Hobart Stadium Site Options

Pre-Feasibility Study for Regatta Point and Macquarie Point Sites

Australian Football League and State Growth Tasmania

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Document control record

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Executive Summary

Following an earlier study into three potential sites for the proposed Hobart Stadium, Aurecon has been commissioned by the Australian Football League (AFL) to provide further information to aid in a more detailed assessment of two of these sites, namely Regatta Point and Macquarie Point.

Our primary assessment is to focus on the below-ground technical issues that are particular to each individual site. It is envisaged that the above-ground stadium would be similar for each site. The aim of this investigation is therefore to identify the technical issues that are unique to each of these sites, so that indicative costs associated with these issues can be determined for the purposes of comparison. To allow an assessment of the inground works, an assumed stadium configuration has been used. An architectural design for the stadium has not commenced, so this study is based on reference projects such as Marvel Stadium in Melbourne, and Metricon Stadium in Queensland but with a reduced grandstand size based on a seating capacity of around 23,000 seats. In the GA zones a grandstand arrangement similar to Metricon Stadium has been adopted, which accesses the lower tier from a raised concourse, and from which the upper tier is accessed via stairs.

A number of key criteria were identified to enable a comparison of the sites to be made. These are described in the body of the report, but have been summarised below for ease of reference.

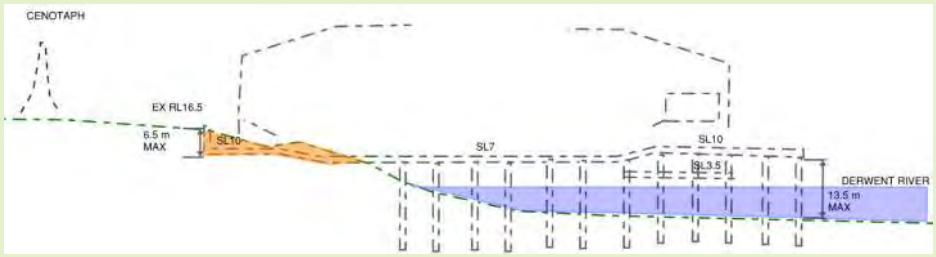
Commentary on the merits of fixed roof vs an operable roof is provided in Section 4.1. Some commentary around the sensitivity of the figures with respect to roof type, façade type, and relative areas of GA vs Operational zones is provided in Section 12.

A pictorial summary for the two sites is also included in Figure 14-1 and Figure 14-2.

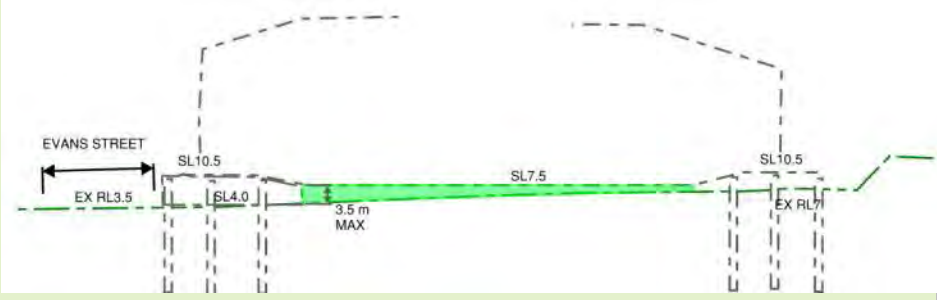
The arrival and departure of over 20,000 people to the events at the stadium will challenge the existing transport infrastructure. Whilst not within the scope of this study, we have included a section that discusses some of the issues that will need to be addressed. This is presented in a graphical format by considering a “Journey Map” for different people within the community that will attend the stadium. Should the stadium development proceed, State Growth Tasmania will need to consider the improvements that may need to be made to the existing transport infrastructure. In Section 13 we have also referenced potential development opportunities a stadium in Hobart would afford the surrounding precinct.

Regatta Point Site

ISSUE	SECTION OF REPORT	DESCRIPTION
Stadium Alignment	1.0	At around 45degrees from the preferred north-south orientation. This is driven by the alignment of the existing Regatta Point shoreline.
Topography	3.1.2	The site topography varies between RL17 and RL3.5. The site falls by more than 13m from the Hobart Cenotaph end towards the Derwent River.
Geotechnical	3.3	Expected to be predominantly natural material, with Dolerite rock at an average depth of around 5m. The max depth of water is expected to be 10m, with sediments at the base of the river, above the clay and Dolerite rock.

Typical arrangement on site	5.1	At the high side (Cenotaph side) the stadium would be set down with a batter where possible and with a retaining wall at the narrowest section. The pitch will be mostly suspended on piles, apart from the end nearest to the Cenotaph. Access for servicing the facility and the location of all the back-of-house areas of the building will need to be from this “land side”, which generates the need for further excavation on the high side compared to the other sites. 
Bulk Earthworks	6.1	Requires around 14,000m^3 of cut into material that is expected to be mostly clean. Minimal fill required.
Site Vehicle Access	6.2	Access road to be created from north. Around 1,200m^2 of new pavement and a retaining wall required.
Potable Water	7.2	Will require a new 150mm water main from the 250mm water main off Tasman Highway. This main could extent to the existing 150mm water main to form a ring main providing additional supply resilience.
Sewer	7.3	May require diversion of an existing 150mm sewer line and if to be used for the stadium upgraded to a new 225mm line discharging close to the Sewerage Treatment Plant in a branch line pit.
Gas	7.4	Extend the existing 63mm line which is currently close to the site and a metered takeoff from this new pipe.
Electrical	7.5	Will require two supply authority substations fed from a new 11kV feed from the nearest zone substation. This site will also require relocation of an existing 11kV feeder.
Stormwater	7.7	New Gross Pollutant Trap to protect Derwent River from solids. New 1100m^2 bioretention basin to treat water quality from stadium. New 30m long 450mm pipe to discharge to basin.
Pitch Structure	8.2	Predominantly suspended on piles
Foundations	8.2	Pad Footings over approximately a quarter of the site, For the piles required for the remainder of the project, approx 25% will be around 15m long and 75% will be around 27m long. Additional retaining wall required on Cenotaph side.
“Found Space”	9.0	A total of 14,000m^2 of back-of-house area has been identified and standardised across both sites. This will need to be tested against the requirements of the project, but may generate in the order of 40 car spaces.
Perimeter Concourse	10.0	An external concourse of 10m width has been allowed to the full perimeter. This is located at the same level as the internal concourse, which is about 3metres above the pitch.
Plaza/ Meeting Place	11.1	3,600m^2, suspended over water on river side.

Macquarie Point Site

ISSUE	SECTION OF REPORT	DESCRIPTION
Stadium Alignment	1.0	Site allows alignment in the preferred north-south orientation
Topography	3.2.2	The site topography varies between RL8 and RL3.5. The site is relatively flat with a fall of 4m from the Hobart Cenotaph towards Evans Street.
Geotechnical	3.3	Expected to be predominantly mine tailings and fill, with Dolerite at depth. The Macquarie Point Development Corporation has undertaken remediation of the site to treat the known contamination that has been present on this site.
Typical arrangement on site	5.2	The modest cross fall on this site enables the pitch to be generally on-grade, or on engineered fill. An aim of the design is to limit the amount of excavation due to the potential for further contamination to be encountered. 
Bulk Earthworks	6.1	Due to the potential for contamination to be encountered, the design requires minimal cut on site. As the pitch will be built up above the existing surface, requires 23,000m^3 of fill
Site Vehicle Access	6.2	Realignment of the road on the northern side is expected to be required to fit the stadium on this site. 400m^2 of new pavement required.
Potable Water	7.2	New tapping into existing 250mm watermain on Davey Street which is part of ring main.
Sewer	7.3	A new branch line pit to be constructed over the existing 450mm pipe.
Gas	7.4	Install a new metered take off line from the 90mm supply on Evans Street.
Electrical	7.5	Will require two supply authority substations from a new 11kV from the nearest zone substation. This will require boring under Evans St.
Stormwater	7.7	New 45m long 525mm RCP to for major flow discharge to existing asset. New gross pollutant trap to protect Derwent River from solids. New 1100m^2 bioretention basin to treat water quality from stadium. New 30m long 450mm to discharge to basin. New 25 long 525mm pipe to discharge major flow to existing asset.
Pitch structure	8.3	On engineered fill.
Foundations	8.3	Piles of approx 20m length across whole site. A retaining wall will be required around most of the perimeter of the pitch.
“Found Space”	9.0	A total of 14,000m^2 of back-of-house area has been identified and standardised across both sites. This will need to be tested against the requirements of the project, but may generate in the order of 40 car spaces.
Perimeter Concourse	10.0	An external concourse of 10m width has been allowed to the full perimeter. This is located at the same level as the internal concourse, which is about 3metres above the pitch.
Plaza/ Meeting Place	11.2	3,600m^2, located on grade at Evans St end.

1 Introduction

Aurecon was commissioned by the Australian Football League (AFL) to aid in the assessment of three potential sites for the proposed Hobart Stadium. The sites investigated in the original study were Lower Domain Road, Regatta Point and Macquarie Point. Subsequent to the completion of our initial assessment, the decision has been made to eliminate the Lower Domain Road site as a viable option, and to delve more deeply into the other two sites. This report builds upon the previous study of the Regatta Point and Macquarie Point sites, but provides more detail. It is intended as a standalone report, bringing forward the relevant information from our initial study, such that reference to our previous report is not required. The main changes we have made since issuing our previous report are as follows:

- A focus on 2 sites only – Regatta Point and Macquarie Point
- The stadium on each site has been rotated to better suit a north-south orientation
- An external perimeter concourse has been added to both sites for costing purposes
- Considerations have been added if the stadium were to include a permanent ETFE roof

The report provides:

- A description of the site and key characteristics
- A review of existing and future infrastructure services available in the surrounding area
- An assessment of existing infrastructure requirements to serve a proposed Stadium
- A description of a generic stadium that has been applied to each of the sites for the purpose of this report (only)
- An indicative structural design of the sub-structure to suit the respective sites.

The location of the two studied sites is shown in Figure 1-1.

Figure 1-1 – Site Locality

2 Review Assumptions

This report has been prepared in response to a request from AFL for Aurecon to further investigate the relative merits of two possible sites for a stadium in Hobart, focussing primarily on the below-ground technical issues that are particular to each individual site. It is envisaged that the above-ground stadium would be similar for each site. The aim of this investigation is therefore to identify the technical issues that are unique to each of these sites, so that indicative costs associated with these issues can be determined for the purposes of comparison.

An architectural design for the stadium has not been made available to date, so this study is based on reference projects such as Marvel Stadium in Melbourne, and Metricon Stadium in Queensland but with a reduced grandstand size based on a seating capacity of around 23,000 seats. The assumed footprint will serve the purposes of this comparison exercise, however will likely need to be refined in future stages of design to further consider spatial requirements for concourses, food and beverage outlets, broadcast media, corporate and function areas, changerooms, BOH areas, vehicular servicing arrangements, etc.

For the purposes of this report, we have divided the stadium into 2 zones, General Admission (GA) and Operational. For the purposes of this report, the footprint of the GA zone is assumed to be approximately 60% and Operational is 40%. It is assumed that the Operational portion of stadium is located on the “low” side of the site to make use of the available space for support and back-of-house areas including kitchens, deliveries, team drop-off, player change rooms, media facilities, etc.

The stadium orientation assumed in this study has the field generally in a north-south orientation. This is because if a fixed ETFE roof is adopted the stadium will require this orientation to optimise the sunlight onto the natural turf. For Regatta Point it is awkward to orient the stadium in a true north direction, so it has been placed as best as possible.

A roof height above the playing surface of at least 37m has been adopted, which provides the same “high ball” line above the pitch as Marvel Stadium. The roof height is also driven by the need for the sports lights to be located below the roof line at suitable height that achieves broadcast illuminance requirements whilst minimising glare to players and spectators. Without a specific sports lighting design, we have adopted a similar height to Marvel Stadium.

Note that due to the confidential nature of this investigation, Aurecon were not able to engage freely with other consultants, utility service providers and other authorities who may have been able to provide more detailed information than what we were able to source as part of this desktop assessment. On this basis, this report is indicative in nature and does not provide comprehensive details of all the technical issues across the two sites.

3 Site Information

3.1 Regatta Point

3.1.1 Location

The property title information is as follows:

Cenotaph & Regatta Grounds Queens Domain - CT1350

South Line McVilly Drive CT179192/4

Crown Land – foreshore apron – historic title

Owner(s):

People of Hobart managed by the City of Hobart

TasRail

Crown Land Services DPIPWE

This site comprises several parcels of land, including reclaimed land. The site has for many years been the site of the historic Hobart Regatta held each February. The Regatta Pavilion holds historic memories but is not heritage listed. The Cenotaph, Anzac Parade and the Queen's Battery are all permanently registered.

The site includes the flat waterfront apron rising up the headland on which the Cenotaph is placed and is bounded to the north-west by Tasports slipway and HMAS Huon facilities; to the north-east by the River Derwent; the south-east by the Taswater Sewage Treatment Plant, Macquarie Point and Tasports Hunter Street port workings; and to the south-west by the Cenotaph parklands.

The site can be accessed via McVilly Drive off the Tasman Highway.

3.1.2 Topography

The site topography varies between RL16.5 and RL3.5. The site falls approximately 13m from the Hobart Cenotaph towards the Derwent River. An illustration of the relative levels (RL) is shown in Figure 3-1.

Figure 3-1 – Regatta Point Topography Heat Map

3.2 Macquarie Point

3.2.1 Location

The property title information is as follows:

10 Evans Street CT179192/3

Owner: Macquarie Point Development Corporation

The Macquarie Point site comprising 9.3 hectares is largely located on reclaimed land within the Hobart port area. The site and surrounding area have a history of mixed industrial use, including the former Hobart Gasworks, Taswater sewage works, rail freight, and bulk fuel storage.

The Macquarie Point Development Corporation was created by the Tasmanian Government to remediate and develop the site, and there are several development plans for the site.

The site can be considered relatively flat and is bounded by the Cenotaph parklands to the north, Tasports operations to the east, Evan Street to the south and the Tasman Highway/ Davey Street to the west.

3.2.2 Topography

The site topography varies between RL7.5 and RL3.5. The site is relatively flat with a fall of 4m from the Hobart Cenotaph towards Evans Street. A heat map of the relative levels (RL) is shown in Figure 3-2.

Figure 3-2 – Macquarie Point Topography Heat Map

3.3 Geotechnical Conditions

The general geology of Hobart is covered in the following diagram published by the Tasmanian Government:

Figure 3-3 – Hobart Geology Map

This is consistent with anecdotal evidence Aurecon has been able to obtain from other sources. Dolerite is an igneous rock that is seen across many sites in Tasmania. The sound (solid) rock is often overlain by completely weathered dolerite (clay in layman's terms). This is the general geology expected at Regatta Point. In the river adjacent to the Regatta Point site it is expected that a layer of estuarine/marine deposits will exist over the weathered dolerite and dolerite bedrock.

For the Macquarie Point site the Hobart Geology map indicates mine tailings and fill. This is consistent with reports sourced from the Macquarie Point Development Corporation.

4 Assumed Stadium Configuration

To enable this desktop pre-feasibility study to be undertaken some assumptions have been made on the configuration of the stadium. These will need to be tested in the feasibility/ concept phase of the project. These issues include the following.

4.1 Roof Typology

To enable a natural turf pitch to be used in the stadium, sunlight will need to reach the pitch surface. This can be achieved by providing an operable roof, or by providing a light-penetrating roof material such as ETFE. Each of these two roof types have advantages and disadvantages as listed below. For the purposes of this report, in the time available, we have assumed an operable roof similar to that on Marvel Stadium. However should an ETFE fixed roof be preferred, the cost of the structure as presented in this report will still be representative for that type of roof. We have aligned the stadium on both sites to optimise (as best as possible) a north-facing orientation to maximise the sunlight onto the pitch should an ETFE roof be adopted.

4.1.1 Operable Roof Systems

Operable roofs have been designed by Aurecon at all of the major venues across Australia – Marvel Stadium, John Cain Arena, Perth Arena, Margaret Court Arena, and the recent upgrade to Rod Laver Arena. We also designed the roof for Wembley Stadium in the UK. The main attributes of operable solid roof systems can be summarised as follows: -

Positive attributes:-

- Ability to be able to incorporate heavy acoustic insulation. Acoustic insulation is used at many of the major arenas worldwide to restrict noise break-out, allowing them to host major concert events.
- Ability to be able to incorporate thermal insulation.
- Design can be readily adapted to incorporate provision for hanging loads at multiple locations across the arena.
- Catwalks and walkways are less noticeable, and these can be loaded with both permanent and temporary equipment (lights, speakers, theatrical items, etc) without potentially affecting the broadcasting of events (shadows) or the ambiance of the space.
- Doesn’t typically require specialist contractors to fabricate and install the roofing components.
- The roofing consists of known technologies, so contractors are less likely to allocate risk contingency to pricing.
- Lifecycle of components is well documented through common usage, and warranties are also known and trusted.

Negative attributes:-

- The roofing elements generally have a less “high tech” look and feel compared to a fabric roof structure.
- Generally heavier in weight, which will increase the size of supporting columns and foundations. Also increases the seismic mass under an earthquake event, increasing the size and cost of bracing members.
- Requires specialist mechanical bogey contractors to construct and assist with the operation and ongoing maintenance of the moving components.

4.1.2 Light Penetrating Roof Systems

Light penetrating roof options can be categorised as those clad in materials such as PTFE, ETFE, PVC and glass. These cladding materials are often combined with lightweight structural system, including tensioned cables to create a more “airy” feel and aesthetic to the facility. It is often considered that these roof structures create a more dynamic and visually appealing feature to the venue.

Whilst these cladding systems all provide a level of translucency, we are not aware of any stadium in the world where natural turf is expected to grow under a fixed PTFE or PVC roof. We understand that only glass and ETFE are able to transmit the Light Spectrum needed to grow natural turf grass. The Forsyth Barr Stadium in Dunedin was the first major natural turf stadium to be built with a permanent ETFE roof. We understand that the turf growth at Forsyth Barr has been acceptable, for the usage that it receives. At the MCG in Melbourne, the northern stand has a roof coverage of up to 42metres, of which the innermost 17metres is fritted glass. This was incorporated into the design to assist with turf growth in the shaded area of the ground.

Challenges associated with the adoption of a lightweight roof cladding system include the ability to acoustically insulate the stadium. Acoustic insulation is achieved by mass, air gaps, noise dissipating (non-flat) surfaces and the like.

Lightweight cladding materials such as ETFE, PTFE and glass do not allow for any significant noise reduction and can limit a venue’s ability to host concerts. Similarly, the lightweight nature of the supporting structure often means it has limited residual capacity to support significant theatrical/concert loads. Another challenge is the fact that the fabric is stretched across the roof, meaning that equal and opposite horizontal forces are induced in the steel structure. Additional steelwork needs to be added into the roof structure to accommodate these loads.

Positive attributes:-

- Generally have a more “high tech” look and feel compared to a solid roof structure.
- Generally lighter in weight, which will minimise the size of supporting columns and foundations. Also decreases the seismic mass under an earthquake event, decreasing the size and cost of bracing members.
- Roof structure designed and detailed to prevent large shadows across the pitch and to assist with reduction of adverse lighting conditions for broadcasting of events.
- Can better support the growth of a turf pitch, when used in conjunction with adequate natural ventilation and grow-lights.
- Ability to act as a screen for projection of images and lighting.

Negative attributes:-

- Reduced ability to be able to incorporate heavy acoustic insulation. Acoustic insulation is used at many of the major arenas worldwide to restrict noise break-out, allowing them to host major concert events.
- Reduced ability to prevent sound reverberation within the bowl space under the roof, negatively impacting on the acoustic sound quality during music concerts and the like.
- Reduced ability to be able to incorporate thermal insulation rendering the space difficult to heat in the winter and difficult to cool in the summer. In order to prevent adverse overheating outcomes in summer, these types of roofs need large openings for natural ventilation. These openings also contributing to noise spill.
- The need for large openings in the walls to allow airflow across the pitch to promote grass growth.
- The lightweight nature of the supporting structure may not be able to incorporate provision for hanging loads at multiple locations across the arena. The light weight and flexible nature of these roof structures makes it difficult to break up the space with curtains or acoustic walls on tracks due to roof movement.

- Catwalks, walkways and equipment (lights, speakers, theatrical items, etc) may affect the broadcasting of events (shadows) or the ambiance of the space.
- May require specialist contractors to fabricate and install.
- Contractors may allocate risk contingency to pricing due to specialist materials and contractors.
- ETFE pillow cladding components require mechanical systems and a network of piping infrastructure to keep pillows inflated. Similarly hotwire systems are required to activate in the event of fire to assist with smoke spill.
- Lifecycle of components is less well documented, so warranties need to be researched and questioned with greater requirements for maintenance.

4.2 Stadium Alignment

In our earlier report, the orientation of the stadium mirrored what was adopted in the February 2022 report by Philip Lighton Architects and MCS. To better suit an ETFE roof, should that be considered, we have oriented the stadium on each site to have one end generally facing north which would maximise the natural sunlight onto the turf.

4.3 Grandstand Configuration

As a means of reducing costs for the stadium, we have assumed a 2-tier grandstand configuration for the GA section similar to Metricon Stadium in Queensland as shown in Figure 4-1. This features a single concourse, from which the lower tier is accessed from the rear and the upper tier via stairs from this concourse.

Figure 4-1 – Metricon Stadium

4.4 Sports Lighting

Sports lighting is a significant design consideration that will influence the stadium geometry and will play a key role in the success of a stadium. For multi-use venues, the lighting design needs to consider the different sports that may be played on the arena surface, each of which will have differing lighting requirements published by their respective governing bodies and design requirements set out in the Australian Standards. Lighting performance requirements will be significantly influenced by broadcast television requirements and in this venue those set out in the AFL's venue standards.

The broadcast lighting requirements result in very high lighting levels and so placement of luminaires is critical to avoid glare to both players and spectators. Typically, luminaires need to be installed at a height such that the angle of the luminaire aimed to the centre of the field and the vertical plane does not exceed 65 degrees. Angles of up to 70 degrees are accepted with careful glare control considerations. In this instance a mounting height of at least 35m above the field of play is likely to be required to achieve a reasonable balance between broadcast lighting and minimising glare. As the stadium is proposed to have an operable roof with the lights positioned below the roof line, the height of the stadium roof line is therefore directly influenced by the lighting requirements.

The lighting design should be a key parameter in developing the stadium design.

The above will likely dictate that the moving roof is positioned at least 37m above the playing surface (as is the case with Marvel Stadium). This roof height is significantly higher than what would normally be required for a 23,000-person seating bowl, which would have the same external perimeter but with light towers and no operable roof. This has the potential to lead to increased façade and roof costs and would need to be studied in more detail in the next phase of the project.

5 Site-Specific Issues for the Stadium

Each of the proposed stadium sites has advantages and challenges to be overcome. The following sections discuss some of these as they relate to each of the proposed sites.

5.1 Assumed Regatta Point Stadium Configuration

This option has an existing difference in height across the site of approximately 13metres at the end closest to the Cenotaph to a point a few metres above the water level.

At the high side (Cenotaph side) the stadium would be set down with a batter where possible and with a retaining wall at the narrowest section. Access for servicing the facility and the location of all the back-of-house areas of the building will need to be from this “land side”, which generates the need for further excavation on the high side compared to the other sites.

To determine a surface level for the stadium on this site a detailed analysis will be required which would include flood modelling and risk assessments. However, for the purposes of this report, as noted in Section 7.7.3 an elevation of RL 3.5 for the lowest floor level is proposed. This is based on a year 2100 sea level with a climate change allowance and 500mm freeboard. To allow for finishes and falls to the concourse, and for structural depth to support emergency vehicles and the like, we have allowed a nominal 6.5m of floor-to-floor height between the concourse and lower slab. This places the concourse at around RL10.0. The back-of-house facilities would need to be located in the undercroft areas under the concourse.

To suit the Metricon-style raised concourse and front tier arrangement, we have placed the pitch at RL 7.0 at the boundary fence (the centre would be around 700mm higher to generate a cross fall for drainage). Allowing for 500mm of soil above the slab, this places the pitch level at around RL6.5.

An image of the stadium position relative to the existing site profile is shown in Figure 5-1.

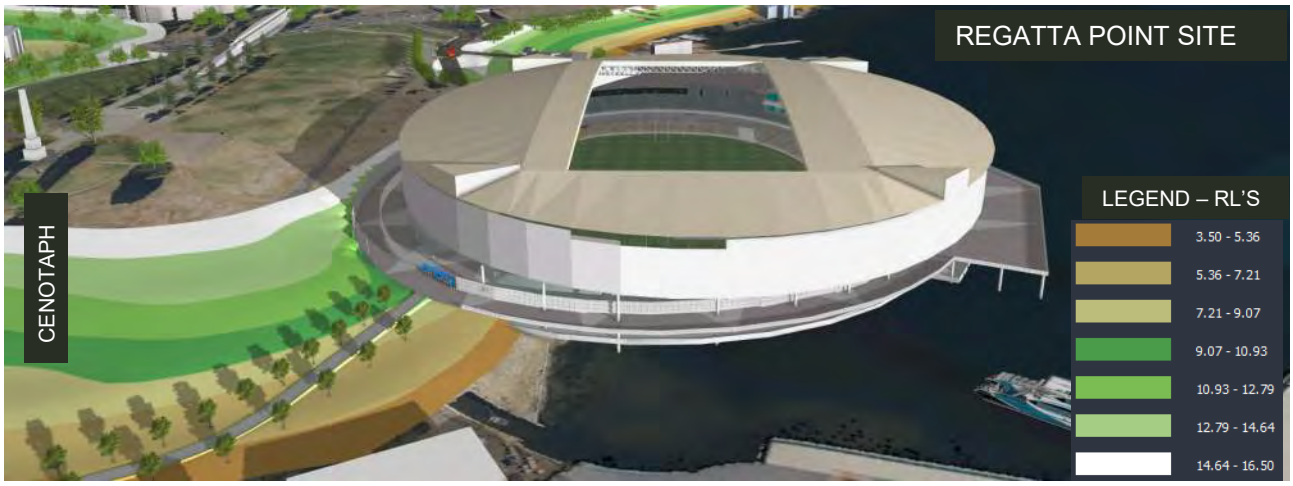


Figure 5-1 – Reduced Levels (Elevation) Heat Map – Regatta Point

An indicative section through the stadium is shown in Figure 5-2. This demonstrates the need for the excavation in the north-western corner on the Operational side to provide back-of-house access etc, while the GA zone side can be generally located on ground with some localised earthworks shaping. The surface level (SL) for the playing surface at around RL7.0 is around 13 metres below the Hobart Cenotaph.

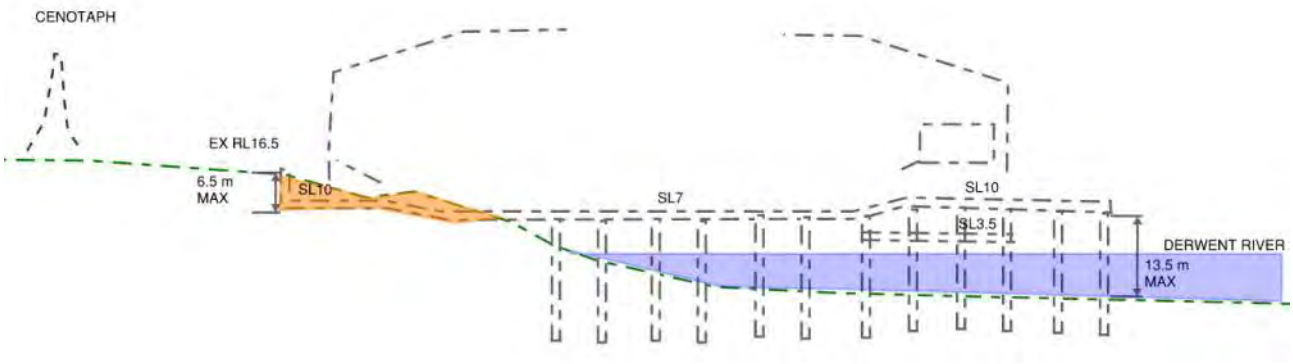


Figure 5-2 - Indicative Site Section Through Stadium

To demonstrate how the stadium would sit against the existing site levels we have generated an image of the slabs as they would appear during the construction phase, without the excavation on the land side being commenced. This is shown in Figure 5-3 below, with the first image showing the outer ring slab at RL3.5 surrounding the pitch slab that would be at around RL6.5. The second image shows the how the upper lab at concourse level (RL10.0) would interact with the existing hill.

Figure 5-3 – Interface between Suspended Concrete and Existing Soil

5.2 Assumed Macquarie Point Stadium Configuration

This option has an existing fall across the site of approximately 3-4m as shown in Figure 5-4 and Figure 5-5. Due to the potential for contaminated soil to be encountered, it is proposed that the building generally be located above the existing surface levels.

To avoid digging down for the pitch at the high (north) end, this needs to be located at around RL7.5. To maintain the Metricon-style raised concourse and front tier arrangement, we have placed the concourse at RL 10.5m, which conveniently maintains the 6.5m floor-to-floor height required at the Evans Street end to allow for finishes and falls to the concourse, the required structural depth for the concourse slab to support emergency vehicles and the like, whilst maintaining tall vehicle delivery heights in the main undercroft area where the Loading Dock and other back-of-house facilities would be located.

The field is proposed to be at grade, to achieve this the site will need to be filled up to 500mm below proposed field level. A retaining wall around the perimeter of the pitch will be required to maximise the "basement" area under the stand. An image of the stadium position relative to the existing site profile is shown in Figure 5-4.

Figure 5-4 - Reduced Levels (Elevation) Heat Map – Site 6

An indicative section through the stadium is shown in Figure 5-5.

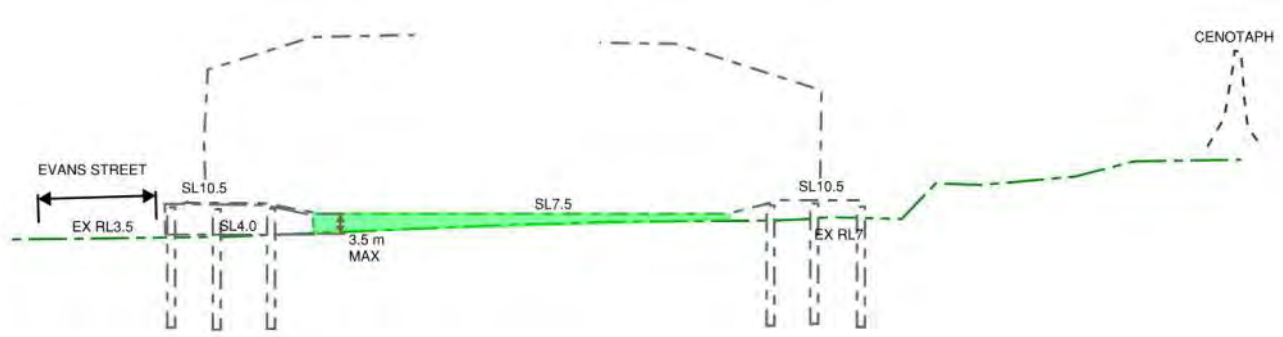


Figure 5-5 - Indicative Site Section Through Stadium

The following image in Figure 5-6 shows how the pitch and lower-most floor slabs would interact with the existing site levels. To minimise the site excavation (which may encounter contamination) the pitch level has been built up above the existing surface level at its highest point (the northern end). This generates the height required for the concourse to allow tall vehicle access to the Loading Dock and back-of-house areas. In this undercroft area, it is envisaged that the floor-to-floor height would reduce towards the north, due to the gentle raising of the existing ground level.

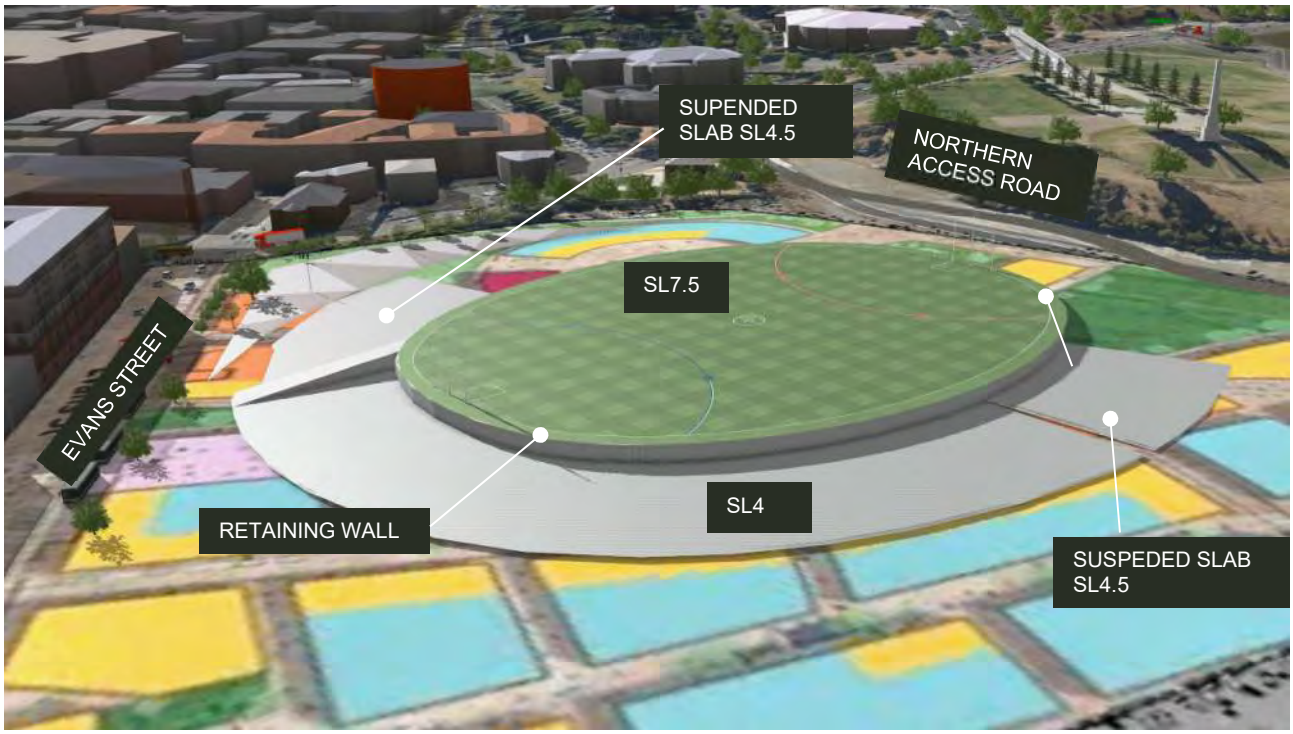


Figure 5-6 – Interface between suspended structure and existing soil

6 Infrastructure Considerations

6.1 Cut and Fill

Based on the above assumptions, the sites will require the following approximate amounts of cut and fill:

Table 6-1 Cut and Fill Volumes

Option	Cut (m^3) Clay/rippable/fill	Cut (m^3) Rock	Fill (m^3)
Regatta Point	13,000	1,300*	0
Macquarie Point	1,800	0	23,000**

* It is assumed due to limited geotechnical data that 10% of the cut will be rock

** Field is at grade. It is assumed the bulk earthworks is to 500mm below field level to allow for drainage and field makeup

6.2 Site Vehicle Access

A high-level assessment of site access has been undertaken for each site addressing the following key considerations:

a) Heavy vehicle access (B-Double) for delivery of equipment for events (such as music concerts or pitch/grass replacement) directly to the field of play

b) Light vehicle access for parking in basement/s where possible

c) Allowance for player bus drop in basement where possible

d) Limit disruptions to existing facilities and walkways

It should be noted that no traffic analysis has been assessed or undertaken as part of this advice and the site access strategy is subject to significant change as a result of any future assessment.

For example, it is likely that multiple points of access may be necessary to provide emergency vehicle access to the full perimeter of the stadium. However, as this requirement will be consistent for both sites, this has not been included in this study.

6.2.1 Existing Vehicle Access Assessment

The existing site assessment is as follows:

Regatta Point Site

The Regatta Point site is located between Tasman Highway and Derwent River as shown in Figure 6-1.

a) Heavy Vehicle will be accessed from the west of the stadium off McVilly Drive.

b) Player bus's will be accessed via Tasman Highway via McVilly Drive

c) As the stadium doesn't have a basement carpark the traffic will not be centralised towards a basement entry.

A new road will need to be constructed as shown in Figure 6-2 to extend McVilly Drive to the lower suspended slab.

There is an opportunity to access the stadium off the recently constructed Northern Vehicle Access Point for Macquarie Point Precinct, this option however will be complicated by the interface with pedestrian movement and the heritage listed Rivulet that discharges to the Derwent River.

Figure 6-1 – Primary Vehicle Route Access to Stadium

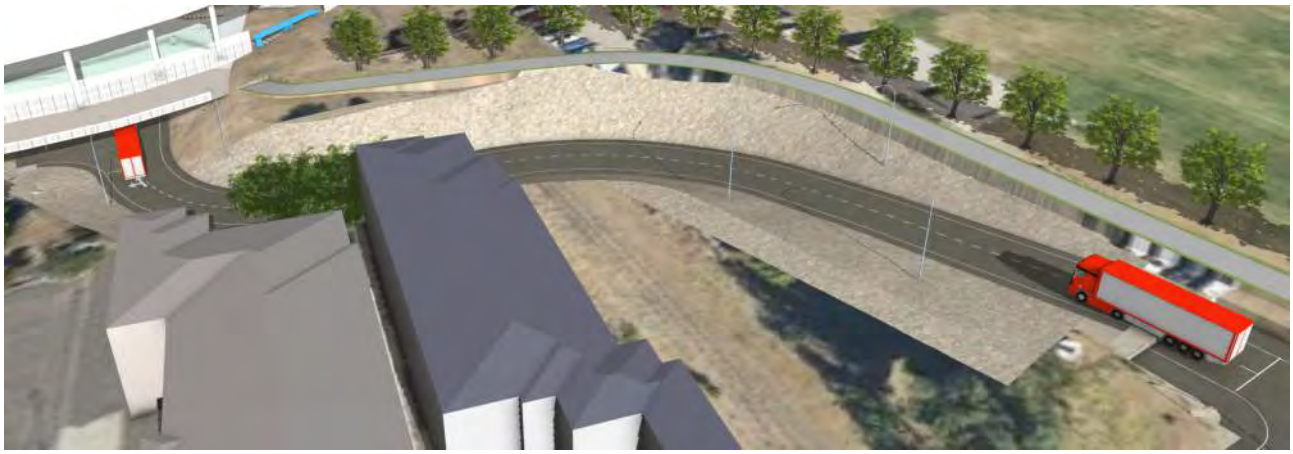


Figure 6-2 – New Roadworks off McVilly Drive

Macquarie Point Site

The Macquarie Point site is located between Evans Road, Tasman Highway and a new Northern Vehicular Access Way to Mac Point Precinct as shown in Figure 6-3.

a) Heavy vehicle access to field of play can be accessed via Evans Road as show in Figure 6-4.

b) Player Bus's will be dropped off on Evans Road as there is no basement level.

c) As the stadium doesn't have a basement carpark the traffic will not be centralised towards a basement entry.

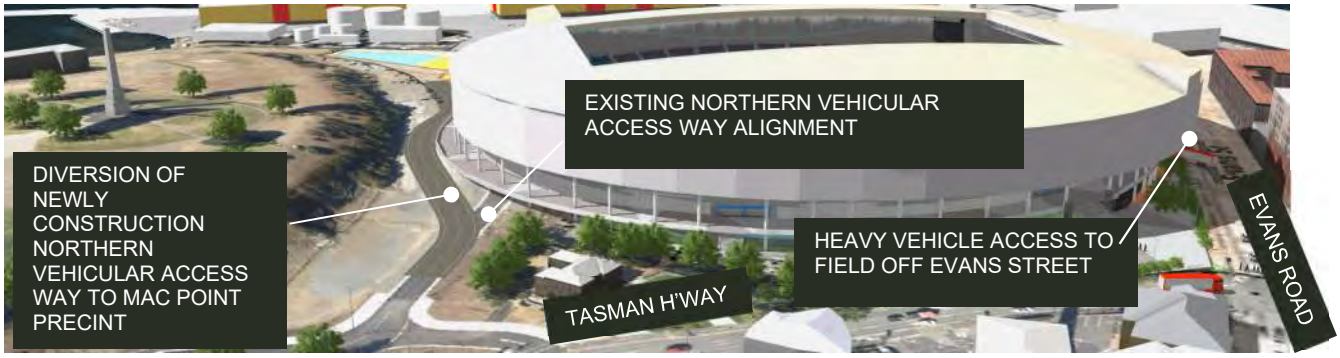


Figure 6-3 – Macquarie Point Roadworks

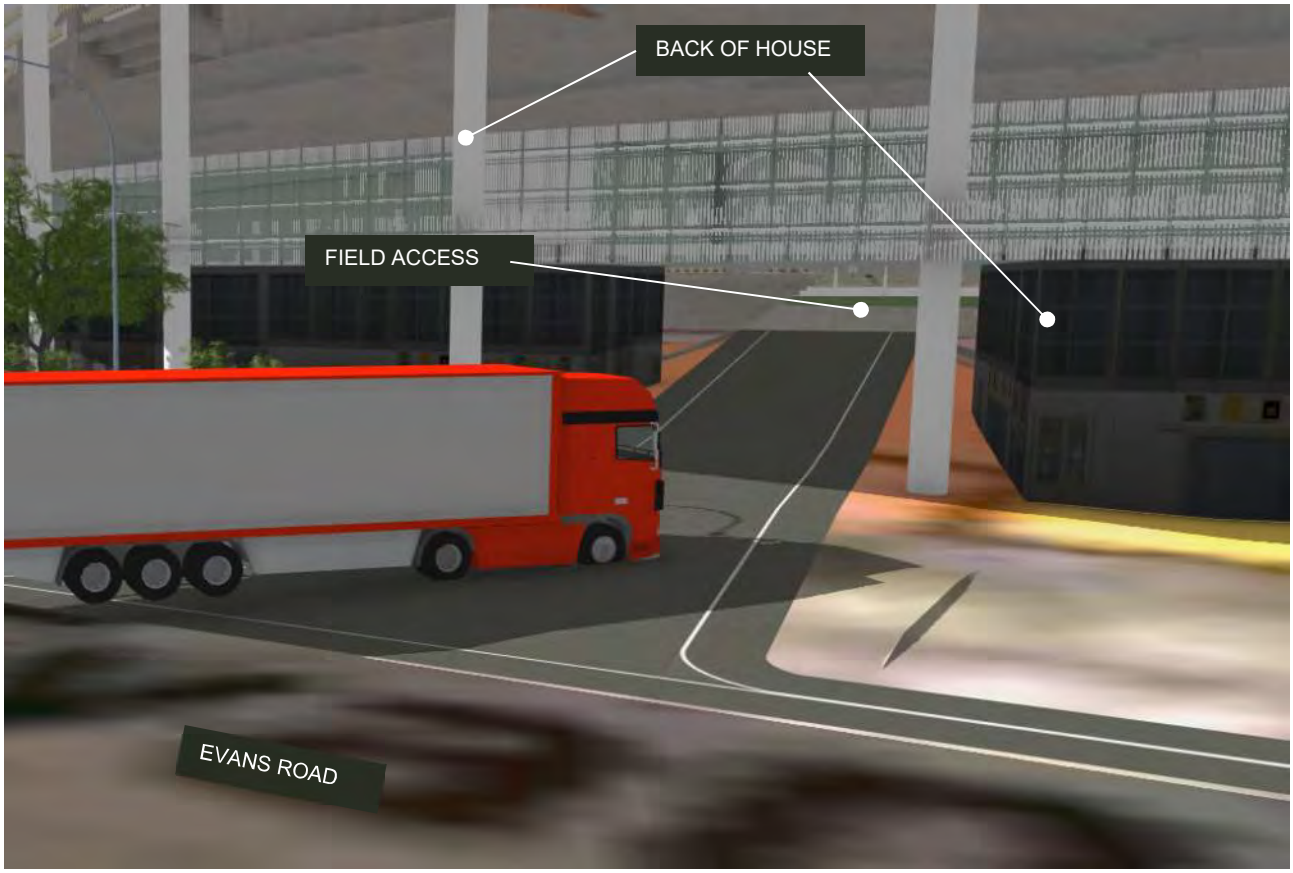


Figure 6-4 – Heavy Vehicle Field Access

6.2.2 Proposed Vehicle Access Strategy

Based on the above, for access to the sites roadworks similar to that shown in Figure 6-5 should be allowed for.

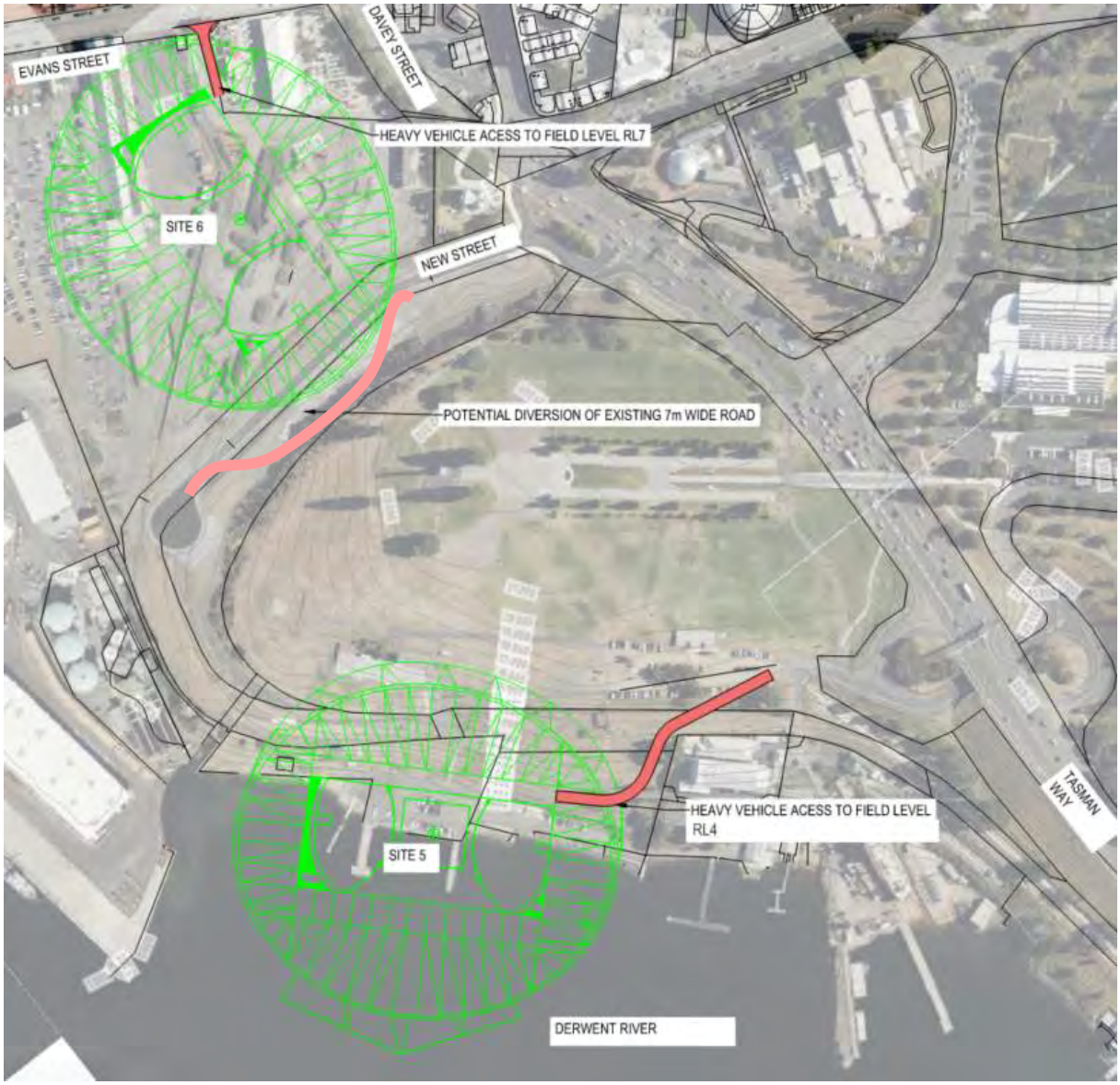


Figure 6-5 – Proposed Site Access

The proposed new road pavement area for each site is shown in Table 6-2.

Table 6-2 Pavement Quantity

Site	Area (m^2)
Regatta Point	1,200
Macquarie Point	400 + diversion of the existing road

No pavement assessment has been undertaken as part of this report, assume 600mm pavement depth for pricing purposes.

7 Utilities Considerations

7.1 Services Authorities

The following servicing authorities are applicable to the subject sites

Table 7-1 Service Infrastructure Authorities

Infrastructure Element	Authority
Local Roads and Drainage	City of Hobart
Sewer and Water	Tas Water
Natural Gas	Tas Gas Networks
Telecom	NBN, Telstra, Optus
Power	Tas Networks

7.2 Potable Water Infrastructure

7.2.1 Existing Infrastructure

Tas Water is the responsible authority for the provision of water supply to service the subject site.

As shown in Figure 7-1, The following key points are of note:

Regatta Point is located near a 150mm and 250mm connection that has been taken off Tasman Highway.

Macquarie Point is surrounded by an existing water main infrastructure forming a ring with an adjacent 250mm potable water supply along Tasman Highway.

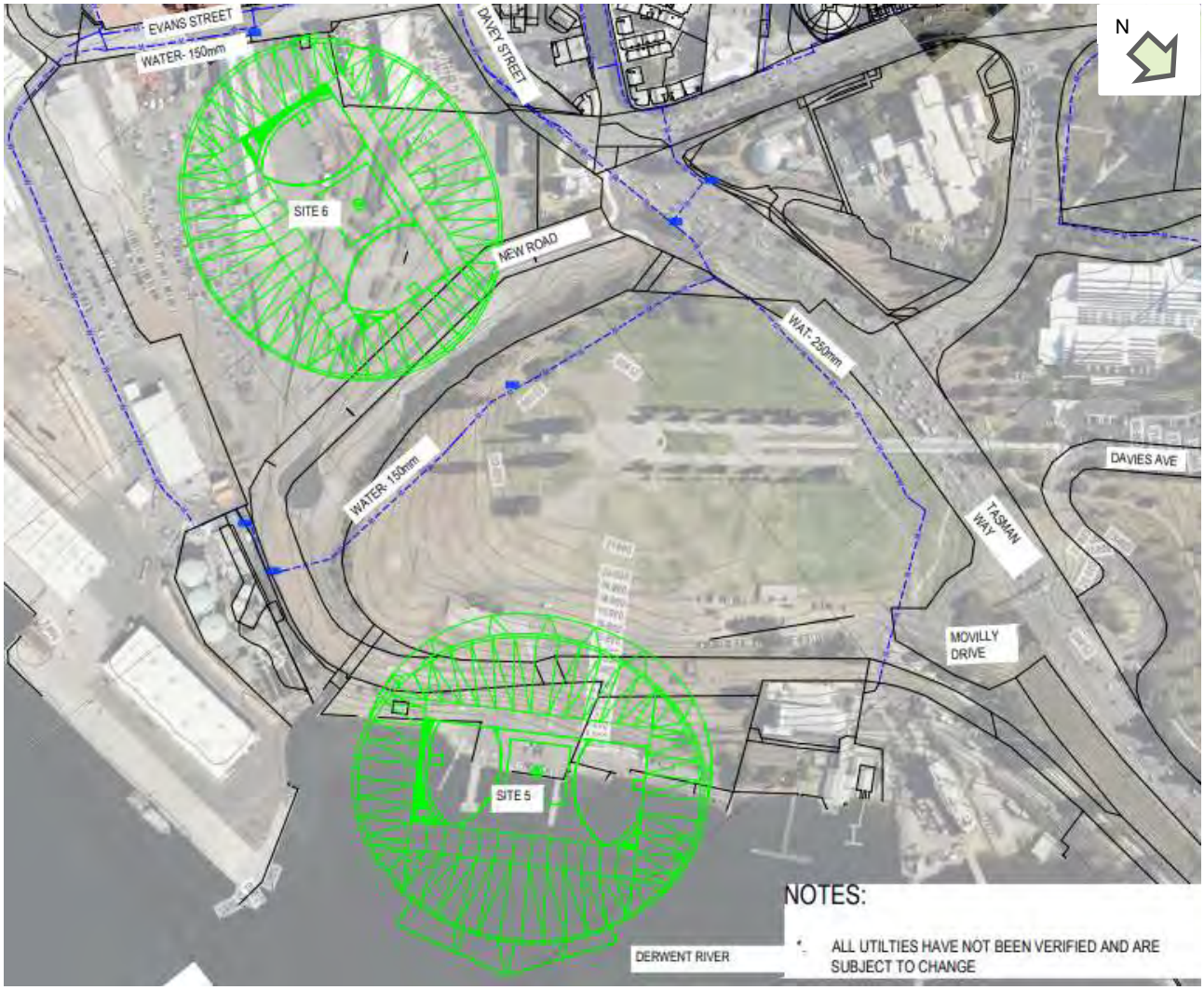


Figure 7-1 – Existing Potable/Fire Water Layout

7.2.2 Estimated Development Demands

Aurecon has undertaken a high-level demand study for domestic water and fire services assuming a capacity of around 23,000.

The demand assessment is based on the following:

- 25,000 Seats
- 1,000 Staff
- 3-hour event time (average)
- Allowance of 5L/pp
- Non-potable used for Sanitary Flushing Systems

The estimated peak water demand is estimated to be between 10-15L/s

The average day potable water usage is estimated to be 100-150 kL/average daily event.

No recycled water infrastructure exists in the vicinity of the subject site and the supply of recycled water in not mandated. Rainwater harvesting may be considered in the design, but has not been relied upon for this study.

The developer will be required to enter into an agreement with TasWater to service the development and extend the services into the site as part the standard conditions.

For fire water demand, the following flow rates are anticipated as minimum requirements, with a maximum anticipated simultaneous flow rate of 30 L/sec made up as follows:

- Sprinkler System Ordinary Hazard (0H3) 25 L/sec
- Wall Wetting System (allowance extra over from the sprinkler demand) 5.0 L/sec
- Hydrant

7.2.3 Proposed Infrastructure

The water supply code of Australia suggested a minimum DN150mm pipe size for industrial and commercial developments. The sizing required is based on maximum demand and will need approval from TasWater.

It is anticipated that the combined potable water/fire water supply of 250mm will be required to supply the stadium.

The proposed infrastructure for each site is proposed as following as shown in Figure 7-2:

Regatta Point will require a new 150mm water main from the 250mm water main off Tasman Highway. This main could extent to the existing 150mm water main to form a ring main providing additional supply resilience

Macquarie Point will require a tapping into the existing 250mm water main on Davey Street which is part of a ring main.

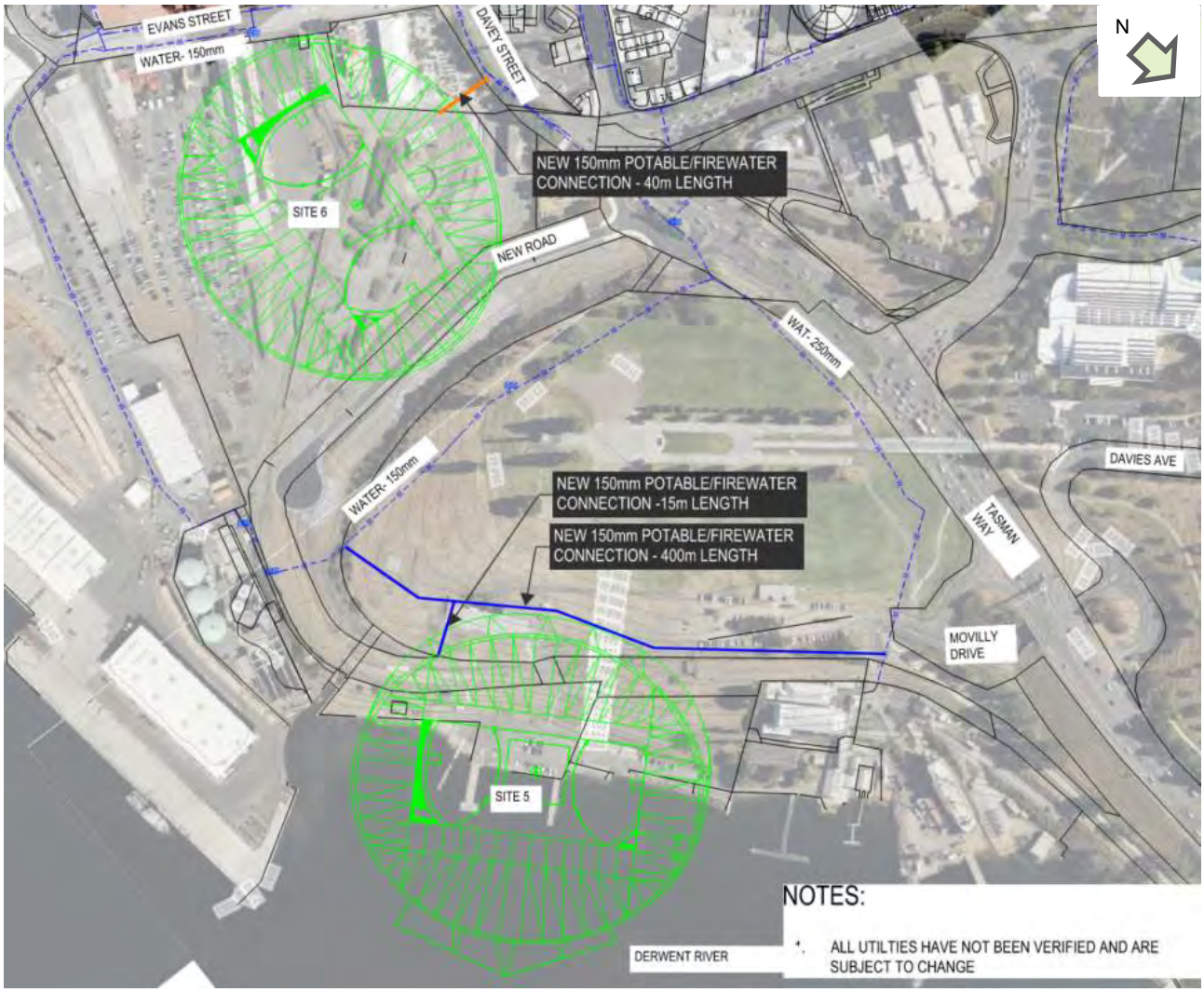


Figure 7-2 – Proposed Water Infrastructure

7.2.4 Future Studies Recommended

It is recommended that the AFL seek pressure and flow tests from TasWater to validate the assessment of this report.

7.3 Sewerage Infrastructure

7.3.1 Existing Infrastructure

Tas Water is the responsible authority for provision of sewerage infrastructure to the site. As shown in Figure 7-3, the following key points are of note:

For Regatta Point, this crosses an existing 150mm sewer that may need to be relocated

For Macquarie Point, there is an existing 1050mm sewer that runs through the proposed site, it is understood that TasWater has engaged a contractor (Johnstone McGee & Gandy Engineers and Planners) to relocate this main to a different alignment. The proposed alignment is not currently public.

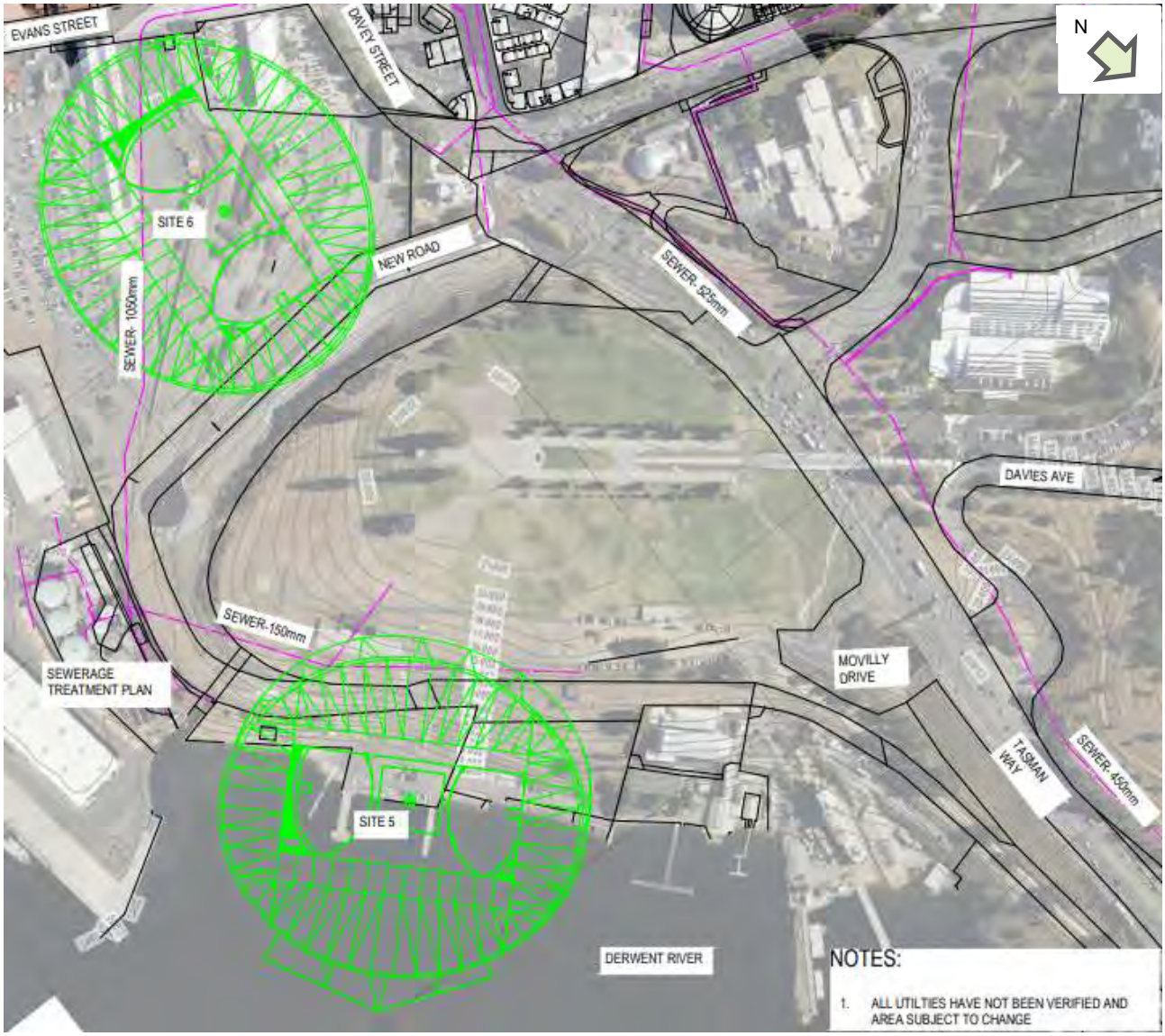


Figure 7-3 – Existing Sewer Layout

7.3.2 Estimated Development Demands

Stadiums typically generate up to about 90% of the potable water flows. Based on the water demand estimates above this would equate to a peak sewage discharge of around 13l/s.

7.3.3 Capacity of Existing System

TasWater was not contacted as part of this study, however, the following has been assumed:

The existing Sewerage Treatment Plant is likely to have sufficient capacity to cater for an additional 13l/s.

For Regatta Point, the 150mm sewer will need to upgraded to cater for the anticipated stadium requirements.

For Macquarie Point the 450mm sewer is like to have sufficient capacity to cater for the anticipated stadium requirements.

7.3.4 Proposed Infrastructure

The Sewerage Code of Australia suggests a minimum DN225m pipe sizes where large flows may be expected. The sizing will need to be confirmed with TasWater and developed through the design process.

The proposed infrastructure for each site is proposed as following as shown in Figure 7-4.

Regatta Point may require diversion of an existing 150mm sewer line and if to be used for the stadium upgraded to a new 225mm line discharging close to the Sewerage Treatment Plant in a branch line pit.

Macquarie Point will likely be able to drain into the branch line below the site. A new branch line pit will likely need to be constructed over the existing 450mm pipe to discharge into it.

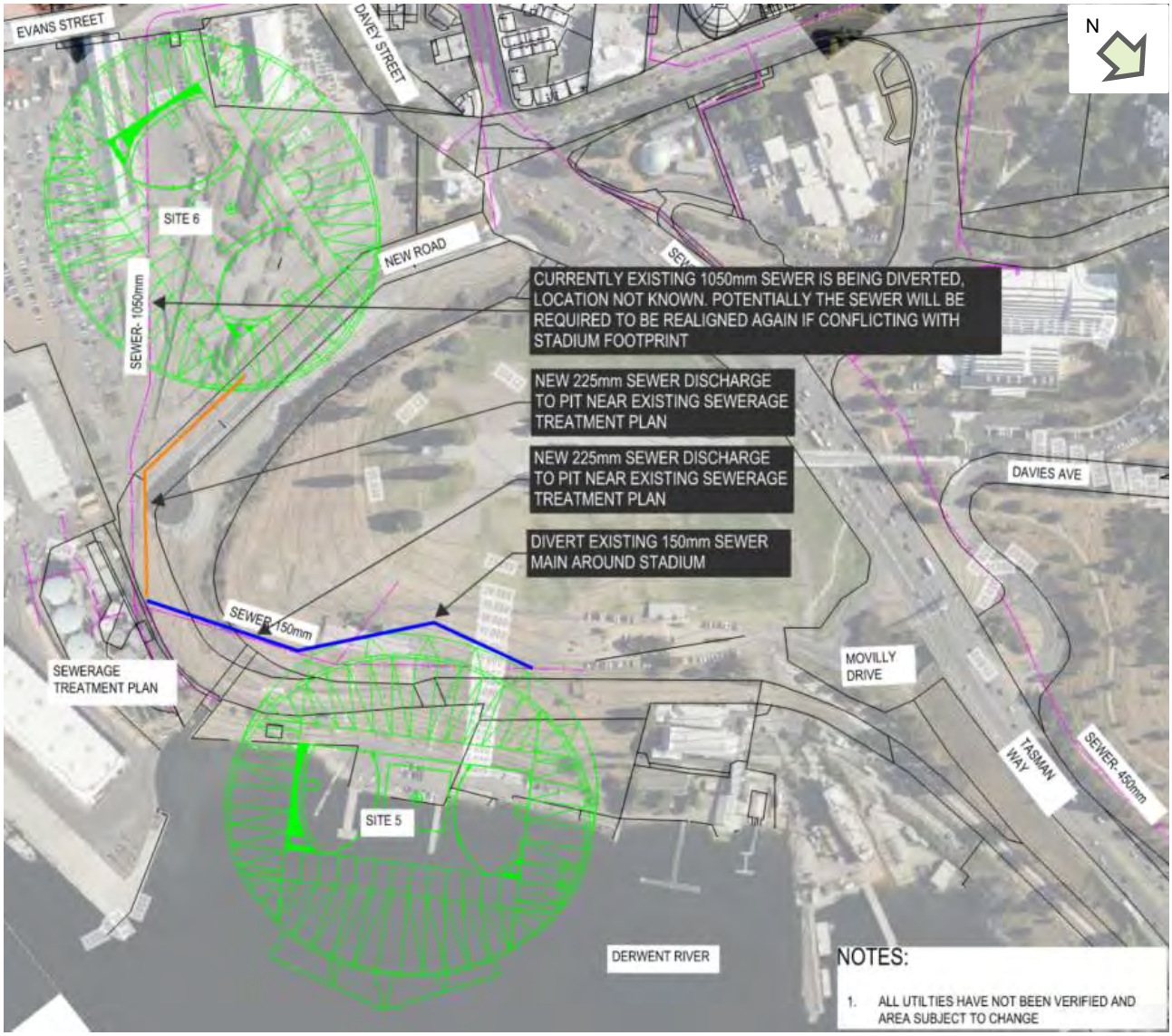


Figure 7-4 – Proposed Sewerage Infrastructure

7.3.5 Future Studies Recommended

It is recommended that AFL seek sewerage flow capacity from TasWater to validate the assessment of this report.

7.4 Gas

7.4.1 Existing Infrastructure

TasGas is the responsible authority for the provision of gas supply facilities in the area.

As shown in Figure 7-5, the following key points are of note:

Neither site has gas mains in close proximity, although at Macquarie Point there is an existing 90mm gas main rated at 500kPa to the north of the site.

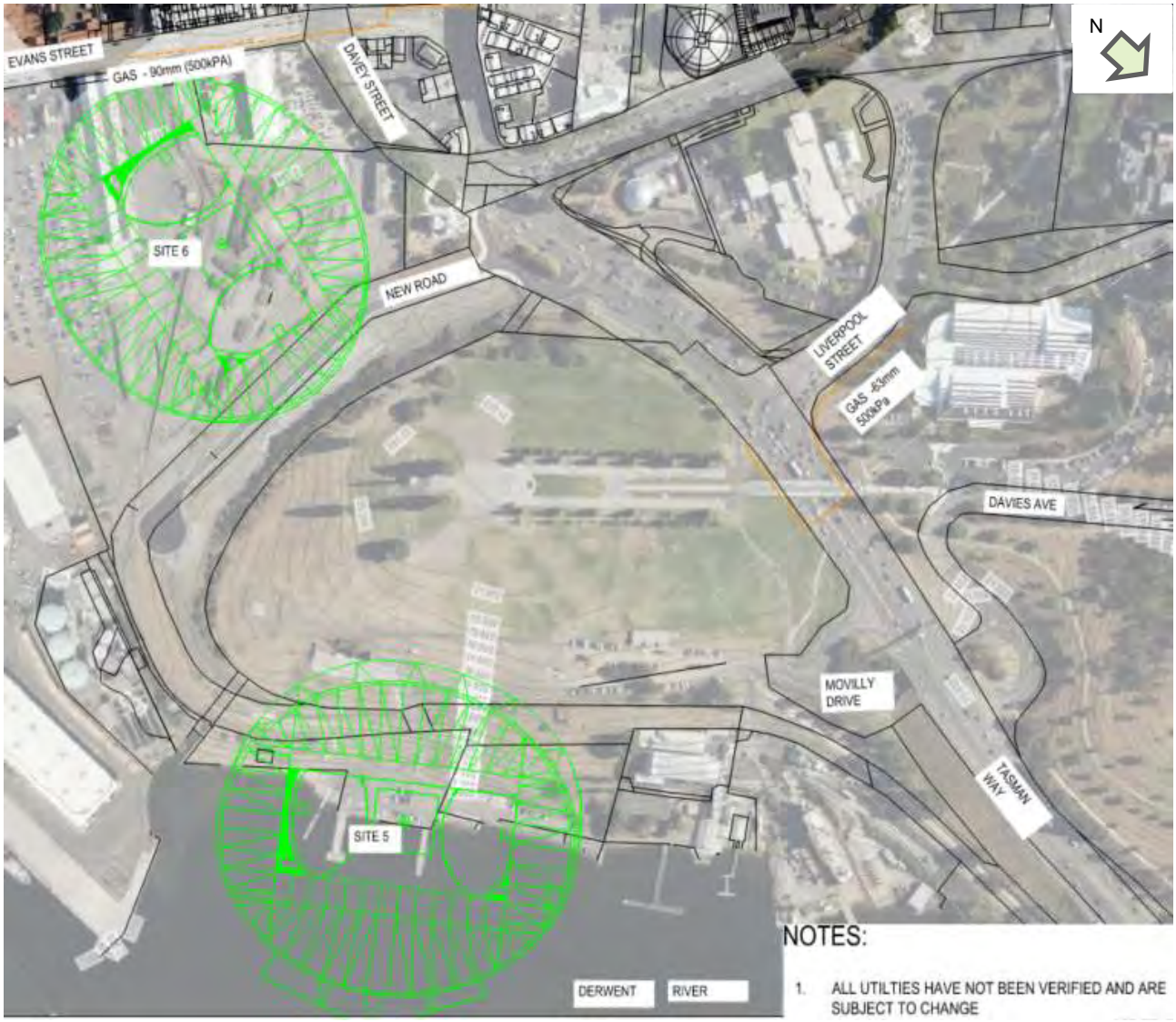


Figure 7-5 – Existing Gas Layout

7.4.2 Estimated Gas Demand

It is anticipated that a natural gas supply will not be required for the stadium. This is in line with current trends to enable decarbonised energy supplies from an electrical network supported by renewables and other non-fossil fuel primary energy source.

However, if gas is required for catering purposes, the anticipated demand will be approximately 5,000MJ/h.

7.4.3 Proposed Infrastructure

If a gas supply to the stadium is required, the proposed infrastructure for each site is as following and shown in Figure 7-6.

For Regatta Point extend the existing 63mm line close to the site and metered takeoff from this new pipe.

For Macquarie Point install a new metered take off line from the 90mm supply on Evans Street.

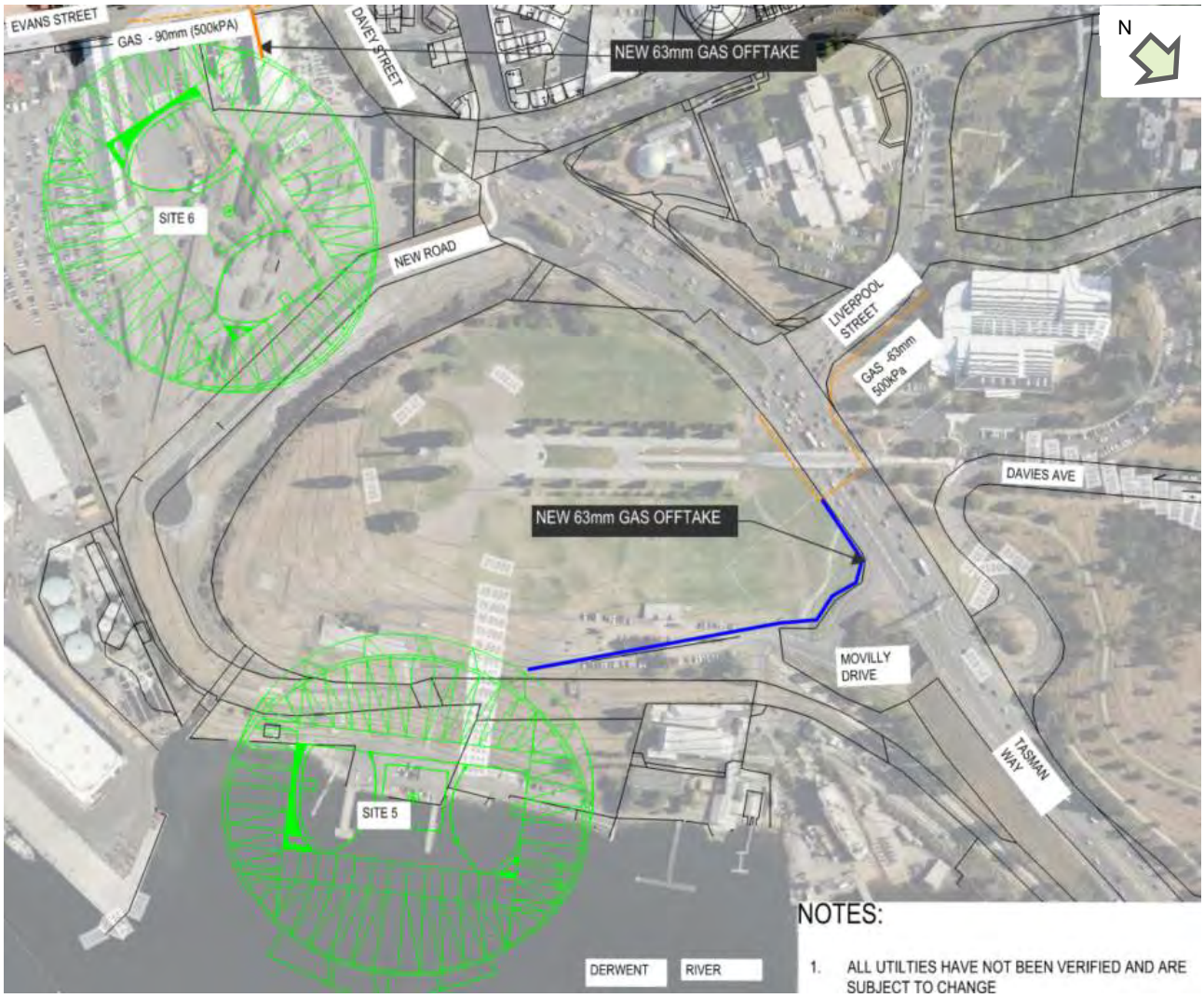


Figure 7-6 – Proposed Gas Layout

7.4.4 Future Studies Recommended

It is recommended that AFL engage with TasGas to confirm the capacity within the network that could supply the sites.

7.5 Electrical

7.5.1 Existing Infrastructure

Tas Networks is the responsible authority for the provision of electricity supply to service the proposed development.

As shown in Figure 7-7, the following key points are of note:

Regatta Point is located close to an existing 11kV cable that will need to be diverted.

Macquarie Point is close to an existing 11kV cable to the north of the proposed site with the Arts Centre zone substation close by.

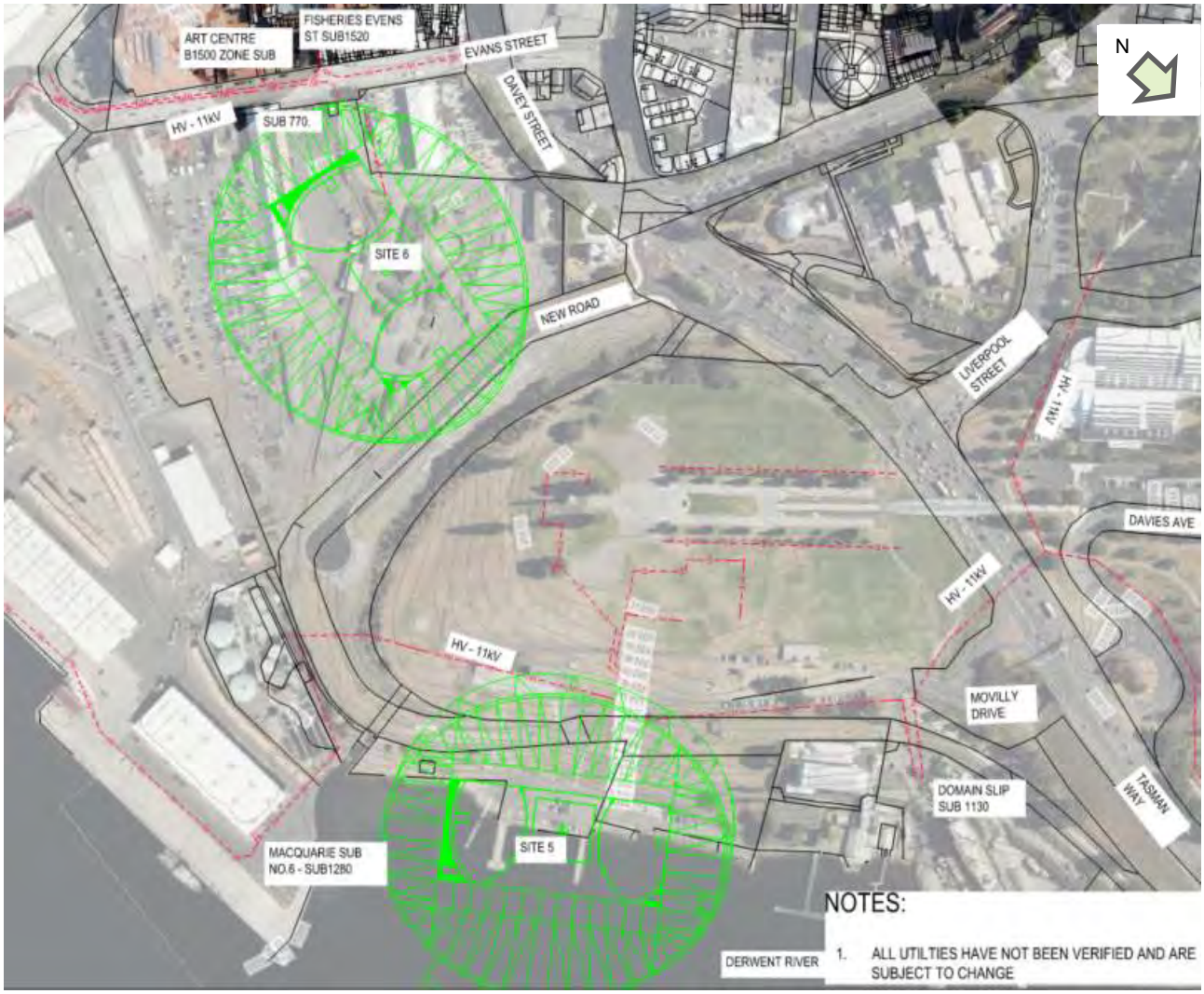


Figure 7-7 – Existing Electrical Layout

7.5.2 Estimated Electrical Demand

Based on experience from comparable stadia, it is expected the electrical demand could be approximately 130VA per seat. The stadiums gross floor area is assumed to be 40,000m2 with a seating capacity of around 23,000 seats. This suggests an expected peak load in the order of 3.5-4MVA.

The above calculation is preliminary based on limited information and will need to be continually refined during detailed design stages as more data becomes available.

Due to the footprint of the stadium and to minimise cable costs it is expected that two supply authority LV substations will be required to be accommodated within the stadium. The load would be shared between the substations, equating to a substation of 2MVA. Each substation will require an associated main switchroom.

7.5.3 Capacity of Existing Network

Tas Networks have not been engaged so it is not known whether there is sufficient capacity within the existing HV network in the area of the proposed sites. Typically, 11kV feeders are rated to a maximum of 6.9MVA. Considering that the existing feeders also service multiple existing customers, it is unlikely that that the capacity of the existing supply can be increased to supply the peak loads for the stadium.

Therefore, additional HV supplies are likely required from a Tas Networks zone substation to meet the estimated demand of the new stadium.

7.5.4 Proposed Infrastructure

The proposed infrastructure for each site is proposed as following as shown in Figure 7-8.

Regatta Point will require two supply authority substations fed from a new 11kV feed from the nearest zone substation. This site will also require relocation of an existing 11kV feeder.

Macquarie Point will require two supply authority substations from a new 11kV from the nearest zone substation. This will require boring under Evans St.

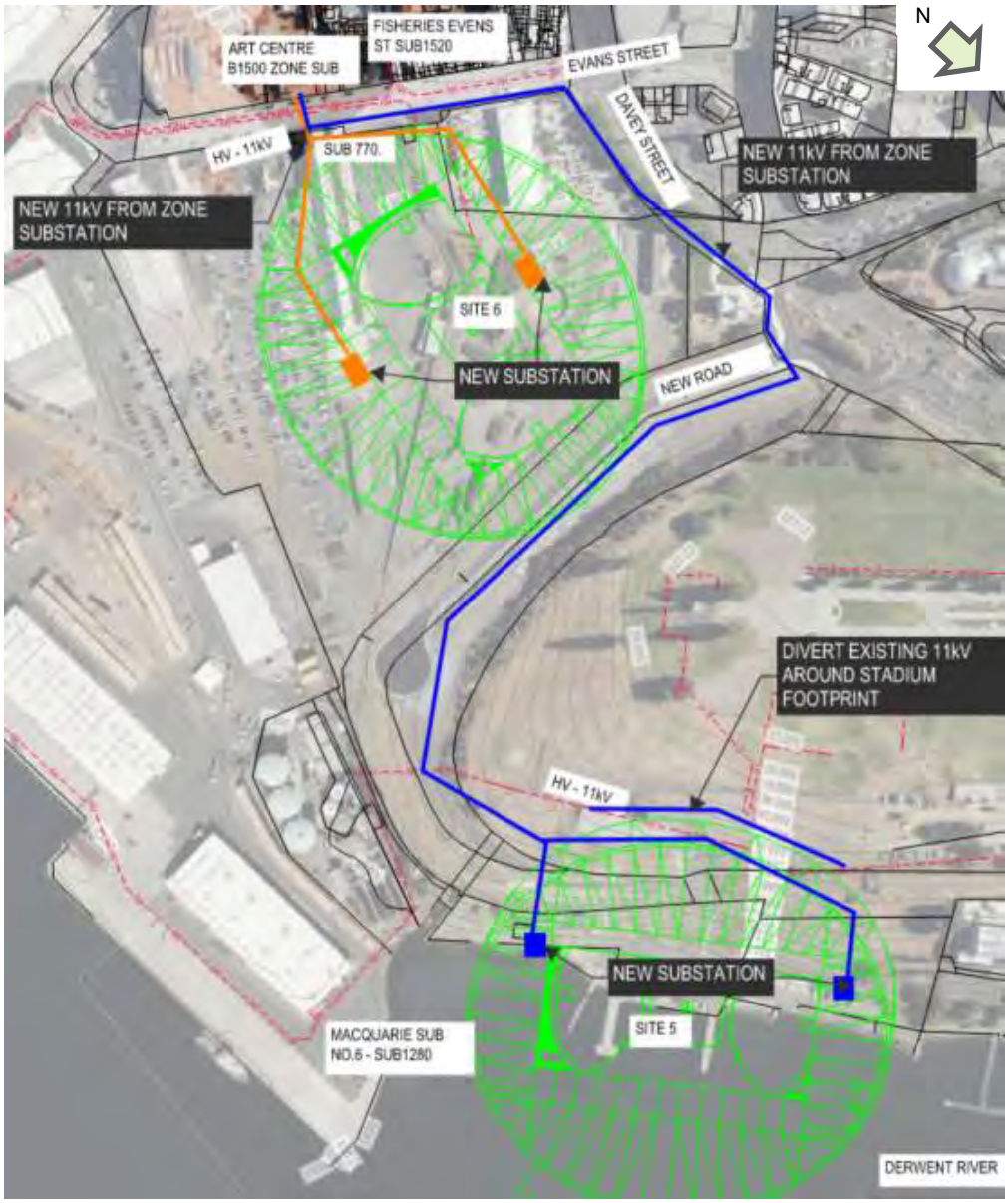


Figure 7-8 - Proposed Electrical Layout

7.5.5 Future Studies Recommended

It is recommended that AFL engage with Tas Networks to confirm the HV capacity to the subject site and any subsequent upgrades to the existing network to service any proposed development.

7.6 Telecommunications

7.6.1 Existing Infrastructure

NBN, Telstra and Optus all have assets in proximity to the proposed sites. In particular,

Regatta Point interfaces with existing Telstra and NBN pit and pipe infrastructure that runs along the existing waterfront. This infrastructure will need to be diverted to maintain connection to existing customers to the north of the site.

At Macquarie Point there is existing Telstra and NBN pit and pipe infrastructure within Evans Street, Davey Street and Tasman Highway

The existing telecommunications network is shown in Figure 7-9.

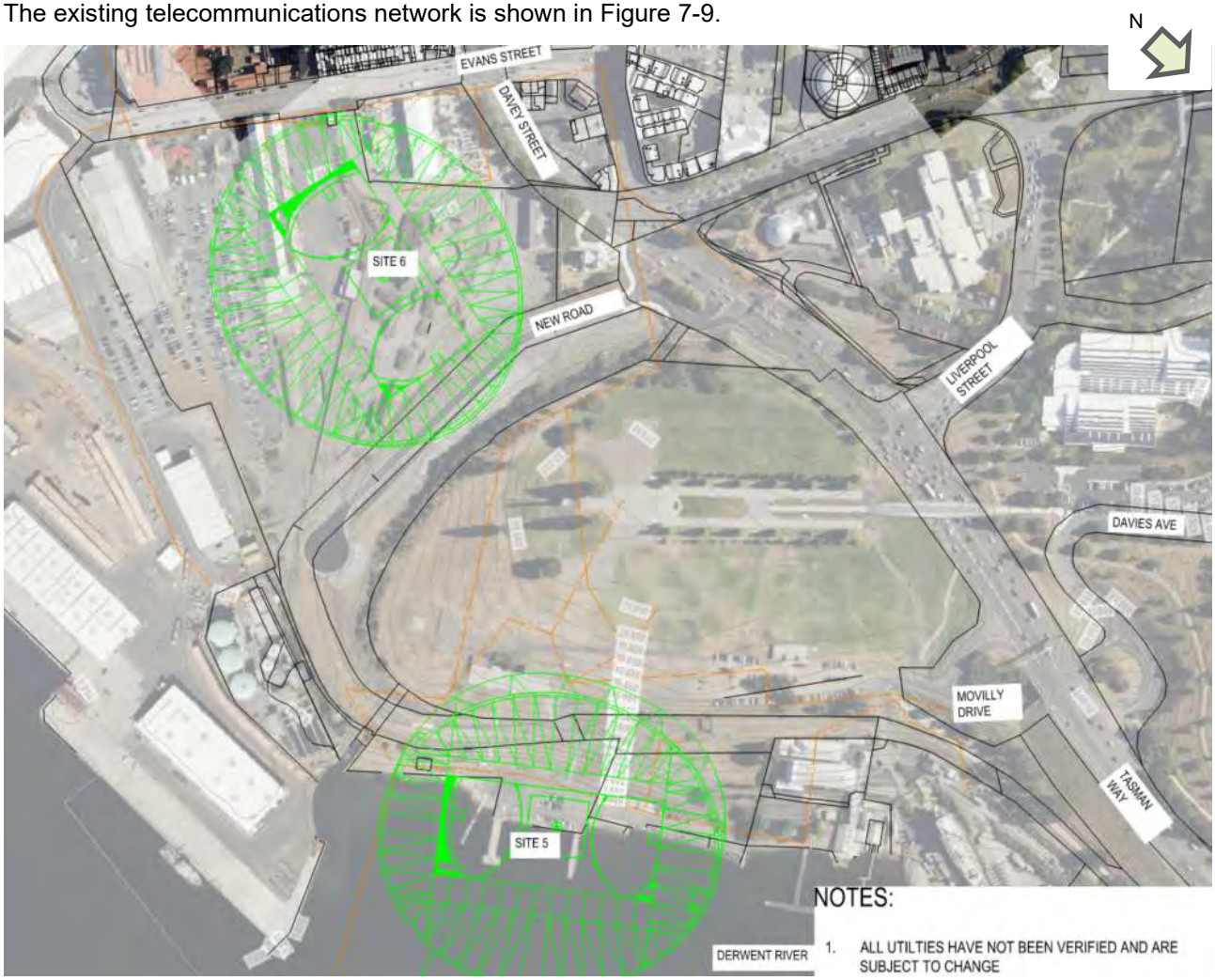


Figure 7-9 – Existing Telecommunications Layout

7.6.2 Proposed Infrastructure

Both sites are likely to be able to be served by NBN and Telstra from the existing pit and pipe infrastructure either in Evans Street or Tasman Highway. The infrastructure may need enhancing in order to install fibre connections to the stadium.

7.6.3 Future Studies Recommended

It is recommended that AFL engage with NBN and Telstra to determine potential new connection arrangements.

7.7 Stormwater

7.7.1 Existing Infrastructure

The City of Hobart is the local stormwater asset owners for the local roads and drainage. Local drainage networks external to the site will fall under Council ownership.

The following key points are of note:

Regatta Point is located on the Derwent River and is located close to a large below-ground Rivulet as shown in Figure 7-10 which conveys significant stormwater through Hobart.

Macquarie Point is located between Evans Street and a new road currently under construction with drainage infrastructure that drains out to the Derwent River. It is assumed that as there is direct access to the river there will not be any limitations on stormwater flow to any assets.

Figure 7-10 – Hobart Rivulet

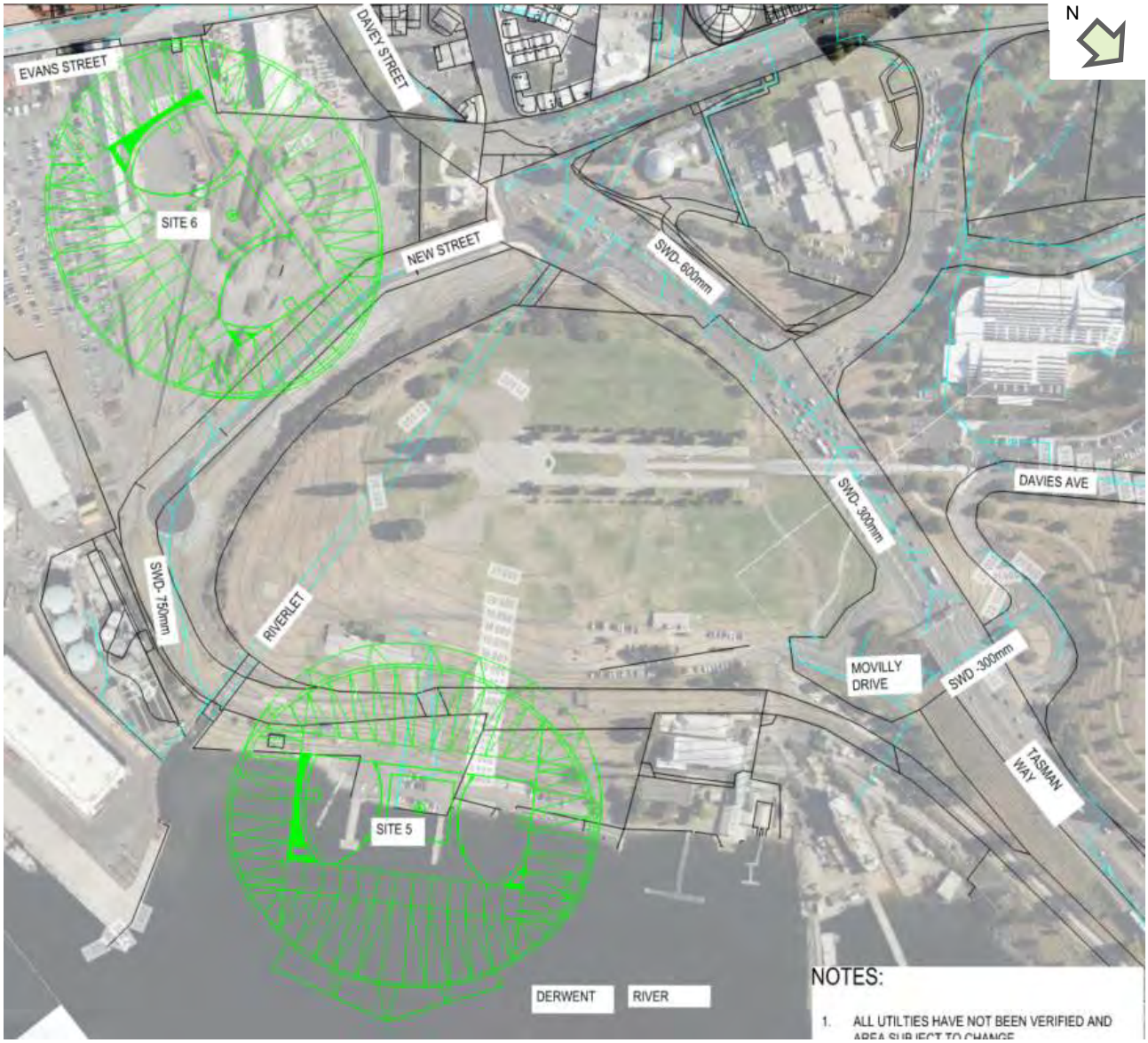


Figure 7-11 – Existing Stormwater Layout

7.7.2 Overland Flow

No flood overlays exist within the subject site, but it is expected that major event overland flow may be conveyed across the site due to the significant site catchment. This overland flow should be considered within the road network/landscape design to ensure overland flow conveyance.

In the early stage of design Finished Floor Levels (FFL) will be required to be set sufficiently above any overland flow paths to limit ingress to building. Any basement ramps will require apex to above freeboard levels.

7.7.3 Sea Level Rise

The maximum 1% Annual Exceedance Probability (AEP) for the year 2100 storm surge is 1.94 metres above AHD83 in the Hobart Region. A 1 metre allowance is then added to account for wind and ocean swell generated waves. This totals 2.94 metres, rounded up to RL3.0 m as shown in Figure 7-12. For the setting of a floor level for the purposes of this report (only), we have allowed a 500mm freeboard resulting in an assumed lowest floor level of RL3.5m.

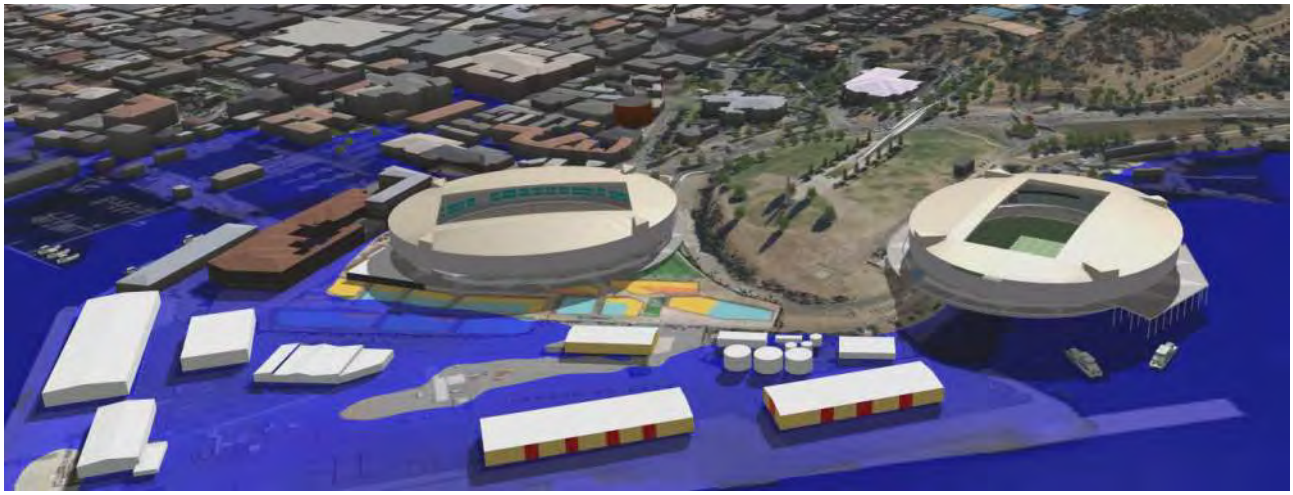


Figure 7-12 – Year 2100 Predicted Sea Level Rise with 500mm freeboard (RL3.5)

7.7.4 Stormwater Quality

Tasmanian State Policy on Water Quality Management 1997 (SPWQM) sets the water quality management and objectives for the State including stormwater which can be summarised as achieving the following:

Suspended solids (SS) – 80% retention of the typical urban annual load

Total phosphorus (TP) – 45% retention of the typical urban annual load

Total nitrogen (TN) - 45% retention of the typical urban annual load

To achieve the above, the Derwent Estuary Program Water Sensitive Urban Design principles is to be utilised.

Typically to meet BPEMG requirements if the development has up to 3-5% of total development area (40,000m^2), WSUD treatment such as wetland and raingardens will meet the water quality objects. This would result in a total treatment area of 1100m^2 -1900m^2 for the site. There are alternative treatment methodologies such as using propriety products. For the purposes of this report it has been assumed that this will satisfy local authority requirements.

7.7.5 Stormwater Quantity

It is assumed that the project will not cause increase flows to existing drainage assets based on the current condition, unless it can discharge directly to Derwent River.

Regatta Point proposes to discharge directly to Derwent River

Macquarie Point proposes to discharge to the existing drainage assets, as the current site is currently impervious there will not be increases in flow to the existing drainage infrastructure.

For the purposes of this report it has been assumed that these solutions will satisfy local authority requirements.

7.7.6 Proposed Infrastructure

The proposed drainage is shown in Figure 7-13 for each option.

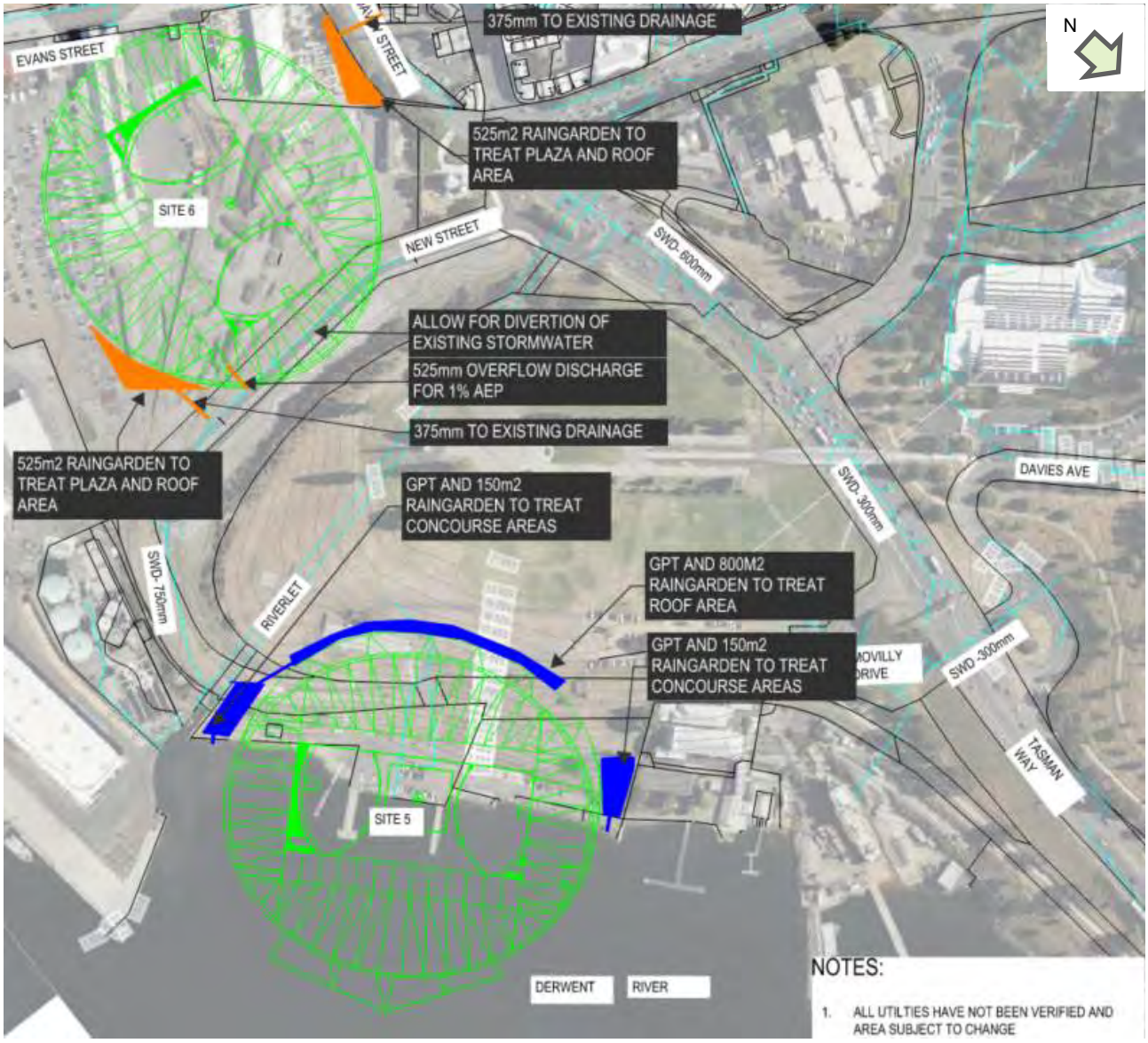


Figure 7-13 – Proposed Drainage Layout

The scope of drainage external to the stadium is shown in Table 7-2.

Table 7-2 Stormwater Proposed Scope of Works

Site	Scope
Regatta Point	New Gross Pollutant Trap to protect Derwent River from solids New 1100m2 bioretention basin to treat water quality from stadium New 30m long 450mm pipe to discharge to basin
Macquarie Point	New 45m long 525mm RCP to for major flow discharge to existing asset New gross pollutant trap to protect Derwent River from solids New 1100m2 bioretention basin to treat water quality from stadium New 30m long 450mm to discharge to basin New 25 long 525mm pipe to discharge major flow to existing asset.

7.7.7 Future Studies Recommended

It is recommended that AFL seek a legal point of discharge from City of Hobart to confirm assumptions of this report.

8 Structural Considerations

8.1 Structural assumptions

For the purposes of this report, it has been assumed that the bowl for the stadium will generally be the same for both sites. As discussed previously in this report, for comparison purposes we have used Marvel Stadium in Melbourne and Metricon Stadium in Queensland as reference for this Hobart stadium. We have assumed similar grid spacings and piling system as Marvel, to enable an indicative footing design to be developed for each of the sites. The seating bowl has been reduced to suit the assumed capacity of around 23,000.

For the purposes of determining the type, size and number of foundations we have assumed a grandstand profile as described elsewhere in this report, which yield the following for each of the sites:

Table 8-1 Stadium Column Assumption

Area	Number of Columns
GA section (wing and 2 ends)	180
Operational section (wing)	170
Playing surface (if suspended)	440
External “Town Square” concourse (if suspended)	34

Table 8-2 Stadium Core Assumption

Area	Number of Cores
Combined stair/lift cores in GA section (eg wing and 2 ends)	0
Combined stair/lift cores in Operational section (eg wing)	3
“Mega cores” in the stadium corners which support the moving roof	4

As noted elsewhere in this report, the stadium has been oriented to favour a north-south direction to optimise light onto the pitch should an ETFE fixed roof be adopted. The location of the Operational portion of the stadium footprint has been to typically locate this on the western side (to suit broadcasting requirements), with other back-of-house areas located to best suit the crossfalls that exist on each of the sites.

For the structural design of foundations for each site, significant geotechnical investigations and analysis will be required. For the purposes of this study, we have assumed a geotechnical profile across each of the sites as described below. We have assumed pad footings will be adopted over the use of piles where the geotechnical and cut profile conditions allow, i.e. where rock is expected near the base of the column/core.

8.2 Regatta Point

The layout Plan for Regatta Point Stadium is shown in Figure 8-1. The Stadium sections, wing to wing and goal to goal as shown in Figure 8-2 and Figure 8-3 respectively.

Figure 8-1 – Regatta Point Layout

Figure 8-2 – Regatta Point - Section A - Goal to Goal

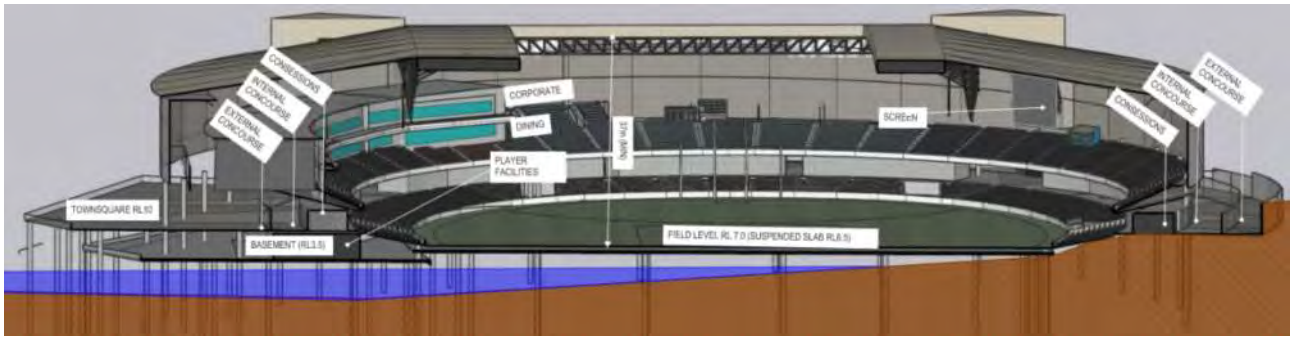


Figure 8-3 - Regatta Point - Section B - Wing to Wing

For this site the Operational areas would be more easily located on the north-east (river) side, to avoid the excess excavation into rock that would be required on the Cenotaph side. The side that is generally preferred for the Operational zone is the west, driven by broadcasting requirements with cameras not facing the sun. However, for a stadium with an operable roof this can be overcome by closing the roof. Shadow studies could be undertaken (based on Hobart's southerly latitude) to determine where cameras can be located to avoid direct sun.

8.2.1 Assumed Geotechnical profile

From the generic high-level information available it appears that the landside portion of this site consists predominantly of natural soils. For this study we have assumed that the top 5 metres consists of clay with a

bearing capacity of 200kPa, underlain by 5metres of highly weathered rippable rock with a bearing capacity of 400kPa. This rock is assumed to be underlain by sound dolerite with a bearing capacity of 1000kPa. It is assumed the piles would continue 2 metres into the sound dolerite, and due to the crossfall the landside piles could extend up to 3m above the ground. This means landside piles would be in the order of 15 metres long.

For the piles over water, we have assumed that the average depth of water is 8 metres, and an additional 3.5m of soft material exists above the clay. This means piles over water would be in the order of 27 metres long.

Based on this assumed profile, the footings under the stadium would consist of the following:

Table 8-3 Regatta Point Footing Quantities

Footing Type	Size	Number
Pad footing A	1.9 x 1.9 x 0.9D	16
Pad Footing B	2.7 x 2.7 x 1.4D	48
350 square Precast piles	15m length	410
350 square Precast piles	27m length	1240
Pile Caps including rafts under cores	Volume	1820m^3

8.2.2 Retaining Wall Requirements

A retaining wall will be required as shown in Figure 8-4 to allow a concourse set at RL10.

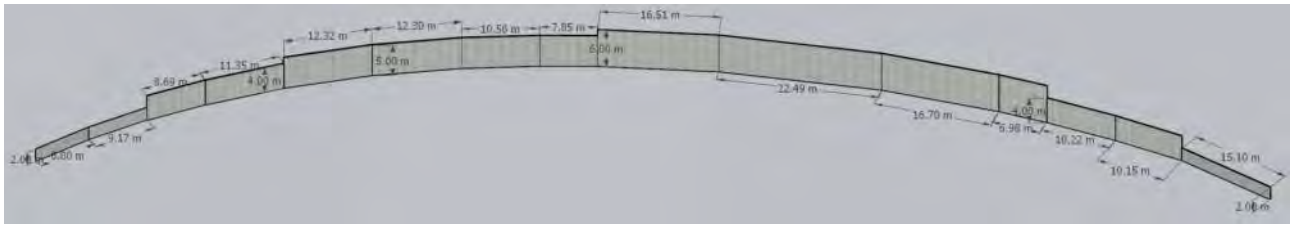


Figure 8-4 – Regatta Point Retaining Wall Extent

8.3 Macquarie Point

The Layout Plan for Macquarie Point Stadium is shown in Figure 8-5. The Stadium sections, wing to wing and goal to goal as shown in Figure 8-6 and Figure 8-7 respectively.

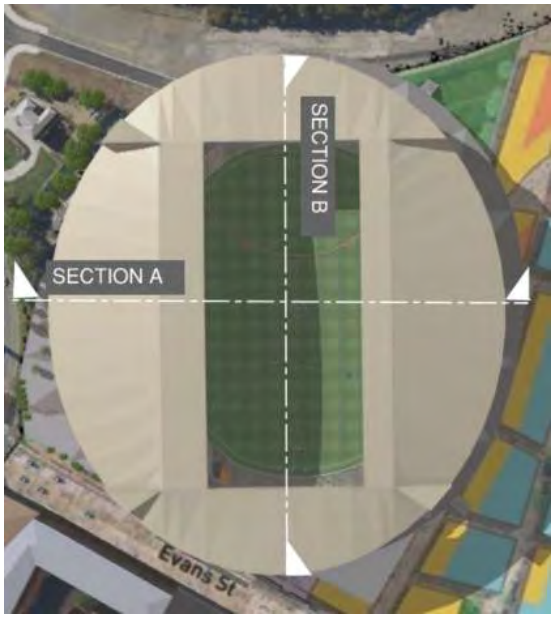


Figure 8-5 – Macquarie Point Layout

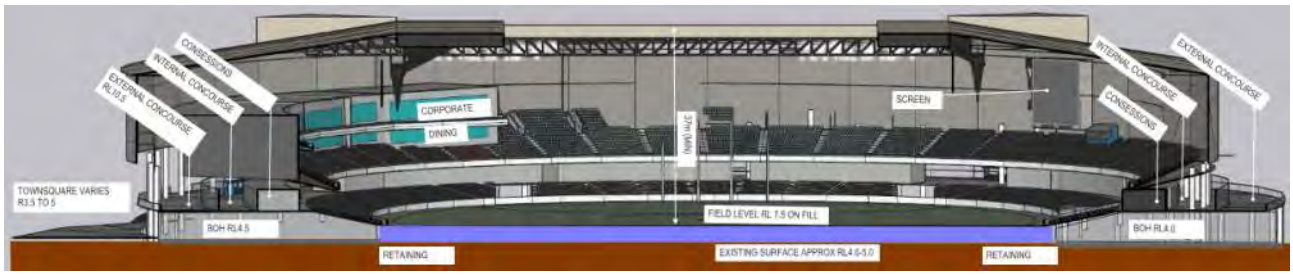


Figure 8-6 – Macquarie Point - Section A - Wing to Wing

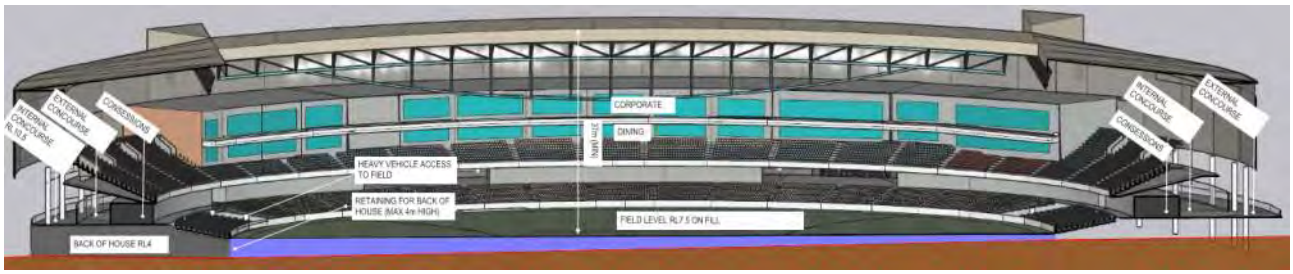


Figure 8-7 – Macquarie Point - Section B - Goal to Goal

For this site the Operational areas would be located on the traditional western side, which is the side that is generally preferred driven by broadcasting requirements with cameras not facing the sun. Some of the back-of-house areas are skewed towards the south to make use of the existing falls across this site. Due to the crossfall on this site a retaining wall or landscaped berm would be required on the western side.

Unlike Regatta Point the playing surface is assumed to be on grade for this site. This results in significantly less columns for the structure.

8.3.1 Assumed Geotechnical profile

From the generic high-level information available it appears that this site consists predominantly of fill and disturbed materials. For this study we have assumed that all columns will need to be supported on piles that are 20 metres long.

Based on this assumed profile, the footings under the stadium would consist of the following:

Table 8-4 Regatta Point Footing Quantities

Footing Type	Size	Number
Pad footing	N/A	N/A
350 square Precast piles	20m length	1130
Pile Caps including rafts under cores	Volume	1530m^3

8.3.2 Retaining Wall Requirements

The retaining wall extent for the Macquarie Point site which is required to retain the pitch and maximise the back of house area is show in Figure 8-8.

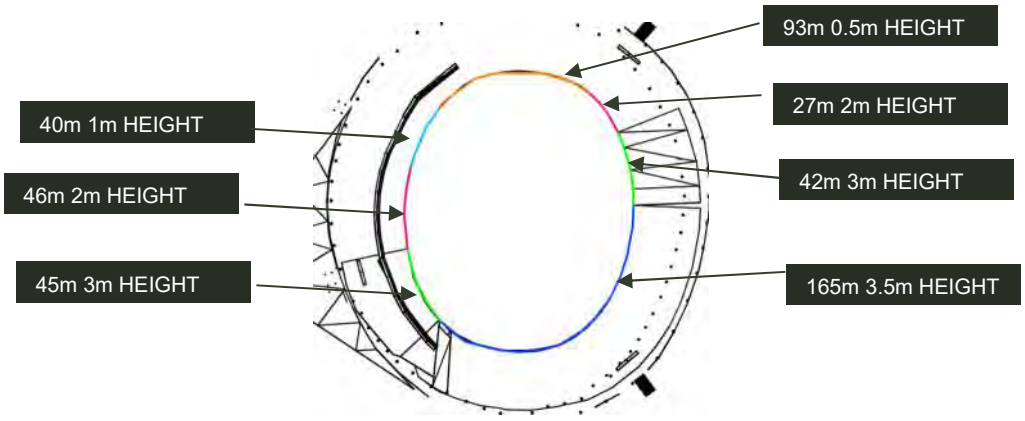


Figure 8-8 – Macquarie Point – Extent of Pitch Perimeter Retaining Wall

8.4 Greenfield Site Comparator

To enable an “extra over” cost for the site conditions to be established for each of the sites, the stadium footprint has been tested on a fictitious greenfield site, which has been assumed to be flat and have sound clay with a bearing capacity of 400kPa at the surface. For this site, all the structural loads would be supported on pad footings and the external plaza would be a slab-on-grade. The pitch for this site would also be on grade (ie not suspended), so there would be no “found space” associated with this design. No retaining walls would be required.

For this study, we have also assumed that the back-of-house and player facilities etc are located above ground, assuming the site is large enough to accommodate this.

To create the depression within the bowl such that the concourse is above the lower tier, the pitch and lower tier area would need to be excavated. The volume of cut required is included in the table below.

For this site, the required foundations and earthworks is shown in Table 8-5.

Table 8-5 Greenfields Comparison Quantities

Footing Type	Size	Number
Pad footing A	1.9 x 1.9 x 0.9D	176
Pad Footing B	2.7 x 2.7 x 1.2D	34
Pad Footing C	3.2 x 3.2 x 1.5D	17
Pad Footings under stair/lift cores	Total volume	700m^3
Pad Footings under mega corner cores	Total volume	2200m^3
Volume of clean soil cut to create the lower tier /pitch profile (Refer Figure 8-9)	Total volume	126,000m^3

Figure 8-9 – Greenfields Clean Soil Cut

9 Back of House Opportunities

For the Regatta Point site, the steep topography on the landside creates opportunities to locate back-of-house and carparking areas in the space generated between the lower seating tier and the concourse for approximately 65% of the stand. As part of this study, it has been assumed that areas for player facilities, kitchens, loading docks, changerooms, and media areas will utilise this undercroft space. For the Macquarie Point site this opportunity for undercroft space between the concourse and the natural surface exists for a similar proportion of the stand, noting that the headheight for this site will reduce as the ground floor slab will following the natural surface upwards to the north. Both sites generate approximately 14,000m^2 of space for back-of-house and carparking (or similar), as shown below:

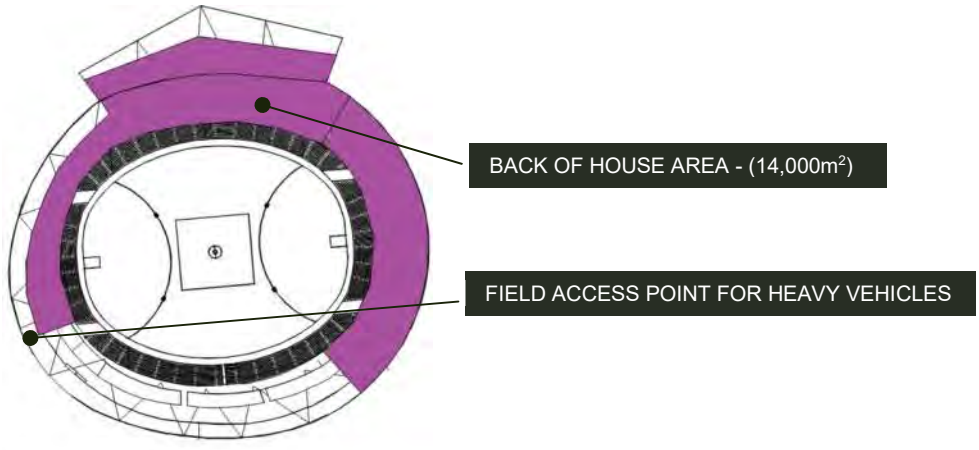


Figure 9-1 - Regatta Point

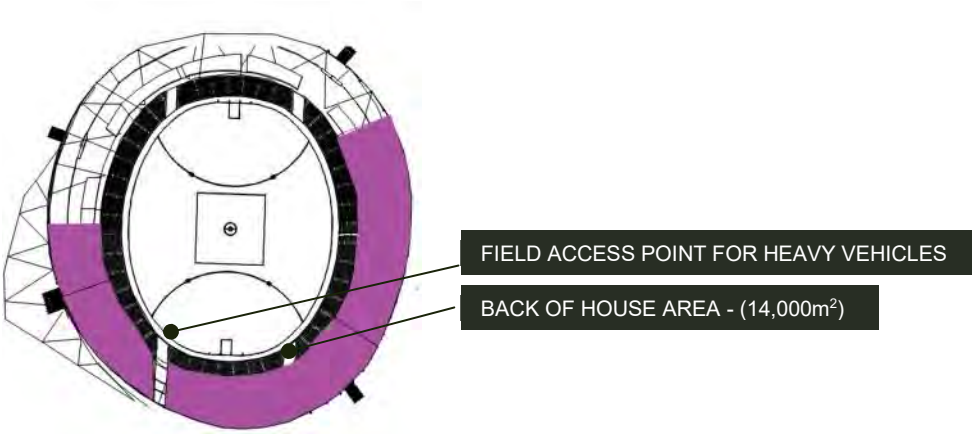


Figure 9-2 – Macquarie Point Site

10 Perimeter Concourse

Entry/exit gates will be required at multiple locations around the stadium. To enable access to these gates, and to provide the amenity expected of a modern stadium, it is expected that a perimeter external concourse will be included in the stadium design. The width of this concourse would be determined in the design phase of the project, but for this study we have assumed 10metres. This would need to be designed to accommodate fire safety vehicles and the like, similar to Marvel Stadium.

Figure 10-1 - External Concourse

11 Plaza/Meeting Space

All modern stadia need an inviting activated meeting place for patron to connect, congregate, and celebrate. Each of the sites has unique challenges when considering the ability to add such a plaza, so the structural issues associated with this have been included for separate costing, if applicable.

The appropriate size for the plaza would need to be established during the preliminary design of the stadium, but for the purposes of this report we have assumed a plaza similar in area to the external portion of the new Town Square currently under construction on the southern end of Marvel Stadium, which is 3,600m^2. The area would include the need for heavy overlay loads such as stages, crowd dancing, landscaping, etc, and the large vehicles that would be associated with this.

11.1 Regatta Point

To reflect the imagery that has been published previously on this site (and to maximise the opportunity this over-water site presents), we have assumed the proposed 3,600m^2 plaza for the Regatta Point site would be located on the eastern side, protruding out into the river.

For the purposes of this report, we have assumed the following layout for the plaza. This would be supported on piles. Visualisation of the Proposed Design is shown in Figure 11-1.

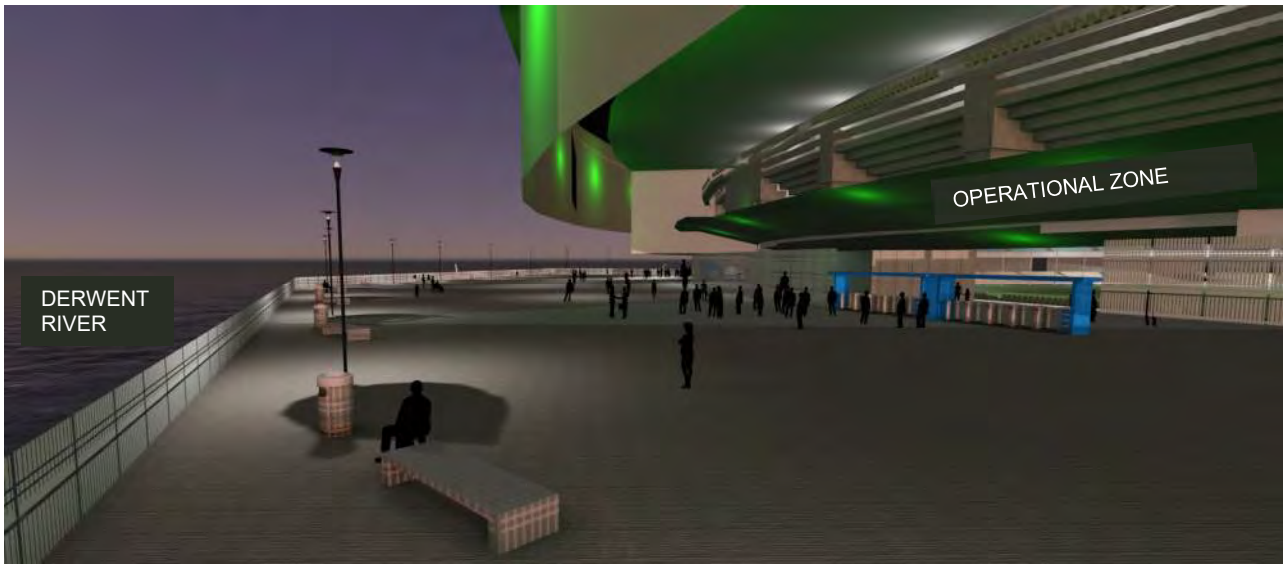


Figure 11-1 – Regatta Point - Plaza/Meeting Space

11.2 Macquarie Point

The plaza for the Macquarie Point site would be located on the southern side of the stadium, which is closest to the Hobart CBD. Due to the topography of this site, this 3,600m^2 plaza would be located as a slab-on-grade on the existing natural surface.

For the purposes of this report, we have assumed the layout for the plaza is shown in Figure 11-2.

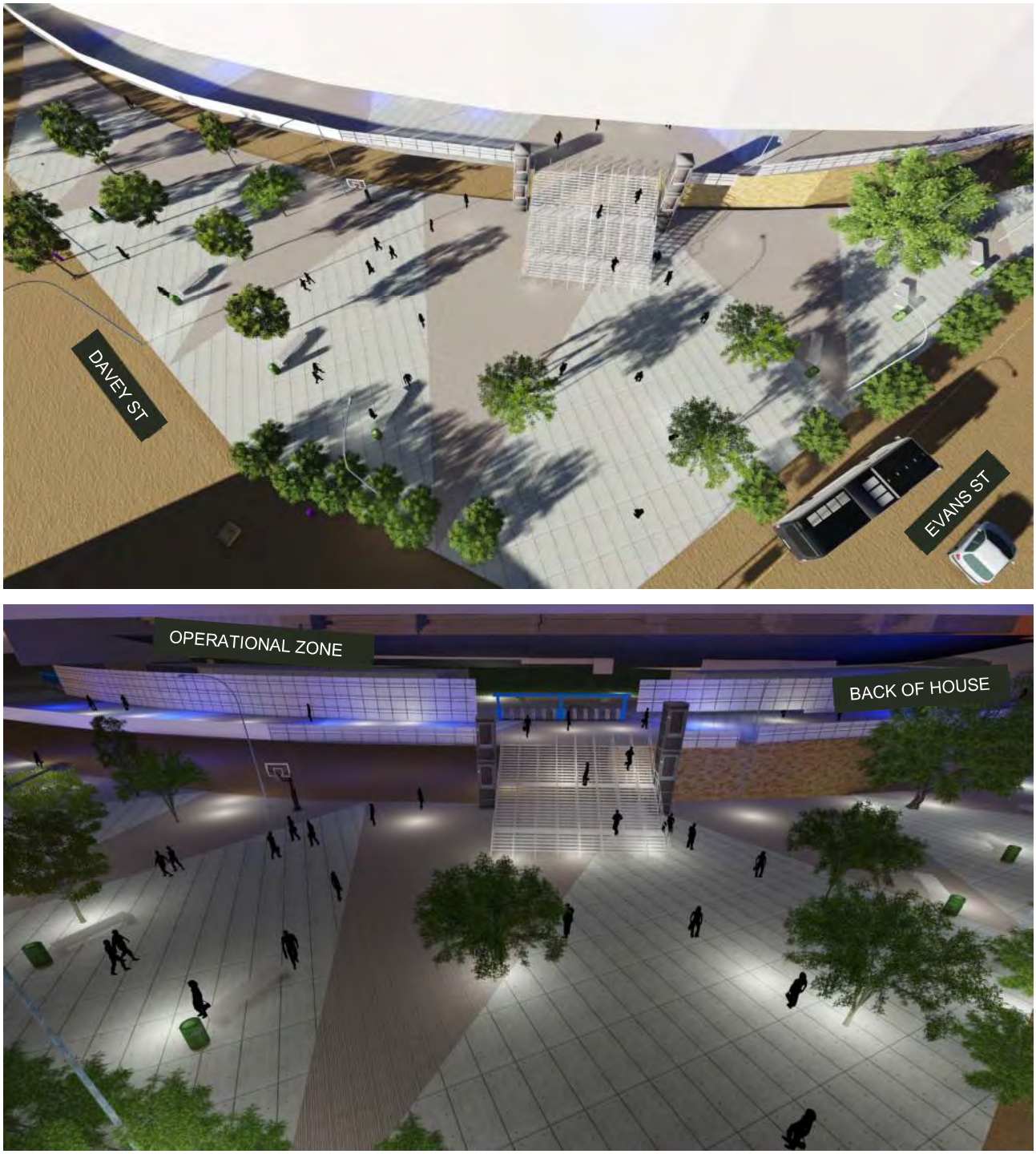


Figure 11-2 – Macquarie Point - Plaza/Meeting Space

12 Sensitivity of Results

To compile this study in the very limited amount of time available, a number of assumptions have been made to enable our team to proceed. During the course of this study, we have been questioned by the client group on the effect that some of these assumptions may have on the indicative costings that are being prepared in parallel by the Quantity Surveyor. The following provides some commentary on some of these issues.

12.1 Fixed vs Operable Roof

Some of the advantages and disadvantages of fixed vs operable roofs are included in Section 4.1. The overall weight of a fixed roof would be lighter than an operable roof covering an equivalent area. A detailed study would need to be undertaken to provide any justifiable assessment of this extra-over cost. In the author's opinion, based on a very crude assessment of the Marvel Stadium roof, around 350tonnes of structural steelwork may have been able to have been taken out of the Marvel Stadium roof if it were a fixed roof. This assumes the weight of the roof (and/or rigging loads) is the same as exists at Marvel Stadium.

In addition to the tonnage of structural steel saved, there is also the cost of the bogies, slide bearings, sensors, controls, electrics, control panels, etc that would be saved, as well as reduced ongoing operational costs and maintenance costs.

As each pile can carry over 150tonne, the difference in the cost of foundations for a fixed roof compared to an operable roof is negligible.

12.2 Effect of Roof on Turf (and walls)

To grow natural turf it is essential than the grass receives sunlight (real and/or artificial) and also that it experiences air movement across the surface. Marvel Stadium achieves this through a combination of opening the operable roof every day, and by the fact that a large percentage of the façade is open to allow air flow into the stadium through metal screens, openings at the gates, louvres and the like.

If a fixed ETFE style roof is envisaged, then significant openings in the walls around the perimeter of the stadium will be required to allow the air movement across the grass. A detailed study of the extent of the openings required is beyond the scope of this report, however an open concourse similar to the Metricon Stadium grandstand may need to be considered. If this arrangement is considered not suitable for the Hobart climate, then a perimeter façade with a large percentage of mechanically operated louvres should be considered.

12.3 GA vs Operational Grandstand Sections

As noted in our report, we have assumed that the cross section of the grandstand is a fairly basic General Admission (GA) arrangement for around 60% of the stadium and the more built-up Operational arrangement for around 40% of the stadium. The Operational portion of stadium includes space for function rooms, broadcasting facilities, and corporate areas, as well as back-of-house areas including kitchens, deliveries, team drop-off, player change rooms, media facilities, etc. The percentage of GA vs Operational footprint is important, as the total floor area constructed for each seat in the Operational zone may be in the order of 3-4 times that in the GA areas. With the higher level of fitout required the cost per seat in the Operational zones may be at least 5 times the cost per seat in the GA zone.

To enable an assessment of the costs associated with this assumption, we have reviewed the proportion of GA to Operational sections for Metricon Stadium and note that this is in the order of 70% GA and 30% Operational. Based on this 70/30 split, the number of footings required for the two sites are compared below.

Table 12-1 Regatta Point 70/30 Split

Footing Type	Size	Number
Pad footing A	1.9 x 1.9 x 0.9D	16
Pad Footing B	2.7 x 2.7 x 1.4D	48
350 square Precast piles	15m length	400
350 square Precast piles	27m length	1200
Pile Caps including rafts under cores	Volume	1800m^3

Table 12-2 Macquarie Point 70/30 Split

Footing Type	Size	Number
Pad footing	N/A	N/A
350 square Precast piles	20m length	1100
Pile Caps including rafts under cores	Volume	1500m^3

Table 12-3 Green Field Comparator 70/30 Split

Footing Type	Size	Number
Pad footing A	1.9 x 1.9 x 0.9D	179
Pad Footing B	2.7 x 2.7 x 1.2D	24
Pad Footing C	3.2 x 3.2 x 1.5D	12
Pad Footings under stair/lift cores	Total volume	700m^3
Pad Footings under mega corner cores	Total volume	2200m^3
Volume of clean soil cut to create the lower tier /pitch profile (Refer Figure 8-9)	Total volume	126,000m^3

13 Access from the CBD

A brand new stadium with a large capacity will provide an exclusive experience to the stadium spectators. However, the travel routes and accessibility to and from the stadium precinct is also vital to the spectators and in some ways affect their decisions of whether to visit the stadium or not. This high level assessment addresses the connections from the stadium site options to the wider precinct from the customer experience perspective and highlights the constraints and potential opportunities to enhance the entire spectator experience from a holistic view.

13.1 Event Size Comparison

Comparing the new stadium capacity to Hobart's largest festival, Dark Mofo Winter Feast, the new stadium's seating capacity of around 23,000 seats is similar to the Dark Mofo final night which had 23,000 people in year 2022. If the new stadium were to host eight AFL games a year, this would be equivalent to nine Dark Mofo final nights a year to manage.

To cater for such high demands several times annually may pose a challenge, and the customer journey is vital to providing a world-class sporting event experience. Among the customer journey, the last mile experience is identified between the local transport hubs and nearby attractions to the stadium, which is a key component to the customer journey and crowd planning.

13.2 Persona Profiles

To fully engage the site options from a transportation perspective and to investigate the opportunities and challenges in broader terms, a journey mapping process was conducted. Personas have been developed based on Hobart's population and demographic information, existing stadium operation, as well as the interstate travellers' needs. The development of the personas and their travel choices were also combined with current transport conditions and future visions. Three personas were developed with their specific needs, as identified in Figure 13-1:

Figure 13-1 - Journey Mapping: Persona Profiles

For Regatta Point and Macquarie Point, each persona was plotted with a unique last mile journey based on local knowledge and understanding of the surrounding sites. This provided visibility to the opportunities and constraints that each persona would encounter along their travel journey. The last mile journey maps for Regatta Point and Macquarie Point are presented in Figure 13-2 and Figure 13-3 respectively.

13.3 Journey Mapping & Constraints

Figure 13-2 - Last Mile Experience - Regatta Point

Figure 13-3 - Last Mile Experience - Macquarie Point

As shown in Figure 13-2 and Figure 13-3, several constraints are identified throughout the journey mapping exercise for both stadium sites:

- **Car Journeys:** for locals, the car-dominating travel behaviour in the daily movement is likely to remain for sporting events. Limited car parking space in the city and on the ground indicates that alternative public transport modes must be provided, particularly in the regional areas to support the stadium access/ exit.
- **Road Congestions:** as the Tasman Highway is the major access/ exit routes to both stadium sites, it is likely to experience traffic pressure, especially for turning movements to/ from the stadium locations.
- **Distance to Public Transport Hubs:** the public transport hubs (the existing Brook Street Pier, the bus interchange at Franklin Square and the potential Bus Transit Centre at City Hall are not within a 5 minute walking distance to either stadium site. This will create challenging conditions for patrons with restricted mobility and for people travelling during Hobart's winter weather conditions.
- **Lack of Park & Ride Facility at Ferry Terminal:** as alternative to the bus service, the existing and future ferry services provide another public transport mode to transfer the major demand. However, the limited park & ride facilities at the current Bellerive Pier limits its capacity to only serve patrons living local to the ferry terminal.
- **Support to Personal Mobility Devices**: Personal Mobility Devices (PMDs)/ e-scooters can be utilised to enhance the last mile experience. Though trials are in place in City of Hobart, it is possible that over time as their use increases, management measures such as geofencing may be implemented in highly pedestrian areas of the city, such as the waterfront. This may impact their viability as a last mile mode of transport to and from the stadiums. Furthermore, on-site management at a future stadium will also be required to control PMD parking, use in crowded spaces and availability post event.
- **Missing Pedestrian Connections:** Regatta Point is currently segregated from the CBD by the Tasman Highway, with several traffic junctions between Brooker Avenue and Tasman Highway, as well as the underpass at the Railway Roundabout which does not provide the most pleasant pedestrian connections. The existing overpass Bridge of Remembrance only provides the north – south connection to the Regatta Point, but no further connection to the CBD.
- **Safety Concerns:** there are areas in the CBD with poor lighting and wayfinding impacting the pedestrian experience for patrons choosing to walk between the city and stadium in the evening.
- **Food & Beverage Amenities:** apart from the food and beverage amenities between Hunter Street and Evan Street, there are no bars or restaurants near both stadium sites.

13.4 Opportunities

With an understanding of the situations through the journey mapping exercise detailed above, several opportunities are identified in Figure 13-4 to improve the last mile experience, with high-level suggestions listed below. Although these routes or areas do not fall within the jurisdiction of the ground management, they are key to create the comfortable, convenient and safe arrival and departure of spectators, therefore vital to the planning and decision-making of the stadium sites.

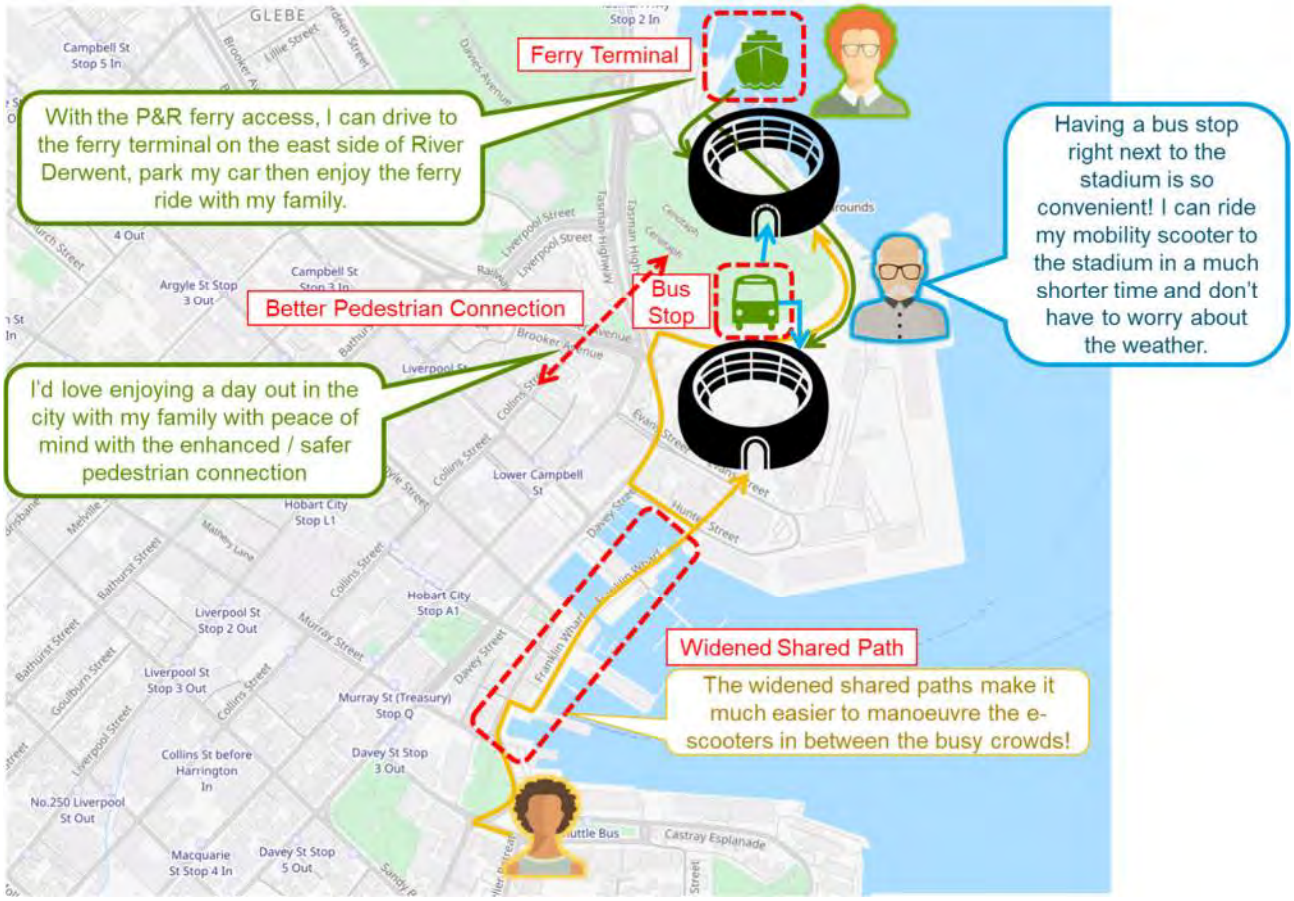


Figure 13-4 - Last Mile Experience: Opportunities

Reduce Car Dependency / Alternative Travel Modes

- A shuttle bus service is highly recommended, with the bus stop being located as close to the stadium sites as possible. Sufficient waiting space and weather-proof facilities are vital to cater for the ingress and egress passenger movements.
- A ferry terminal is proposed at Regatta point, to provide shuttle ferry services to the existing ferry terminal Bellerive, with future possibility to extend to Sandy Bay, Kingston, Claremont and Bridgewater. Similarly, to the shuttle bus stop, sufficient waiting space and weather-proof facilities are highly recommended.
- For both shuttle services, it is advised to provide Park + Ride facilities such as car parking and weatherproof facilities in the suburbs (either permanent or temporary to service an event), this will encourage people to use public transport when travelling to and from the stadium, minimising traffic and parking impacts in the Hobart CBD.
- Supplementary to the shuttle service, designated spaces are proposed for taxi / uber services as well as drop off and pick up bays.

Key Traffic Management

- Key access roads such as Tasman Highway should be carefully managed, with temporary traffic management plans developed for both the construction stage and stadium operation stage. The turning movements to/ from the stadium sites need to be further investigated to ensure that the key traffic routes are functioning appropriately during construction and on an event day.

Enhance Pedestrian Links

- Additional pedestrian connections such as an overpass or underpass are proposed between Regatta point to the CBD, to provide enhanced pedestrian connectivity between the CBD and the waterfront.
- Key footpaths/ shared paths between the Hobart CBD and stadiums may need to be widened to cater for high patron movements on event days, with sufficient space for PMD movements and pedestrian circulation.
- Clear wayfinding and sufficient lighting will enhance the connectivity and safety, which improves the traveller's experience.

Create 24/7 Attractions / Access

- Additional food and beverage amenities are proposed to be within proximity to the stadium, to encourage higher activity levels in the area before/ after events and on non-event days.

13.5 Further Integrated Traffic and Mobility Studies

The commentary above is the result of a quick assessment to identify some of the transport issues associated with locating a stadium near the Hobart CBD. It identifies that additional work should be undertaken to identify the allied work that should be undertaken in parallel with the stadium project, to ensure the stadium is successfully embraced by Tasmanian locals and visitors alike.

13.6 Allied Opportunities

The following image in Figure 13-5 identifies some of the potential opportunities to bring government and private sector development in and around the precinct to deliver a cohesive and responsive placemaking outcome. The stadium can be the catalyst to lasting legacy for the future of Hobart.

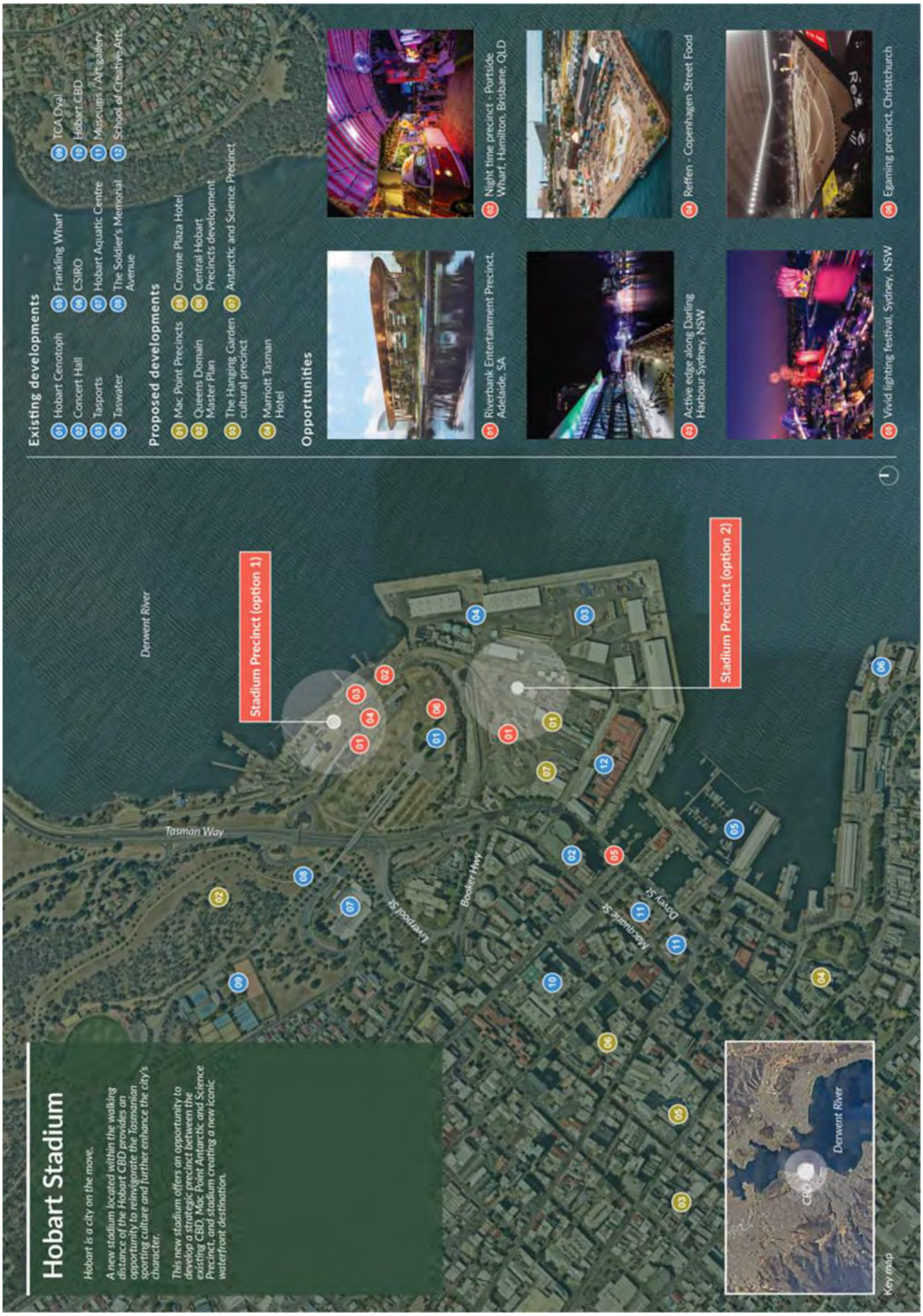


Figure 13-5 - Development Opportunities

14 Summary

This report has been prepared in response to a request from AFL for Aurecon to further investigate the relative merits of two possible sites for a stadium in Hobart, focussing primarily on the below-ground technical issues that are particular to each individual site. It is envisaged that the above-ground stadium would be similar for each site. The aim of this investigation is therefore to identify the technical issues that are unique to each of these sites, so that indicative costs associated with these issues can be determined for the purposes of comparison.

To achieve this in a compressed timeframe, numerous assumptions have been made about the configuration of the grandstands, roof types, concourse locations, broadcasting and BOH requirements, etc. The validity of these assumptions will need to be tested in the Feasibility Study/Concept Design phase of the project

In response to the request from AFL, Aurecon have undertaken a desktop study of inground utilities and infrastructure required to service the facility, as well as the earthworks and structural foundations that are likely to be required at each of the two sites. The key findings as they relate to the two sites have been collated in the Executive Summary at the start of this report, and more detail on each of these items can be found in the body of this report.

A pictorial summary for the two sites is also included in Figure 14-1 and Figure 14-2.

During the course of this project, we identified that the arrival and departure of over 20,000 people to the events at the stadium will challenge the existing transport infrastructure. Whilst not within the scope of this study, we have included a section that discusses some of the issues that will need to be addressed. This is presented in a graphical format by considering a “Journey Map” for different people within the community that will attend the stadium. Should the stadium development proceed, State Growth Tasmania will need to consider the improvements that may need to be made to the existing transport infrastructure. We have also considered how the experience of an event at the stadium by visitors to Hobart would feel. In this section of this report (section 13) we have also referenced potential development opportunities a stadium in Hobart would afford the surrounding precinct.

Figure 14-1 - Regatta Point summary

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PROPOSED

1. Existing McVilly Drive to be extended to provide access to site
2. Heavy vehicle access to field level off McVilly Drive
3. Field level to be suspended above water
4. General Admission zone on city side, cut into existing hill
5. Media, corporate, player change and Operational areas suspended over river
6. 1 level of basement under concourse
7. 3600m² plaza/meeting place
8. Roof to be located 37m above field level
9. Sewerage connection to existing sewer treatment plant
10. Stormwater to be treated before discharging to Derwent River
11. Gas connection
12. Electrical connection

EXISTING

13. Access from Airport from Tasman Highway
14. Hobart Cenotaph
15. Heritage rivulet that conveys stormwater below Hobart City
16. Mac Point sewerage treatment plant to be relocated by TasWater in coming years
17. Macquarie Wharf planned upgrade (TBD)
18. Planned Macquarie Point precinct (TBD)
19. Current primary pedestrian pathway form city along Davey Street and Tasman Highway
20. Secondary primary pedstrian route along river edge through future Macquarie Point precinct
21. Salamanca markets
22. Townhall
23. Ferry to Mona
24. Soil expected to be mainly natural clay and rock

Figure 14-2 - Macquarie Point summary

aurecon

PROPOSED

1. Existing Evans Street to provide primary access to stadium including player bus drop off
2. Heavy vehicle access to field level off Evans Street
3. Field to be supported off existing soil
4. General Admission area on eastern side
5. Media, corporate, player change and Operational areason western side
6. 1 level of basement back of house under concourse
7. 3600m² plaza/meeting place
8. Roof to be located 37m above field level
9. 1050mm dia sewer main to be diverted
10. Stormwater to be treated before discharging to Derwent River
11. Gas connection
12. Electrical connection

EXISTING

13. Access from Airport from Tasman Highway
14. Hobart Cenotaph
15. Heritage rivulet that conveys stormwater below Hobart City
16. Mac point sewrage treatment plant to be relocated by TasWater (TBD)
17. Macquarie Wharf planned upgrade (TBD)
18. Planned Macquarie Point precinct (TBD)
19. Current primary pedestrian pathway form city along Davey Street and Tasman Highway
20. Secondary primary pedstrian route along river edge through future Macquarie Point precinct
21. Existing road to be diverted
22. Soil expected to be mainly fill/reclaimed land

15 Reference Material

This report has been prepared with reference to the following. Due to the size of these documents they have not been appended, but are available upon request:

Dial before you Dig request made 15th June 2022

LISTdata Open Data (thelist.tas.gov.au) downloaded on 17th June 2022.

Macquarie Point Strategic Framework and Master Plan 2015 – 2030

Macquarie Wharf Redevelopment ECI Documentation

Estuarine Habitat Mapping in the Derwent – 2007, A resurvey of Marine Habitats by SeaMap Tasmaina

Hobart Stadium Site Selection Process by MCS Management and Philip Lighton Architects 25th Feb 2022

Macquarie Point Development Corporation Contaminated Land Audit Report- Area 4 West by Coffey 24th September 2020

Macquarie Point Development Corporation Contaminated Land Audit Report- Area 1 by Coffey 5th June 2019

Macquarie Point Site Remediation Strategy – Report by Aecom dated 17th March 2015

Urban Geological Mapping Project Report 1 Engineering Geology of Greater Hobart Area dated 1991

16 Qualifications

Due to the confidential nature of this project contacting authorities about the direct potential development was not undertaken and is subject to agreement with the AFL for any potential communications with authorities. Any additional information that is obtained for the three sites should be forwarded to Aurecon for review, as this may conflict with the outcomes of this report.

This report is to be considered as a high-level review only. Due to the limited time available information obtained has not been verified, and key information may not have been provided to us. This report has been prepared to enable an indicative relative costing to be prepared by the QS.

Scope limited to Desktop Assessment study only of the following information:

- Dial before you Dig
- Authority GIS data

Aurecon, in preparation of the report will not take any responsibility for the reliability of the documentation provided to it, by the State, the project Stakeholders, and information freely sourced from various websites on line. The report will assume any data sourced on the internet of provided to it by the State or the project stakeholders is accurate, complete, and adequate.

No design has been undertaken for the future upgrades as part of these works, we have used industry baseline of similar Stadium style footprints to identify potential upgrade requirements.

DBYD and other publicly available information has been relied solely for this report for the proposed development site. This is advice that may be out of date and requires further validation for any design progression.

The scope does not include condition assessment of existing utilities.

The advice forming part of this engagement is exclusively for the use of AFL and cannot be relied upon by others. The findings, observations and conclusions expressed by Aurecon in this report will not be, and should not be considered as, an opinion concerning the commercial feasibility of the property or asset.

The owner or prospective purchaser of an existing property or asset necessarily assumes the risk of there being defects inherent in the asset. An engineer's report can assist an owner or prospective purchaser to assess risk but does not eliminate that risk.

A report of this nature is not a certification, warranty, or guarantee.

Any opinion/estimate of costs by Aurecon will be made on the basis of Aurecon’s experience and qualifications and will represent Aurecon’s judgement as an experienced and qualified professional engineer, familiar with the construction industry. However, Aurecon has no control over the cost of labour, materials, equipment, or services furnished by others or over Contractors' methods of determining prices or over competitive bidding or market conditions. Therefore, Aurecon cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from Aurecon’s estimates/opinions of costs, and the AFL are advised to make your own assessment on the opinions of costs presented by Aurecon.

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