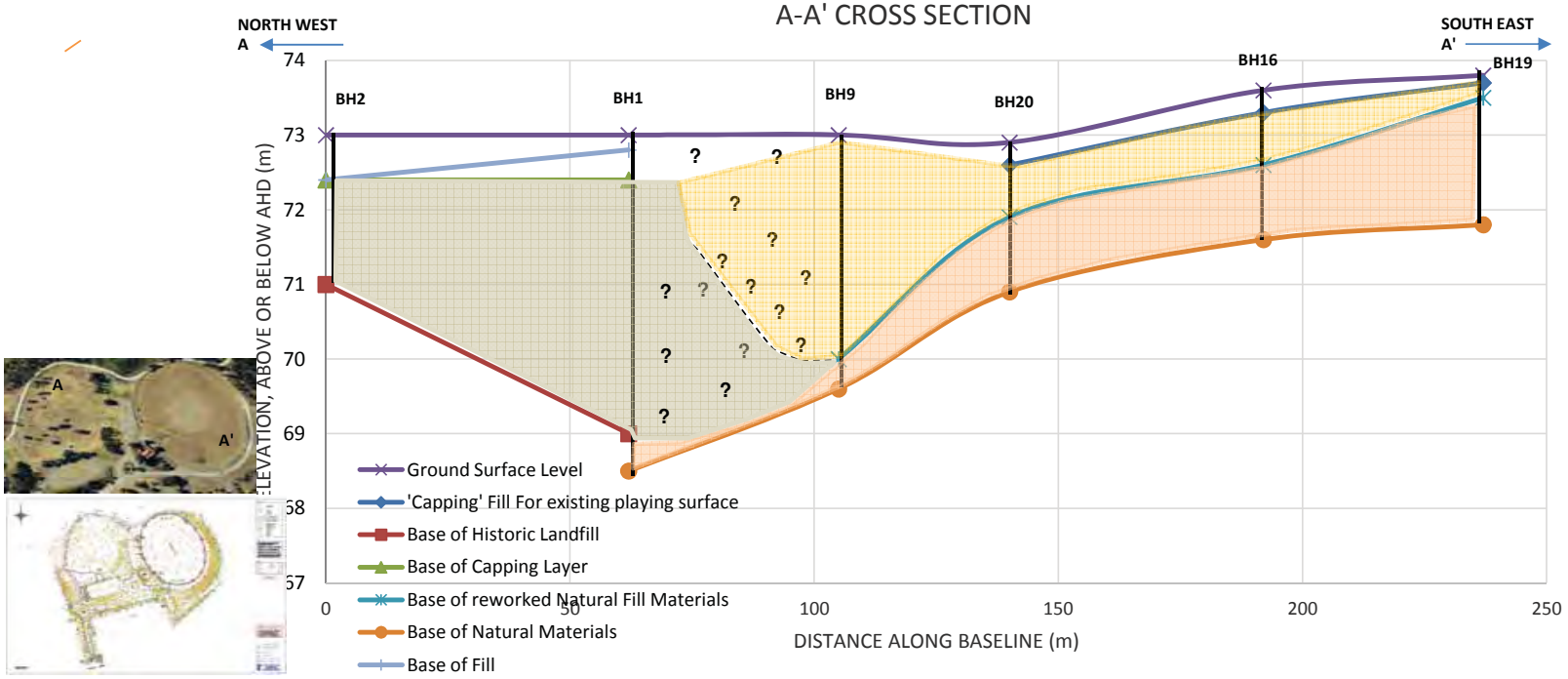
A.S.JAMES PTY. LTD.
Geotechnical Engineers

Location: PROPOSED EASTERN FOOTBALL HUB, WANTIRNA **Borehole:** 19 & 20
Job No. 115706 **Date:** Mar '14
Ground Water: NIL

Soil Type	Description	Depth	Tests	Results
BH19	**Grass Playing Surface**			
FILL	Brown Sand	0		
	Accessory Materials: silt, organics	0.1		
	Moist, Medium Dense (0 - 0.1 m)			
SILT	Grey brown containing trace gravels and sand	0.3		
(ML)	Moist, Medium Dense (0.1 - 0.3 m)			
			.	s > 140 kPa
CLAY	Grey Brown / orange brown / red at deeper depths			
(CH / CL)	Silty			
	Moist, very stiff			
	Dargile Formation		.	s = 130 kPa
			.	s = 140 kPa
	BOREHOLE TERMINATED	2.0		
BH20	**Grass Playing Surface**			
FILL	Brown Sand	0		
	Accessory Materials: silt, organics	0.1		
	Moist, Medium Dense (0 - 0.1 m)			
FILL	Brown Sand / Silt / Gravels	0.3		
	Moist, Medium Dense (0.1 - 0.3 m)			
FILL	Orange brown / grey brown stiff clay			
	Accessory Materials: Silt			
	Dry to moist, medium dense, **Likely Reworked**			
	Natural Material			
		1.0	.	s = 94 kPa
CLAY	Grey Brown / orange brown			
(CH / CL)	Silty			
	Moist, very stiff		.	s = 90 kPa
	Dargile Formation			
	BOREHOLE TERMINATED	2.0		

+ Standard Penetration Test - N blows/150mm. incr.	c Apparent Cohesion	L.L. Liquid Limit	**Figure 17**
I Undisturbed Sample - Diameter Stated	Ø Friction Angle	P.L. Plastic Limit	
s Vane Shear Strength	P Wet Density	P.I. Plasticity Index	
p Pocket Penetrometer Resistance	w Moisture Content	L.S. Linear Shrinkage	

A-A' CROSS SECTION



Surveyed Map Provided by InsideEDGE Sport and Leisure

A.S. JAMES PTY LTD
Geotechnical Engineers

JOB: PROPOSED EASTERN FOOTBALL HUB
WANTIRNA

JOB No: 115706 **DATE: Mar ' 14**

LEGEND FOR LITHOLOGY . *It is emphasised this cross section only represents those depths investigated*

- Fill — **Historic Landfill**
- Fill — **Reworked Natural Materials**
- CH/CL — **Dargile Formation**
- ------ *Inferred Depth of profiles.*

CHECKED: T. HOLT
DRAWN: J. HOLT

CROSS SECTION A-A'

Note: Distance Along Baseline Measurements Approximate, depths approximate and strat in between boreholes is inferred

A3

SOURCE: Surveyed Drawings provided by InsideEDGE Sport and Leisure Planning Survey done by A Line Surveying, Sub-surface information from A.S.James borelogs

FIGURE 18

D R A F T

Appendix G

Site Visits, Landfill Gas and Personal Recounts

AECOM

ANZ

FQM - Landfill Services and Utilities Surveys Data Sheet

Q4AN(EV)-702-FM1

Project Name:	Wantirna Reserve	**Project Number:**	60548185
Project Location:	Wantirna Reserve	**Client:**	KCC
PM Name:	WD	**Date:**	7/08/2019
Monitoring Instrument and Serial Number:	Inspectra Laser - 1215	**Fieldwork Staff:**	VL

Field Data

Point ID	Easting	Northing	CH4 (ppmv)	Comments/ Features
Ambient Air			**1.3-1.5**	**Taken in Carpark**
10			1.8	Carpark Drain
9			2-2.4	Carpark Drain
17			1.6	Entrance Road - pit
32			1.6	Entrance Road - pit
33			4.6	Entrance Road - pit
6			1.5-1.6	Telstra Pit
7			3.9	Drain
18			1.6	Pole
20			1.6	Flag Pole
34			1.5	Utility Pit
29			1.6	Building - Scout Hall underfloor vents
22			1.7	Pole
5			1.7	Triangular Drain - East
3			1.7	Triangular Drain - West
35			1.8	Electrical Box
16			1.6	Utility Pit/Drain
21			1.9	Light Pole
31			1.6-1.8	Building - Cricket Pavillion underfloor vents, drainpipes, etc
8			1.7	Stormwater Drain
4			1.7	Utility Pit
1			1.8	Drain
2			1.6	Drain
36			1.4	Sign Post
12			1.5	Drain
28			1.1	Sign Post
27			0.7	Sign Post
19			0.7	Water Tap
23			0.7	Sign Post
26			0.8	Sign Post
37			1.4	Old Oval Pole
25			1.3	Sign Post
13			1.4	Drain
14			1.4	Drain

AECOM

ANZ

FQM - Landfill Cap Surveys Data Sheet

Q4AN(EV)-702-FM1

Project Name:	Wantirna Reserve	**Project Number:**	60548185
Project Location:	Wantirna Reserve	**Client:**	KCC
PM Name:	WD	**Date:**	7/08/2019
Monitoring Instrument and Serial Number:	Inspectra Laser - 1215	**Fieldwork Staff:**	VL

Field Data

Point ID	Easting	Northing	CH4 (ppmv)	Comments/ Features
Ambient Air			**1.3-1.5**	**Taken in Carpark**
Carpark Western Posts			1.3-1.4	Exposed posts
Carpark West of Drains			1.2-1.5	Exposed posts
Carpark Eastern Posts			1.2-1.6	Exposed posts
Roundabout Posts			1.3-1.5	
Concrete Slab			1.5	
Roundabout SW Gate			1.3	
SW Drain with trench			1.5	
Roundabout South Posts			1.3-1.6	
Roundabout South Track			1.4-1.6	
Roundabout Southeast Subsidence in Asphalt			1.7-1.8	
Roundabout inner circle and adjacent Cracks in Asphalt			1.5-1.6	
Entrance road poles along western boundary			1.5-1.6	
Tennis Club Carpark Drainage Pit			1.6	
Tennis Club Drain under entrance			1.6	
Tennis Club Western Side Fence			1.5-1.6	
Main Roundabout sign poles			1.4-1.6	
Posts on road to Scout Hall			1.5-1.6	
Scout Hall Carpark Pole			1.5	Opposite Playground
Northwest Carpark Posts			1.6-1.8	
Short yellowing grass South of NW Carpark			1.6-1.8	May be due to short mowing
Cricket Cages			1.6-1.9	Posts and cracks in concrete and concrete slab edges
Park Sign near cages			1.6	
Concrete Path edge north of Batting Cages			1.6-1.9	
Posts near 2 and 12			1.5	
Cut Grass walkway between 19 and 11 in grassed area north of carpark			0.8-1.4	
Gravel in carpark			1.3	
Path east west direction north of			1.2-1.3	

Equipment Calibration Check
Inspectra Laser

enqip

Enqip #: 9718
Company: AECOM Australia Pty Ltd
Consultant: Vera Levina
PO #: 60548185 task 2.2
Certificate #: 13594

UNIT IDENTIFICATION

Model Number: Inspectra Laser
Serial Number: CH48921215
Unit Type: Methane Analyser

INSPECTION RECORD/CONDITION REPORT

Flow Rate: PASS
Alarms: PASS

CALIBRATION DETAILS

Gas	Reading	Traceability Lot #
Nitrogen UHP	1.3 ppm	1068301
Methane 100 ppm	96.6 ppm	1009971
Methane 2.5 %	2.4 %	977870

Calibration Successful: YES

Calibrated By: Doyle Schapendonk

Test Date: 6/08/2019

enqip
423 City Road, South Melbourne 3205
P 1300 218 987
E info@enqip.com.au | W www.enqip.com.au

Interview Questions – Wantirna Reserve
Date: 22/07/19

AECOM Imagine it. Delivered

Present: Breana McCartney
Marissa France (KCC)
Nicole (KCC)

Name Darryl Barrett & Alison Rogers (AR)

Position Tennis Club council contacts.

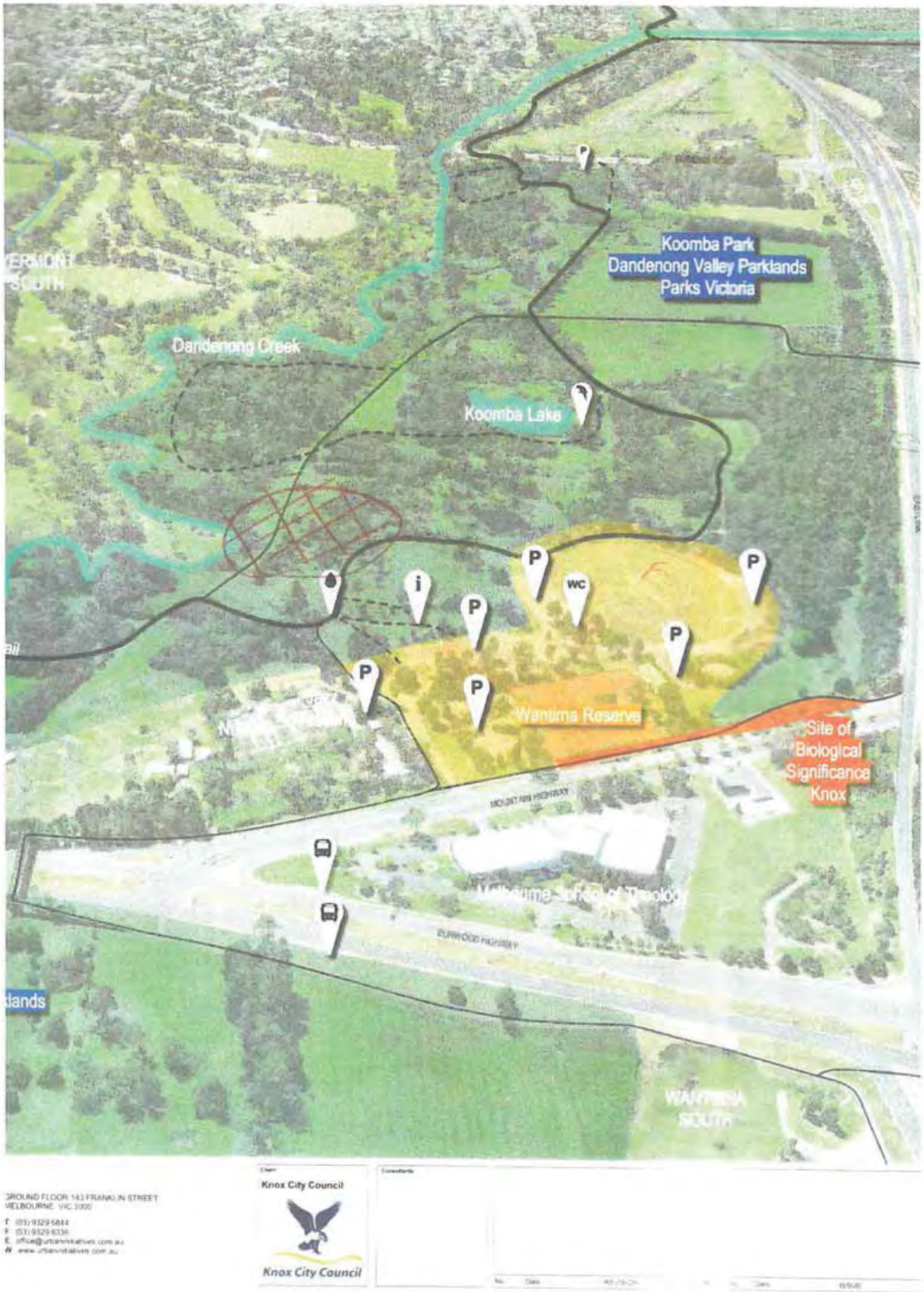
Period involved a club/site: 1980 - current

What development have you observed over this time at the landfilled site – two separate areas on maps? AR: Only remember area north of clubs. It was a household waste dump, where people drive up with personal trailers, then developed later - thought 1980s on into oval.
Do you have any old photos? None.
How did they land fill – was there an old pit, a depression or a trench and fill, straight onto the surface. Unsure, think probably straight onto the surface DB: said must have closed prior to 70's as Cathies Lane & an old dam elsewhere were used.
How thick the waste was? unknown.
What use was the site before landfilling began? Orchards all through area - adjacent too. Small dams in area too.
Who developed the landfill - private developers or council operated? AR: unsure, possibly council. likely private land filled in by opportunists.
What types of waste were brought in (municipal, building material, etc?) liquid/solid waste. AR: Municipal waste typical of semirural area, eg orchard waste. Everyone had incinerators in area for most waste. DB: Local farming tip - metal scavengers for scrapmetal, etc. likely.
Was the waste odourous? AR: No, old ladies at tennis club always remarked there was no smell.
How frequently was waste disposed of here? AR: Not extremely busy, would have been come & go, so not much. No trucks ever seen so only locals.
Did they cap the waste? Where did the material come from? AR: They did bring material in when developing the oval, unsure what.

Interview Questions – Wantirna Reserve
Date:

AECOM Imagine it. Delivered.

What were the stormwater pond and private ponds as marked on the maps used for? Potentially for orchard area.
Redevelopment of tip into oval in ~1975– when and by who? Unsure.
What happened during construction of additional tennis courts #6-10 – some settlement? Fill brought in for development - Cts 9-10 were filled up to 0.7m in northern corner. Ct 9 settlement but foundations of net fence not subsiding.
Could you outline on the map where you think waste was placed and extent of landfilled area north of tennis club? Knox map.
Other comments Background: ALison lived in area from 1980 - present, but did spend time on friends' properties here prior. Remembers the tip being there and some development of the oval after. MF: council discussions with roundabout developers from 1980's - encountered 1000's tanbetts & liquid.


Koomba Park
Dandenong Valley Parklands
Parks Victoria
Dandenong Creek
Koomba Lake
WC
Wantima Reserve
Site of
Biological
Significance
Knox
EASTLINK
EUROWOOD HIGHWAY
Knox City Council
Knox City Council

From: Marissa France <Marissa.France@knox.vic.gov.au>
Sent: Wednesday, 24 July 2019 10:23 AM
To: McCartney, Breana
Cc: Levina, Vera
Subject: RE: Wantirna Reserve information

Hi Breana,

Nice to meet you too (finally)!

So I have found a font of knowledge on the waste collection front, one of our contractors Richard Lever. He has advised that in Knox from pre 1950s to approx. 1968 waste collection was carried by a contractor (Cook), and you use to put the bin out with a coin under the bin (as a way to pay for the service). In 1968 a company called Vantiller and Scott collected in the area until approx. 1975 when Cleanaway started. As the area was mostly orchards there was not a large domestic collection service. Richard said he thought the name of the access road to the old tip was Koomba Road, and that from about 1975 onwards people did refer to the area as the old tip but there definitely was signage on the old access road in the mid 1970s. (He does not recall the tip being there as it was before his time, but that people did definitely refer to it as the old tip and that Vantiller did tip waste there).

Thanks

Marissa France | Waste Management Engineer
+61 3 9298 8234

511 Burwood Highway
Wantirna South
Victoria 3152
Knox.vic.gov.au

knox your city

Knox City Council

From: Marissa France <Marissa.France@knox.vic.gov.au>
Sent: Tuesday, 23 July 2019 4:43 PM
To: McCartney, Breana <Breana.McCartney@aecom.com>
Cc: Levina, Vera <vera.levina@aecom.com>
Subject: Wantirna Reserve information

Hi Breana,

Thank you for meeting with us out on-site yesterday.

As a follow up I have been provided with, and attempted to make contact with some members from the football club and cricket clubs. Once I make contact I will provide you with responses.

Also as we had discussed there is a member of staff here who worked on the installation of the access roads and carparks at Wantirna Reserve. He recalls that the internal road waste OK, up until the roundabout. He said once they got to putting in the round about they had excavated to about 0.5m depth and found thousands of rubber fan felts mixed with liquid. He said he cannot remember anything else.

I have uncovered a couple of other emails with some history .

Attached is a plan dated 1965 that shows the existing oval just north of the first lot of tennis courts and a pavilion (as the pre 1970 aerials had shown). It also shows an open channel in the approx. location of where the round about may have ended up. (Map M605 (1)).

A contour map with existing site conditions in 1979

The oval and pavilion (in the location where the landfill was) became settled and uneven and ceased being used as a sporting field in 1989. It was converted by Parks Vic to a picnic shelter and was later demolished due to significant movement. (Believe this aerial is from 1996).

Still searching for any more informtion.

Thanks

Marissa France | Waste Management Engineer
+61 3 9298 8234

511 Burwood Highway
Wantirna South
Victoria 3152
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McCartney, Breana

From: Marissa France <Marissa.France@knox.vic.gov.au>
Sent: Tuesday, 30 July 2019 12:17 PM
To: McCartney, Breana; Levina, Vera
Subject: Information - Wantirna Reserve

Hi Breana and Vera

Just spoke with a man called Bernie (Whitney?) who has played cricket at the site since the late 1960's, and before I forget here is a dot point of his recollections:

- Original cricket ground in the 'pre 1970 field location'
- A landfill was located just to the north of that ground (in the 1975-1991 oval location)
- On hot days there was a strong smell from the landfill
- It was a Council tip, but people could drive in with trailers if they wanted. It was fairly open.
- The oval then moved to the area where the landfill was. Council was going to put turf on the oval, but members didn't want it so the ovals were top dressed
- If any work was done on the ground they would be pulling out paper and rubbish
- The ground ended up settling 'like a potato chip'
- Recalls stormwater pond to the NE of the oval
- Does not recall the private pond further to the west
- He recalls a deep guttering of the main drive (the drive to the tip), and there would be a lot of water in it when it rained.

He is going to pass my contact details onto another lady, and if she thinks she has any information of worth she will give me a call.

Thanks

Marissa France | Waste Management Engineer
+61 3 9298 8234

511 Burwood Highway
Wantirna South
Victoria 3152
Knox.vic.gov.au

WANTIRNA TENNIS CLUB - COURTS & GROUNDS WORKS DETAILS FOR KNOX CITY COUNCIL MAY, 2019

BACKGROUND

At a meeting between Knox City Council and Wantirna Tennis Club representatives, it was decided that we would search our records and interview older members in an attempt to provide details including timelines of ground works (within the Tennis club's area) including:

- Dates when courts were installed,
- Dates when other major construction occurred including light towers etc.,
- Other significant developments occurred, and
- Identification of the (now disused) rubbish tip boundaries.

EXECUTIVE SUMMARY

1. Ground movements within the Tennis court grounds have been minimal for the past 40 plus years and explainable.
2. The previous rubbish tip was nowhere near the Tennis club for at least 60 plus years.

SUMMARY OF FINDINGS FOLLOWING DISCUSSIONS WITH MEMBERS AND A SEARCH OF OUR RECORDS.

- The club was established on the present site in 1934.
- One of our club members played at the club when she was 11 years old (63 years ago) and is willing to identify the site of the tip which was and as quoted "nowhere near the Tennis courts". There are also other older members that can be interviewed.

DEVELOPMENTS	COMMENTS – (re ground stability & evidence of a rubbish tip within tennis club perimeter)
1935 CLUB ESTABLISHED	The original courts, (Bitumen 1) and then sand 2 were located in the south east corner of the existing site. This is the site of courts 1, 2 & 3. (refer map) The ground has always been stable & no remedial works undertaken
Developments though to the late 1960's saw the progressive installation of 5 en tout cas courts along Mountain Highway.	A search of records & member feedback indicates that not one of these courts have ever had a "complete" rebuild, ie. only refurbishments have been undertaken, the last of which was approximately 25 years ago. Hence evidence is that the ground is stable & we believe that there is no reason to believe that the rubbish tip extended to this area. (Note: some of these courts are constructed using coke (ie. a coal derivative) as part of their drainage/foundation. As we know, coke has not been available in Melbourne since the early 1960's.

Construction of the present new club house in 1980	No evidence of building cracks or unstable ground exists
1975. 2 new courts (6 & 7) were constructed in north east corner of site	These courts have never been reconstructed nor refurbished. They have been maintained by club members/working bees. There have never been any ground movement issues.
In 1987 the existing court 8 was constructed.	This court has never been reconstructed nor refurbished. It has been maintained by club members/working bees. The only ground movement that has occurred (north eastern corner along the fence is believed to have been caused/influenced by inadequate precautions and ramifications during the construction of the sewerage line (to/from the Scout Hall) to the north of the boundary fence, and potentially the partial collapse of a surface drain near fence.
In 1993 Lights were installed on courts 1,6,7,8.	During this process, a member has identified that when the foundations were bored for the light tower on the northern boundary of court 8, rubbish/debris was encountered at approx. 2 meters deep. An inspection will reveal that this light tower & immediate area has been stable since then. No such debris was encountered when the foundations for the other light towers were bored.
In 1994 Courts 9 & 10 were constructed.	These courts were built over an area used as a car park, with considerable "fill" being added as part of the 'court construction processes. Court 10 is very stable has never been reconstructed nor refurbished. It has been maintained by club members/working bees and no ground movements/issues encountered. Court 9 however, has encountered, ground movement during/post the recent drought on the northern end. A visual inspection of the area will readily reveal: o At ground level there has been some (probable 120mm) sink age at both sides of the court. o The fence set in concrete foundations (approx.) .5 meter deep, has NOT sunk or moved. From these observations, we are of the opinion that the ground (court surface) "problems" in this immediate area (which we have not very successfully tried to rectify ourselves) were probably caused by settling of added fill during the court construction, or the collapse of installed court drainage and/or drought issues, &/or issues with the construction of the sewerage drain in approximately the late 1980's or early 1990's.

Daryl.

Brief history. - Wandirna Reserve was originally owned by J Biscoff & ~~Joes~~ Joseph Smith in 1858. Later Robert Triall Berwick Councillor owned part of the holding on which the Wandirna Recreation Reserve now stands. The area was proclaimed a Reserve in 1925 and the Council provided land for a Tennis Court which was built shortly after.

Wandirna Club commenced in 1934

1959 First en-tout-cas courts installed (Sand previously)
Shows how long lasting en-tout cas is

1952 3rd court built
1956 New pavilion built (not the present one)
1959 Court 4 build
1961 New courts opened (Councillors attended)
1975 More courts built

* April 1982 M.M.B.W (South Coast Water) announces take over of lease for the area from Knox Council as of Aug 86.

1986 Court 8 built
1991 Renovations to Clubhouse (Moving of Entry to clubhouse)
1993 Court lighting to Courts 1, 6, 7, & 8.
1994 Courts 9 & 10 built
Built on old carpark

1991 Pergola added to pavilion
1993 New playground installed
Council $5000-00 Club $2000-00
Thanks to Councillors Ken Mc Bride & Marie Wallace.
Council Bruce Mc Cartney (Facilities)
John Daly & Ian Bell.
Borders and soft play installed by Club.
1994 Courts 9 & 10 built.
1994 New carpark completed.
1993 Light towers 6, 7 & 8 installed

1993. New carpark started.
* Council supplied car park plans including landscaping plans and species of plants to be planted.
Council supplied sleeper edging and crushed rock
Club supplied retaining wall rocks and plants for garden beds
Club ~~did~~ also supplied the machinery to build garden beds and retaining walls, including the spreading of crushed rock to carpark.
Club supplied and fitted all signs and posts including centre bollards
Club also obtained quotations for the kerb & chanel and asphalting of carpark for Council.

This carpark was to be only a tempory design until Council built an asphalt car park with kerb and chanel This is why they would only do the design and plans and for the Club to do all other work so we could have a proper parking area, after loosing our existing gravel carpark where courts 9 & 10 now stand.

1997 Major Clubhouse extension and upgrade to Tennis Victoria standard.

20xx? Rainwater tanks and sprinkler system.

GH.