# INTEGRATED STORMWATER MANAGEMENT PLAN

CLAYTON BUSINESS PARK
7 SEPTEMBER 2023

PREPARED FOR GOODMAN

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# 1. INTRODUCTION

Spiire have been engaged by Goodman Property Services (Aust) Pty Ltd to prepare an Integrated Water Management (IWM) Plan for Clayton Business Park.

This document builds on the planning approach outlined in the Integrated Water Management (IWM) Framework for Victoria (DELWP, August 2017) by investigating and identifying opportunities to implement IWM within the site based on water management authorities' strategies and policies. Specifically, the document has been prepared in line with City of Kingston's Civil Design Requirements for Developers – Part A: Integrated Stormwater Management (City of Kingston, 2018).

The requirements of Civil Design Requirements for Developers – Part A: Integrated Stormwater Management got as large scale site are outlined in Table 1, as well as where in this document that requirement has been addressed.

**Table 1. Civil Design Requirements**

| Type of Development | Application Requirements | Section |
|---|---|---|
| **Large Scale**<br>• Residential and/or mixed use developments of 10 or more dwellings<br>• Non-residential developments with new building gross floor area and / or an increase in impervious aera greater than 1,00m$^2$<br>• Subdivision of vacant land greater than 4,999m$^2$<br>• Subdivision of land involving public road networks or public open space as determined by Council | • A satisfactorily completed Application for Drainage/Civil Approval and Drainage Declaration Forms explaining: | |
| | ○ Compliance with conditions specified in planning permit | TBA |
| | ○ Compliance of all private stormwater drainage with Plumbing and Drainage AS/NZS 3500.3:2015 | |
| | ○ How protection of inundation of buildings, garages or carports from overland flow caused by 1 in 100 year storm events is achieved. | 5 |
| | ○ How stormwater discharge onto adjoining properties is prevented. | 5.3 |
| | ○ Compliance with City of Kingston permissible site discharge | 5.3.1 |
| | ○ Compliance with required on site storage volumes | 5.3.1 |
| | ○ Public drainage assets designed in compliance with Part B | |
| | ○ How best practice Water Sensitive Urban Design requirements are achieved and /OR partial or full contribution to Stormwater Quality Offset scheme | 6, 7 and 7.1 |
| | • An Integrated Water Management Plan (IWMP) including a Water Sensitive Urban Design Response | This Report |
| | • A MUSIC program output demonstrating how WSUD requirements have been achieved. | Provided with this Report |

## 2. BACKGROUND

Clayton Business Park is a 31ha brownfield site located in Clayton South owned and managed by Goodman Australia Limited (Goodman). The site features declining industrial uses and infrastructure no longer supporting the needs of businesses in the region. The adjacent to Westall Station and has frontage to two key industrial roads: Centre Road and Westall Road. The site vicinity is shown in Figure 1.

The general grade of the site is from the north-west to south-east with large industrial and commercial based on flat pads creating benching across the site. The low point in the south-eastern quadrant on the eastern boundary of the site is aligned with the Westall Road stormwater culverts.

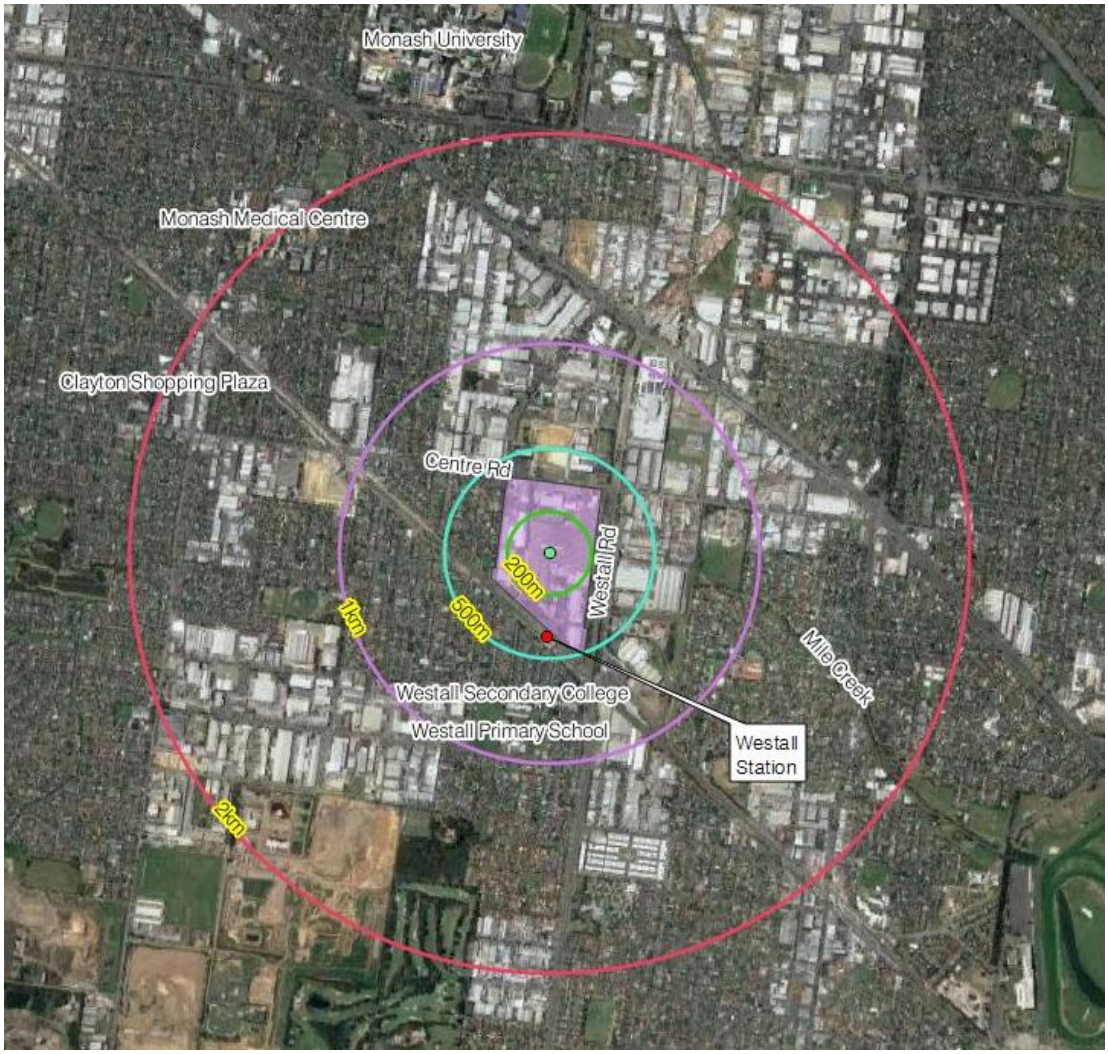



**Figure 1: Site Vicinity Map**

## 2.1 PREVIOUS WORKS

The Victorian Planning Authority (VPA) together with Goodman and City of Kingston previously produced a Comprehensive Development Plan in 2018 for the site to inform the future land use and redevelopment of the site. Clayton Business Park was one of the key strategic sites within the Monash National Employment and Innovation Cluster and is identified in the City of Kingston Industrial Strategy.

As a part of these works, an Integrated Stormwater Drainage Strategy (March 2020) was developed for the site. This included specific stakeholder engagement with a range of authorities, including:

- City of Kingston
- Victorian Planning Authority
- Goodman
- South East Water
- Water Sensitive Cities CRC
- Aurecon – ESD Consultant
- Group GSA – Open Space Planner



The outputs from the engagement set the scene and priority for Integrated Water Management within the site and form the basis of this report. From the engagement, three different objective levels were developed:

- Base Case – setting minimum standard for delivery of IWM principles
- Good Case – setting a mid-level standard for the delivery of IWM principles
- Aspirational Case - setting an industry leading level standard for the delivery of IWM principles

These works identified that major drainage and flood management were the two key constraints to developing the site and would inform the future urban structure. This report is particularly focussed on addressing those two elements of water cycle management.

## 2.2 PROPOSED DEVELOPMENT

The proposed development plan for the renewal of the Clayton Business Park is shown in Figure 2. This plan includes several large warehouses, similar to the existing site, with appropriate carparks and hardstands to service the area. A key feature of the development plan is the green spine, running north to south through the site.

The total development area is approximately 24.8ha.


**Figure 2: Proposed Development Plan**

# 3. IWM POLICY AND STRATEGIC CONTEXT

The Victorian Government is committed to realising the enhanced outcomes for the water cycle that can be achieved through taking a collaborative IWM planning approach to development areas and infrastructure planning. *Water for Victoria* sets the strategic direction, the *Integrated Water Management Framework for Victoria* outlines the structure to facilitate collaboration, and the *Strategic Directions Statements* are the foundational product of the collaboration.

Individual organisations also develop policies and strategies that contribute to the IWM body of knowledge and, provide context in setting the strategic direction of collaborative IWM planning. The City of Kingston are a recognised leader in the Integrated Water Management discipline, providing clear direction and options to developers for delivering improved water cycle outcomes.

## 3.1 KEY STAKEHOLDERS

The water sector in Victoria is made up of various service providers and authorities established to enable policy, regulation, and service delivery. However, stakeholders in IWM are broader than just these authorities.

The key stakeholders who have an interest in IWM within the Clayton region are listed in Table 2, along with their roles in IWM planning. In conjunction with this, the table contains relevant documents and policies to each stakeholder.

**Table 2: Key Stakeholders and Relevant Policies**

| Organisation / Stakeholder | Role | Main documents / Policies |
|---|---|---|
| Bunurong Land Council Aboriginal Corporation | Statutory authority. Bunurong Land Council Aboriginal Corporation, is an organisation under Registered Aboriginal Party (RAP). This authority has responsibilities for the protection and management of Aboriginal cultural heritage and engages with a large variety of stakeholders including the development industry, local government, state government, and state government agencies. | |
| City of Kingston | Local governing body. Council has set out the planning conditions for the site including the requirements for IWM planning. | *Our Local Water Ways: Kingston's Integrated Water Strategy (2022)*<br>*Civil Design Requirements for Developers – Part A: Integrated Stormwater Management (2018)* |
| Department of Environment, Energy and Climate Action (DECCA) | DECCA works in partnership with agencies and stakeholders 'to maximise connections between the environment, community, industry and economy'. The Department is responsible for aligning the strategic planning of all agencies in is responsible for both land use and water cycle planning in accordance with policy. | *Dandenong Catchment Integrated Water Management Plan (2022)*<br>*Central and Gippsland Region Sustainable Water Strategy (2022)*<br>*Dandenong IWM Forum Strategic Directions Statement (2018)*<br>*Plan Melbourne (2016)*<br>*Water for Victoria (2016)* |
| Environmental Protection Authority (EPA) | State authority with respect to environmental protection. The regulator is an independent statutory authority, established under the Environment Protection Act 1970 to prevent and reduce harmful effects to the environment | *EPA Act 1970*<br>*Environment Protection Amendment Act (2021)*<br>*Urban stormwater management guidance (2021)* |
| Goodman | Goodman is a specialist global industrial property group. They own, develop and manage high-quality, sustainable properties that are close to consumers and provide essential infrastructure for the digital economy. | |
| Melbourne Water | MWC is the caretaker for waterways in the Port Phillip and Westernport regions. A key objective of this authority is the protection and improvement of waterways on behalf of the community.<br>MWC is also the regional drainage and flood plain authority within the Western Port catchment and any modifications to the regional drainage or flood plains requires their approval. | *Greater Melbourne Urban Water & System Strategy: Water for Life (2023)*<br>*Healthy Waterways Strategy (2018)*<br>*Melbourne Sewerage Strategy (2018))* |
| South East Water | South East Water is the water and sewerage service provider across the region. | *Greater Melbourne Urban Water & System Strategy: Water for Life (2023)* |
| Victorian Planning Authority (VPA) | The VPA is responsible for precinct structure planning in Victoria's Growth Areas and coordination of agencies to deliver integrated land use planning that aims to provide affordable housing, job creation and development. | |

## 3.2 INTEGRATED WATER MANAGEMENT FRAMEWORK FOR VICTORIA

Integrated water management involves a coordinated approach to water management in collaboration with key water stakeholders. It also extends to those able to affect and enable urban design, natural resource management, land-use planning, and economic development. An IWM approach has the potential to provide greater value to our communities by identifying and leveraging opportunities to optimise the outcomes of water cycle planning and management.

The Integrated Water Management Framework for Victoria provides guidance aimed at helping government, the water sector, and the community in working together to "provide a consistent process for collaborative integrated water management planning with clear roles and responsibilities to deliver effective urban water management, including water supply, wastewater, flood resilience, urban waterway health and management of public spaces".

The IWM Framework for Victoria outlines expectations for IWM Forums and IWM Plans.

## 3.3 DANDENONG IWM FORUM STRATEGIC DIRECTIONS STATEMENT

The Dandenong IWM Forum was the first convened out of *Water for Victoria* in December 2017. The Strategic Directions Statement document outlines the Stakeholders' (20 organisations) shared goals and drivers for IWM across Dandenong region, committing the Forum to a vision:

*By valuing water in its entirety, the Dandenong catchment is a well-planned, healthy, resilient and thriving environment for people and nature – now and into the future*

The Forum's seven strategic outcomes for IWM best summarise the documents' aims in the Table 1 below:

**Table 1: The forum's seven strategic outcomes for IWM**

| Outcome | Further Description |
|---|---|
| Safe, secure and affordable supplies in an uncertain future  | A diverse range of fit for purpose water supplies and resources are utilised.<br>Water quality meets regulatory standards and community expectations.<br>Efficiently managed water and demand.<br>Secure fit for purpose water supply for industry and economy.<br>Water available to maintain valued green community assets. |

| Outcome | Further Description |
|---|---|
| Effective and affordable wastewater systems  | Meets public health and environmental standards.<br>Effective innovative, best practice sewerage systems for both septic and non-septic systems.<br>Optimised and managed onsite domestic systems.<br>Waste-to-resource opportunities are maximised.<br>A risk-based approach to sewerage and wastewater management adopted. |
| Existing and future flood risks are managed to maximise outcomes for the community  | Appropriate levels of flood protection in urban areas.<br>Community and property resilient to local flood risk.<br>Resilient urban and natural environments.<br>Flooding is managed to support environmental values.<br>Floodplains are managed to support aquatic ecosystems. |
| Healthy and valued waterways and marine environments  | Impacts from urban, peri urban, industrial, business and transport activities are mitigated close to the source to protect our waterways and bays.<br>Water quality at the bays supports active and passive recreation.<br>Remnant higher stream values and habitats are rehabilitated and protected.<br>Reduced nutrient and sediment discharges to aquifers, waterways and bays.<br>Wetlands and other aquatic ecosystems are enhanced with sustainable populations of macroinvertebrates, iconic fish, bird and frog species, and platypus.<br>Traditional Owner and Aboriginal values, knowledge and practices are integrated and protected in waterway management and planning and embraced collectively.<br>The waterways, wetlands and floodplains provide a secure bio-link with a range of habitats resilient to changes in condition and climate. |

| Outcome | Further Description |
|---|---|
| Healthy and valued urban and rural landscapes | Aboriginal cultural values associated with urban landscapes and waterways are protected.<br>Urban landscapes are supported by water to retain moisture for cooler, greener cities and towns.<br>Waterways and coastal environments accessible as valuable open space.<br>Active and passive recreation supported by fi t for purpose water.<br>The waterways, wetlands and floodplains are inviting places that are connected, accessible and interconnected for public enjoyment and amenity.<br>Waterways form the basis for an interconnected network of natural spaces where biodiversity is connected and resilient, and people can connect with nature.<br>Riparian zones and floodplains within the catchment continue to increase and expand the quality and connection of indigenous vegetation. |
| Community values are reflected in place-based planning | Diverse urban landscapes that enhance local conditions and add value to community liveability.<br>Exemplary leadership enables informed, engaged and an empowered community who value water and connect with water environs.<br>Local water related risks and issues understood and managed on a catchment scale.<br>Empowered and engaged community who actively participate in collaborative decision-making.<br>Place-based planning considers and integrates urban stormwater runoff and retention to protect waterways, enhance groundwater systems and support urban landscapes. |
| Diverse jobs, economic benefits and innovation | Jobs and economic growth supported by water.<br>Innovative planning and operation.<br>Strong governance, collaboration and performance.<br>Empowered key industry groups to enable good water cycle management through improved business practices.<br>Actions in Water for Victoria 2017 with specific regard to Traditional Owner and Aboriginal consultation, engagement, employment and economic development have been comprehensively implemented.<br>Improved business water practices provide new opportunities for jobs and economic growth. |

## 3.4 KINGSTON'S INTEGRATED WATER STORY: THE FULL PICTURE

Kingston's Integrated Water Story, and subsequent strategy, outlines the water management direction of the council, what the council will do and what actions the community can take. The Strategy includes a vision:

*To become a 'Water Sensitive City'. A place where healthy waterways are valued, and our community is engaged in making wise choices about water. A place where our built and natural environments are in harmony.*

Four broad objectives are outlined:

- Strategic Objective 1: Use our water wisely
- Strategic Objective 2: Protect our waterways and bay from pollution
- Strategic Objective 3: Improve our flood management
- Strategic Objective 4: Enhance our education, engagement and partnerships

The City of Kingston through this strategy have been proactive. The impacts of growth and climate change have been modelled and a plan to mitigate those impacts identified. In particular, the strategy outlines the Developer Contributions initiative, whereby Kingston Council offers flexible options for developers to meet stormwater quality obligations. Under this scheme, developers may pay council a fixed in-lieu contribution to a Kingston Council fund to construct larger and more cost effective treatment and reuse projects.

## 3.5 GREATER MELBOURNE URBAN WATER & SYSTEM STRATEGY: WATER FOR LIFE (2023)

The Greater Melbourne Urban Water and System Strategy (GMUSS) is a 50 year strategy water security strategy developed by Melbourne's water corporations, Greater Western Water, Melbourne Water, South East Water and Yarra Valley Water. The strategy outlines the proposed approach of water corporations to provide Greater Melbourne with a secure and sustainable water supply.

The strategy's primary focus is to:

- Ensure a secure and sustainable water supply

This is supported by three complementary focus areas:

- Equitably and affordably meeting diverse water needs
- Ensuring healthy people and healthy environment
- Meaningful partnerships, engagement and education



Over the next 50 years, Melbourne may need to double its water supply system, adding an average of 12 GL of water each year. Options are presented in three themes, supply system augmentations, water efficiency solutions and Integrated Water Management solutions. The GMUWSS acknowledges that a multiple opportunities will need to be pursued, and that all water resources need to be considered including surface water, desalinated water, stormwater and recycled water.

The GMUWSS identifies an action to lead system scale stormwater management and invest in stormwater harvesting trials for environmental flows or potable use.

## 3.6 HEALTHY WATERWAYS STRATEGY

The Healthy Waterways Strategy (HWS) is a collaborative document developed with an extensive list of partners and stakeholders. Developed in 2018, the Strategy aims to reduce the effects of urban development by setting targets for the reduction of urban volumes to waterways and bays. The main themes are centred on: reducing water quality and volume impacts and establishing water reuse systems that benefit the whole water cycle.

The document identifies the Clayton Business Park Precinct and its downstream waterway Mile Creek as part of the non-priority waterway area. For the Melbourne City annual rainfall band, a harvesting target of 1.6 ML/ha of imperviousness and an infiltration target of 0.5 ML/ha of imperviousness is outlined.

Other goals outlined in the Healthy Waterways Strategy relevant for the Clayton Business Park region include:

- Management of the catchment is integrated and includes the whole water cycle.
- Impacts from urban, peri urban, industrial and transport activities are mitigated to protect our waterways and the Bay.

# 4. WATER CYCLE SERVICING

## 4.1 POTABLE WATER SUPPLY

Potable water services for the Clayton Business Park are provided by South East Water, with water supplied from the Yarra-Thomson Pool and the Victorian Desalination Plant, through connections surrounding the precinct, See Figure 3. The water security of the region is a challenge into the medium term with a desalination plant augmentation proposed to support medium water security and a new desalination plant and/or IWM solutions to provide long term water security.

To minimise the reliance on potable water the development proposes a number of water saving initiatives, which are further outlined in Section 6.




**Figure 3. Potable water infrastructure servicing Clayton Business Park**

## 4.2 SEWAGE MANAGEMENT

Sewage management services are also provided by South East Water, with sewage collected and treated at the Melbourne Water operated Eastern Treatment Plant, to the south of the precinct in Carrum. This treatment plant recycles a significant volume of the sewage it manages, providing Class A recycled water for South East Water urban customers and for agriculture. Excess recycled water is discharged to Bass Strait through an outfall at Boag Rocks.

Two main sewerage lines are located near the site, as shown in Figure 4. These are:

- Naughton Road Branch Sewer
- Sewer to the Westall Road Branch Sewer




**Figure 4. Sewerage infrastructure servicing Clayton Business Park**

## 4.3 NON-DRINKING WATER SUPPLY

No recycled water supply is proposed by South East Water for the site. However, with the large roof space of each proposed warehouse, there is an opportunity to provide non-drinking water to the development through rainwater harvesting. These have been further explored through this document.

## 4.4 STORMWATER MANAGEMENT

Stormwater management is a significant issue for the surrounding community, with existing flooding predicted to occur in a 1% AEP through the site and along Rayhur Street. The site is currently serviced by an existing Westall Main Drain, which traverses the southern part of the site.

Downstream of Westall Main Drain there are culverts the cross under Westall Road and daylight into an open concrete channel (Mile Creek). These culverts are 3600W x 1800H box culverts.

The existing flood extents of the site are presented in Section 5.


**Figure 5: Existing Main Drainage through CBP – highlighted in Orange**

### 4.4.1 BEST PRACTICE ENVIRONMENTAL MANAGEMENT OBJECTIVES

Guidelines for urban stormwater quality management in Victoria are contained in *"Urban Stormwater Best Practice Environmental Management Guidelines*". These guidelines are included in all municipal planning schemes as state policy in the Victorian Planning Provisions. The guidelines seek to minimise the detrimental effects of urbanisation on receiving waterways. The best practice objectives for pollutant removal are presented in the Table 2 below.

**Table 2: Stormwater Quality Objectives**

| | Total Suspended Solids (TSS) | Total Phosphorus (TP) | Total Nitrogen (TN) | Gross pollutants (GP) |
|---|---|---|---|---|
| Objective target (% reduction) | 80 | 45 | 45 | 70 |

Stormwater modelling is undertaken using MUSIC, an industry standard water balance tool, to quantify the pollutant removal from stormwater of proposed assets. A MUSIC model has been provided to Council to support the stormwater quality objectives identified for this development.

# 5. FLOOD MANAGEMENT ASSESSMENT

A hydraulic TUFLOW flood model and a hydrological RORB model for the whole Mile Creek catchment were developed for the site. Flood modelling of the Clayton Business Park development was completed by Incitus. A copy of the report is provided in Appendix B.

## 5.1 EXISTING DRAINAGE

The site is traversed by the Westall Road Main Drain. At the CBP, this is a 2 x 1750 mm diameter pipes along Rayhur Street, before converting to a 3650 mm x 1825 mm box culvert as the drain traverses the lower portion of the site from west to east towards Westall Road. The drain crosses Westall Road and discharges to an open concrete channel which flows to Mile Creek.

Incitus completed a hydraulic analysis of the existing drainage infrastructure indicates that the Westall Main Drain has the capacity to convey approximately 10.2 $m^3/s$ through the 2 x 1750 mm diameter pipes and approximately 13.8 $m^3/s$ through the 3650 mm x 1825 mm box culvert.

## 5.2 EXISTING FLOODING

Based on the modelling provided by Incitus, the site experiences significant flood because of the upstream catchment. These results are consistent with the previous studies on the site. Key conclusions from the report include:

- The subject site and adjacent Rayhur Street are severely flooded in the existing conditions due to the southern extent of the site being a trapped low point that only drains via Westall Road Culvert.
- The 1% AEP flood depths on Rayhur Street and within the southern site extent are high and therefore flooding is unsafe for all people and all vehicles in large areas.
- There is notable flooding on Rayhur Street and south-western site extent in the 10% AEP event. It is anticipated that future land use concept and upgraded drainage will significantly reduce the flood depth.

An extract of the flood modelling results is provided in Figure 6.

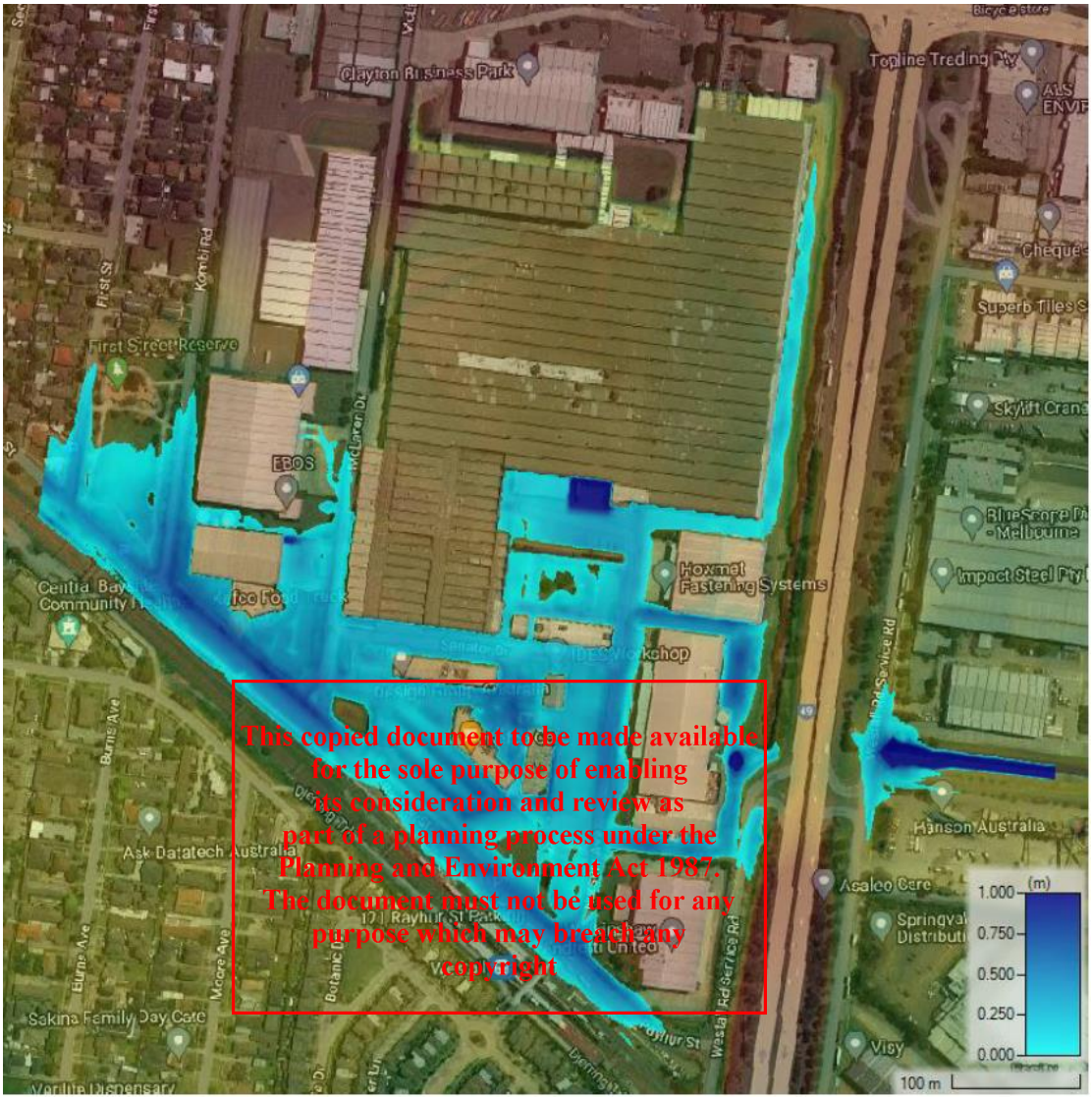





**Figure 6: Existing Flood Conditions at CBP**

## 5.3 FLOOD MANAGEMENT

The flood modelling was modified for the proposed developed conditions of the site. The Incitus modelling showed, that to manage the existing flood through the site a combination of overland flow paths through the road network and a large underground drain is required. The modelling also showed that to develop the site witin acceptable flood limits, a large diameter pipe will be required to convey 5.5 $m^3/s$.

Based on the current grading of the site, this pipe is estimated to be in the order of 2400mm dia. The pipe would connect directly to the existing drainage pit before discharge to the Westall Road culverts.

The modelled developed flood conditions, including the proposed underground drainage, is shown in Figure 7.

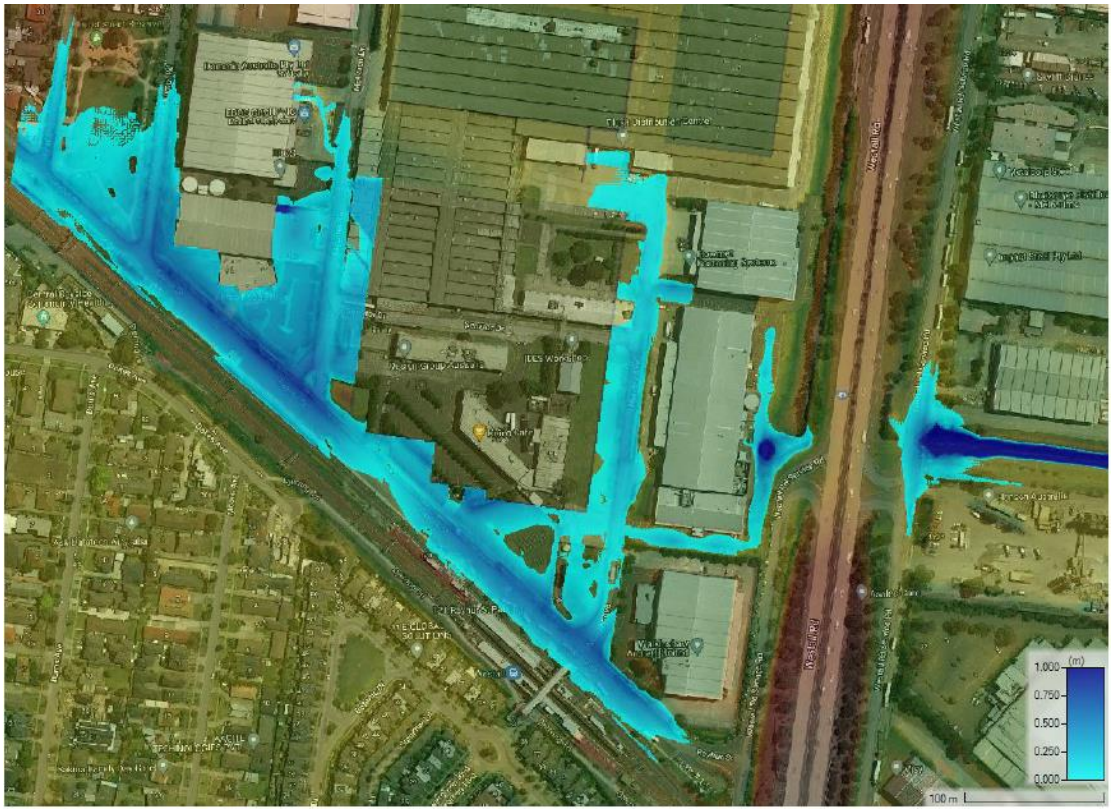



**Figure 7: Proposed Developed Flood Conditions**

### 5.3.1 FLOOD CONVEYANCE AND STORAGE

The Incitus modelling demonstrates that the proposed development of the CBP site does not impact flood elevations through the site or downstream of the development. The flood modelling also shows that there are no flood impacts to the surrounding community as a result of the development. In addition, it is noted that with the development local flood impacts are improved near Kombi Street. This is a result of improved conveyance through the CBP site, moving the water from the high point in Rayhur Street to the Westall Road culverts.

The development with a 5.5m$^3$/s drainage pipe, results in a maximum flood depth through the site of approximately 0.5m. The overall hazard mapping within the site, will be less than 0.4m$^2$/s, meaning the development will be a low flood hazard.

No storage for the site is recommended for either the 1% AEP or 10% AEP. This recommendation is based on the capture and conveyance of stormwater through the site by the proposed 2400mm dia pipe. This pipe captures at least 5.5m$^3$/s that is currently gap flow and conveys it through to the Westall Road culverts. The development has demonstrated that there is no increase in flood level to the surrounding properties and is not diverting any flows to the detriment of adjoining downstream properties. The lost flood plain storage between the existing development and the proposed redevelopment is provided in the additional subsurface pipe drainage.

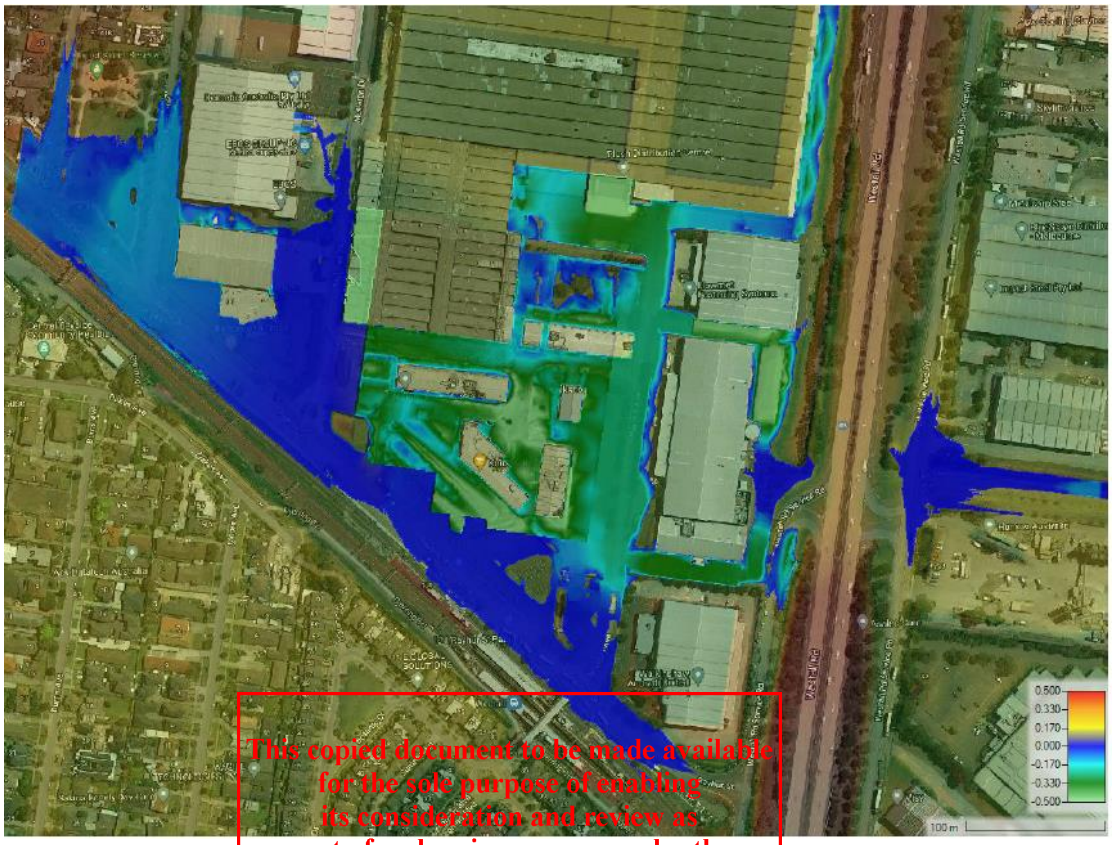





**Figure 8: Change in Flood Levels showing no change in flood conditions both upstream and downstream**

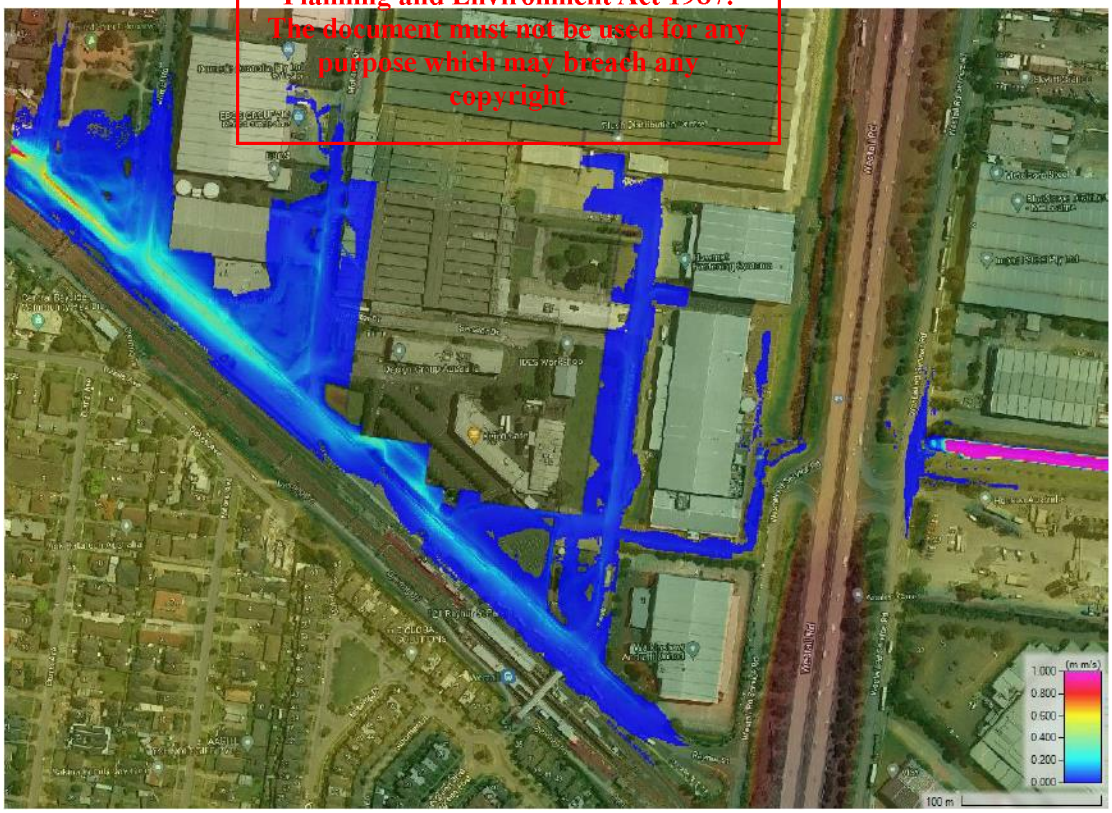



**Figure 9: Hazard mapping across CBP**

### 5.3.2 FREEBOARD

Melbourne Water requires a freeboard of 300/150mm for overland flowpaths and 600/300mm for waterways. It is considered that the subject site is within an overland flowpath and therefore the minimum freeboard of 300/150mm is considered appropriate for the design of the Clayton Business Park site.

The proposed floor levels for the development are provided in the Incitus report in Appendix B.

# 6. INTEGRATED WATER MANAGEMENT

## 6.1 INITIATIVES

Integrated water management (IWM) initiatives are implemented to achieve one or more of the strategic outcomes outlined in Table 2. The typical land use of an industrial site is challenging from an IWM perspective. Large roof areas and hard stand surfaces create significant run-off, and with little on-site demand for water, it is difficult to justify on-site management initiatives. For Clayton Business Park several initiatives are explored, these include:

- Rainwater Harvesting
- Vegetated Swales
- Stormwater Harvesting
- Precinct Rainwater Harvesting
- Offsite Stormwater Management



## 6.2 RAINWATER TANKS



Rainwater tanks can be implemented as above ground or underground tanks on the warehouses. Connecting roof catchment to rainwater tanks can be undertaken in several ways. Downpipes may be directly connected to individual tanks, resulting in several tanks distributed around the perimeter of the warehouse. In some instances, multiple downpipes may be connected to a single tank, this requires additional above ground piping along the outside wall of the warehouse.

A siphon drainage system may be used, in this case downpipes are permanently charged with rainwater, the level in the pipe is the same as the level in the tank. The benefits of a siphon system is that greater flowrate can be achieved, and therefore less downpipes, and all downpipes can be connected to a single tank. The downside is that the drainage pipes need structural integrity to carry the weight of the water and be sealed so there is no leakage of water from the siphon system, examples of siphon drainage systems include Southern Cross Station and Melbourne Cricket Ground.

The use of rainwater harvested by the rainwater tank systems is recommended for non-potable demands across the site, this includes toilet flushing and irrigation. Toilets and irrigation systems are connected to the tanks, with a small pump providing water pressure.

Rainwater tanks provide for a significant reduction in the demand for potable water, and also assist in the protection of downstream waterways. The rainwater tanks contribute to the nitrogen reduction across the site by removing flow from the downstream environment.

The reliability of water supply from rainwater is determined by the roof area, storage size, demand and rainfall. Rainwater tanks are typically sized to achieve between 70-80% of non-potable water demand, though this target is adjusted depending on the context.

Rainwater tanks will be used to reduce the demand for potable water. In this assessment, we have assumed that all warehouses are suitable for installation of a rainwater tank, with downpipe (not siphon) connection. The rainwater tanks configuration is shown in Figure 10. Water saving benefits that this will provide are discussed below.

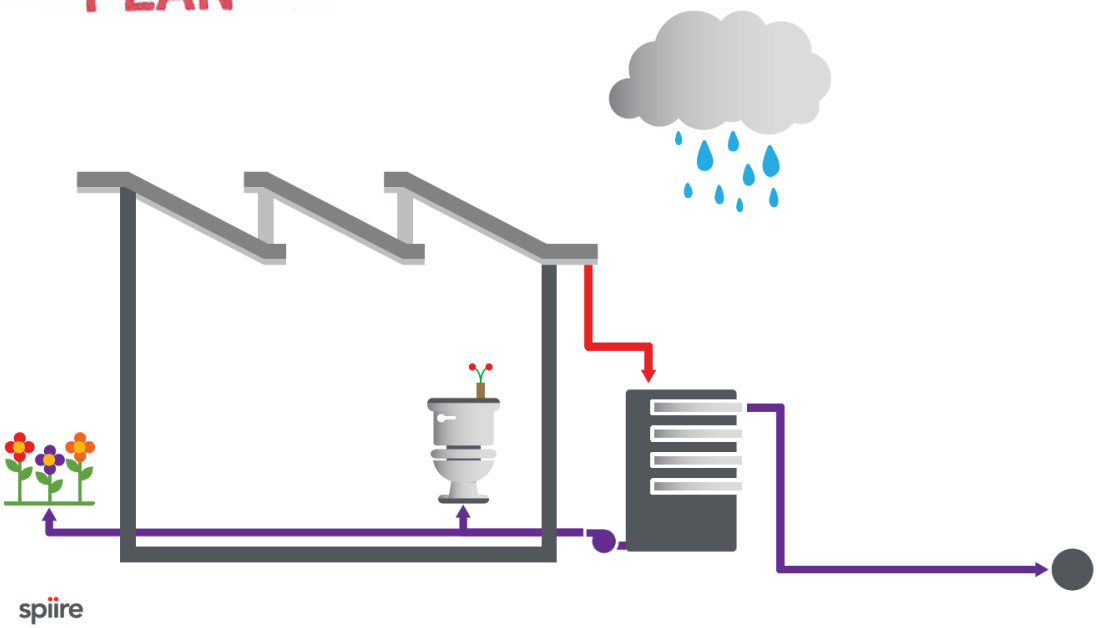



**Figure 10: Rainwater Harvesting configuration**



### 6.2.1 LOT SCALE DEMANDS

Water demands were estimated for toilet flushing and local landscape irrigation only. It was determined that there are no other suitable non-potable water demands across the site.

*Toilet Flushing*

- All toilets have been assumed to be 4 Star WELS rated as per the ESD requirements for the warehouses.
- Building occupancy has been calculated as per the National Construction Code - 30m$^2$/person for a warehouse.

It should be noted that the 30m$^2$/person design occupancy for the warehouse spaces can be revised when the tenants are confirmed. This number is appropriate for tenants who are fulfilling e-commerce sales type activities, however if the warehouses are being used only for storage and logistics this design occupancy is likely high and the toilet flushing demand will be lower.

- Annual Toilet Demand has been calculated using Green Star Design & As Built Potable Water Calculator v1.1 (Green Building Council of Australia, 2015).

At this assumed occupancy density, annual toilet flushing demands across the precinct is 10.7 ML.

*Open Space Irrigation*

The landscaped areas across the precinct may be considered for irrigation from harvested rainwater. The annual demand for the irrigation for the landscaped area across the precinct is estimated to be up to 9.4 ML.

For location and areas of these open spaces please refer to the site master plan provided in Appendix A.

### 6.2.2 MUSIC MODEL WATER BALANCE

Water balance modelling has been undertaken using MUSIC to assess the supply of harvested rainwater across the development. MUSIC was specifically chosen as the most appropriate tool due to the very large roof areas and the need for a rainfall-runoff model which could calculate the large peak flows generated. The model assumes that rainwater is harvested from 40% of the warehouse roof areas.

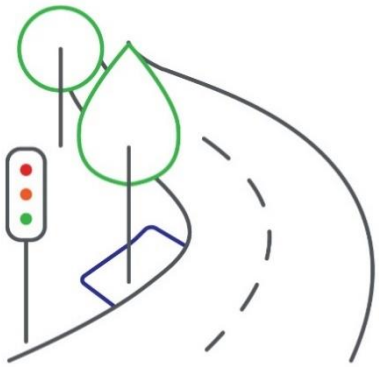
The model results for the rainwater tanks supplying toilet flushing demands only are presented in Table 3. A screenshot of the MUSIC model is shown in Figure 13. The model includes ten rainwater tanks across the site, receiving roof runoff from the warehouses. The proposed layout of the rainwater tanks is shown in Appendix A.

**Table 3: Summary of the rainwater tank water balance analysis.**

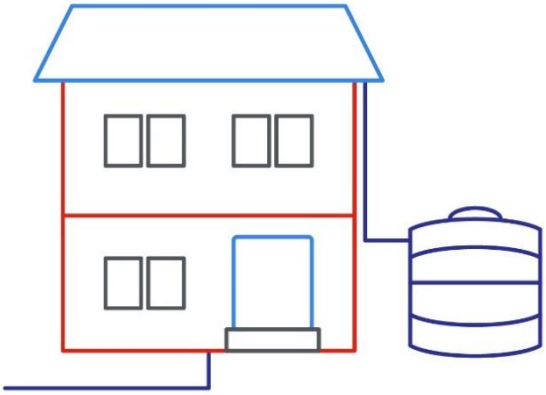
| Warehouse Address | Rainwater Tank | Average Annual Demand (kL) | Average Annual Supply (kL) | Reliability (%) |
|---|---|---|---|---|
| PRECINCT 1 | | | | |
| 1490 Centre Rd | Tank 1 (10kL) | 726 | 470 | 65% |
| 1500 Centre Rd | Tank 2 (10kL) | 795 | 500 | 63% |
| 5 McLaren Dr | Tank 3 (20kL) | 1323 | 900 | 68% |
| PRECINCT 2 | | | | |
| 12 McLaren Dr | - | 527 | - | - |
| 14 McLaren Dr | - | 376 | - | - |
| 16 McLaren Dr | - | 545 | - | - |
| *sub-total* | Tank 4 (10kL) | 1449 | 690 | 48% |
| 10 McLaren Dr | - | 534 | - | - |
| 11 Nursery Ave | - | 373 | - | - |
| 9 Nursery Ave | - | 467 | - | - |
| *sub-total* | Tank 5 (10kL) | 1375 | 670 | 49% |
| PRECINCT 3 | | | | |
| 1550 Centre Rd | Tank 6 (15kL) | 1047 | 690 | 66% |
| 10 Nursery Ave | - | 596 | - | - |
| 8 Nursery Ave | - | 657 | - | - |
| *sub-total* | Tank 7 (20kL) | 1252 | 870 | 69% |
| PRECINCT 4 | | | | |

| Warehouse Address | Rainwater Tank | Average Annual Demand (kL) | Average Annual Supply (kL) | Reliability (%) |
|---|---|---|---|---|
| 8 McLaren Dr | - | 302 | - | - |
| 6 McLaren Dr | - | 204 | - | - |
| 4 McLaren Dr | - | 209 | - | - |
| 2 McLaren Dr | - | 359 | - | - |
| *sub-total* | Tank 8 (10kL) | 1,074 | 590 | 55% |
| 7 Nursery Ave | - | 431 | - | - |
| 5 Nursery Ave | - | 319 | - | - |
| *sub-total* | Tank 9 (15kL) | 750 | 570 | 76% |
| 3 Nursery Ave | - | 322 | - | - |
| 1 Nursery Ave | - | 446 | - | - |
| *sub-total* | Tank 10 (15kL) | 768 | 570 | 74% |
| OTHER | | | | |
| 3 McLaren Dr, extension | - | 116 | - | - |
| *TOTAL* | - | 10,676 | 6,520 | 61% |

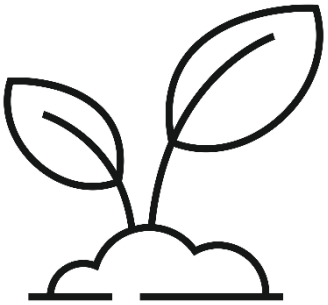
Annual Rainfall
**131 ML**



Total Annual Road Runoff
**37.4 ML**

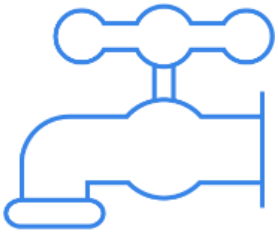


Annual Water Usage – Toilet Flushing
**10.7 ML**



Annual Road Runoff to Vegetated Swales
**28.4 ML**

Annual Potable Water Substituted – Toilet Flushing
**6.5 ML**



Annual Potable Water Usage – Toilet Flushing
**4.2 ML**

**Figure 11. Key inflows and outflows of the Clayton Business Park water balance.**

## 6.3 VEGETATED SWALES AND STREET TREES

Tree-scaped streets contribute to the amenity and mitigation of the heat island effect within the development. To facilitate this within Clayton Business Park there is potential to implement vegetated swales along the main road. The swales can capture and convey runoff from the roads and carparks, facilitating infiltration of the runoff and providing treatment. Runoff from carparks that are not adjacent to the vegetated swales is managed with a conventional pit and pipe system. An estimated length of 1020m of vegetated swales may be installed through the development.

The swales are proposed to be vegetated with appropriate nitrogen capture plants, which may be specified during the design phase of the project.

The development of Clayton Business Park, will see a large area of imperviousness similar to the current arrangement. To further improve the local environment, it is proposed to disconnect some of these areas from the downstream receiving waters (Mile Creek).

To do this, the development will utilise swales along the main roads. This will facilitate the infiltration of water into the soil for vegetation use. The swales are generally flat, based on the surrounding development pads, as such they will promote infiltration and use of water by the vegetation rather than conveyance. Water will be transferred from the roads through a series of kerb cuts.

Trees are proposed to be offset in the swales, allowing an opportunity for passive watering of trees within Clayton Business Park. Assuming trees are located every 5m (where appropriate, and depending on sight lines), these swales could incorporate over 200 trees across the precinct.

A cross section of a typical swale is provided below Figure 6.



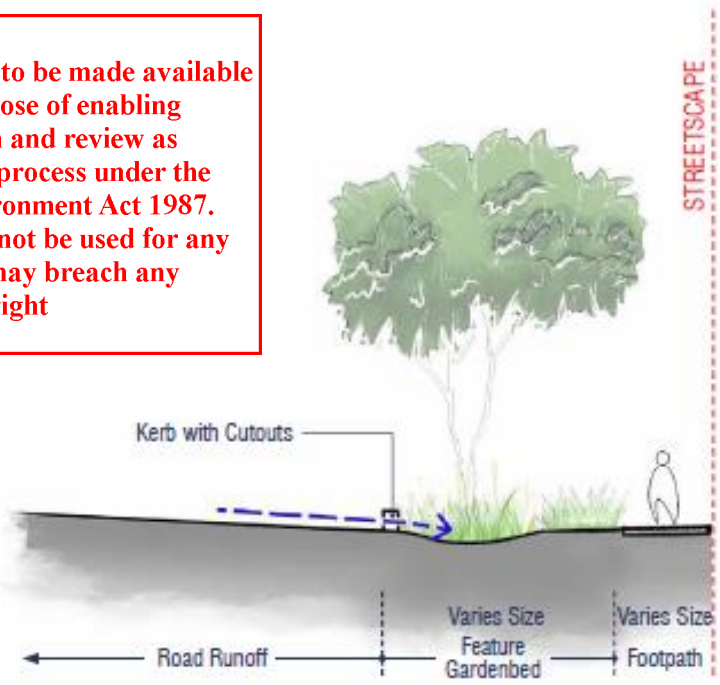





**Figure 12. Lot scale water balance for Clayton Business Park**

## 6.4 STORMWATER HARVESTING

Stormwater harvesting can deliver water supply and waterway health outcomes, and is most feasible on large scale residential and commercial catchments (i.e. precinct/estate wide). This strategy is most effective when stormwater can be captured in a wetland or diverted off a major drainage pipeline and stored in an end-of-line tank or pond, and where demand is nearby such as public open space.

For the Clayton Business Park, stormwater harvesting could provide a water source to the park to supply water for irrigation. This water would be captured from the underground drainage network and stored in a tank for use. Treatment of this water, or management of irrigation times, would required to reduce the exposure risk to park users.

Due to the limited demand for non-potable water at Clayton Business Park, large scale stormwater harvesting is not considered viable at this stage.

## 6.5 PRECINCT ROOF WATER HARVESTING

Further to the stormwater harvesting opportunity at the Clayton Business Park, an alternative may be a precinct scale roof water harvesting. Roof water harvesting at this scale would incorporate a centralised tank with connections to each down pipe on the warehouses. From the centralised tank, water could be provided using smart technology back to the rainwater tanks on each warehouse, and also used for irrigation across the development.

Similar to the stormwater harvesting option, a precinct roof water harvesting system would not have a suitable demand within or near Clayton Business Park for this option to be considered viable.

## 6.6 OFFISTE STORMWATER MANAGEMENT

Kingston City Council has proactively determined the optimal opportunities for water sensitive urban design and stormwater harvesting infrastructure across the municipality. To fund the implementation of these initiatives an offset scheme for developers has been developed, allowing developers to financially contribute to these schemes to offset the impact of stormwater from the site. With its significant hardstand area, and limited onsite demand for water, the offset scheme may present the best whole of community investment to achieve the best practice environmental management requirements. The prospect of making contributions to this offset scheme is to be discussed with Council.

# 7. ACHIEVING BPEM WATER QUALITY STANDARDS

The development of this WSUD solution was based on the priorities established from the stakeholder workshop and the strategic direction provided by organisations articulation in the range of IWM documentation. From the original workshop, a mixture between the *Good Case* and the *Aspirational Case* was selected. This mixture includes rainwater tanks on warehouses and disconnected impervious areas which contribute to onsite treatment and urban cooling.

Some impervious areas are disconnected by vegetated swales which provide both biological and physical treatments that reduce pollutants in runoff. This onsite treatment was modelled using the stormwater management software, MUSIC. The lengths of the vegetated swales are modelled based on the average distance runoff is conveyed by the swales. This average distance was calculated with the assumption that all runoff which enters the vegetated swale network, is conveyed to the end of the network. The results of the MUSIC model, relating to stormwater treatment, are summarised in Table 5 below. Contributions to the stormwater quality offset scheme is to be discussed with Council.

**Table 4: MUSIC modelling results**

| Item | TSS | TP | TN | GP |
|---|---|---|---|---|
| Target (% Reduction) | 80 | 45 | 45 | 70 |
| Performance (% reduction) | 21.3 | 16.5 | 11.9 | 35.0 |

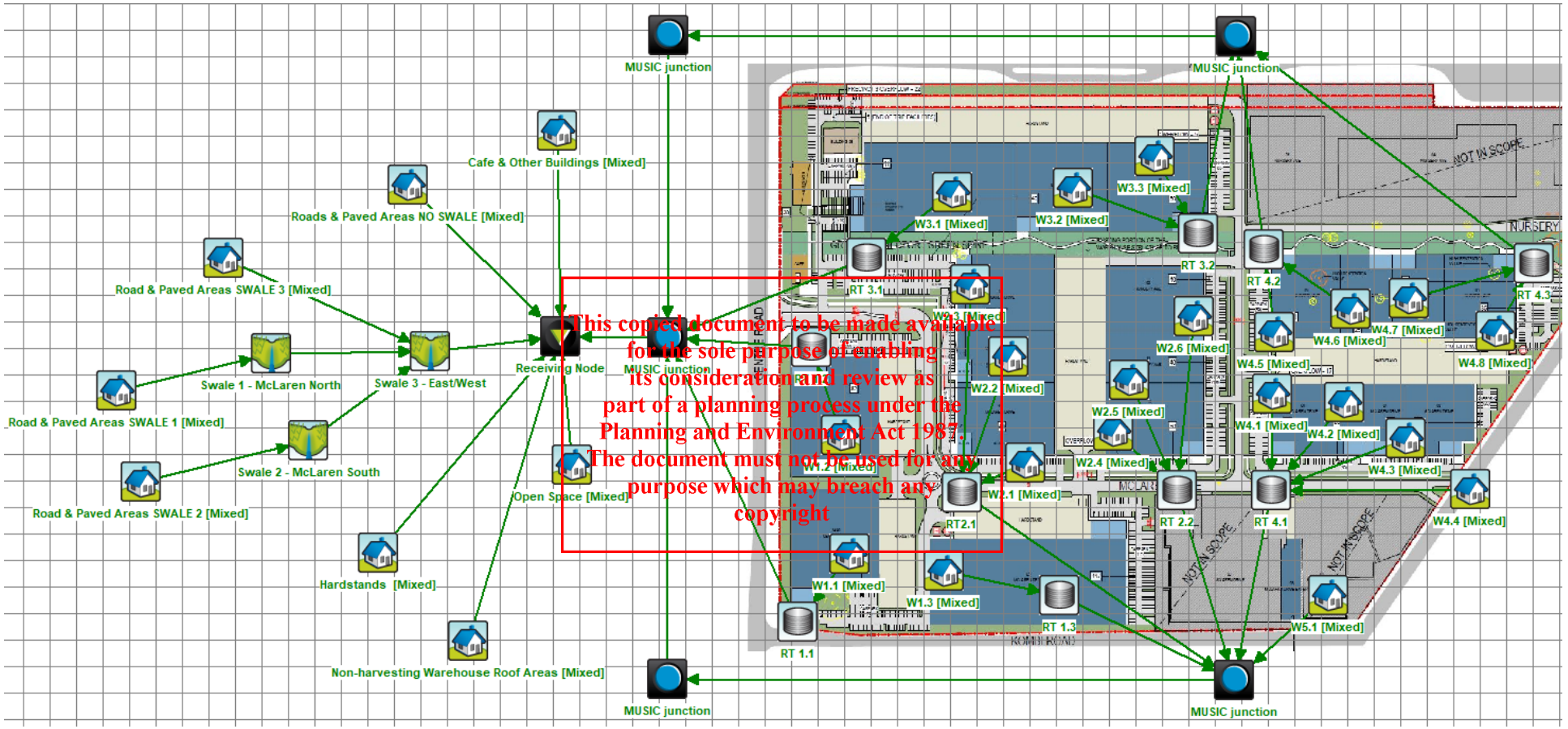





**Figure 13: A screenshot of the MUSIC model used to analyse the pollutant reductions and the rainwater harvesting scheme.**

# 8. RECOMMENDATIONS

This Integrated Water Management Plan has been prepared in response to support the planning permit for the Clayton Business Park. A range of Integrated Water Management options were investigated as part of this plan. The following is recommended from the assessment:

*Rainwater Tanks*

- Rainwater tanks are proposed to capture roof runoff from the warehouses. The roof catchment area is optimised through downpipes and roof grading.
- The harvested rainwater is proposed to be used for toilet flushing purposes. In total these rainwater tanks will offset the potable water usage within the development by an estimated 6.52 ML/yr[1].

**Table 3: Rainwater tank summary – fulfilling toilet flushing demands only.**

| Tanks | Tank Size (kL) | Annual Average Supply (ML) | Annual Demand (ML) | Reliability (%) |
|---|---|---|---|---|
| 10 | 10-20 | 6.52 | 10.7 | 61.1 |



*Vegetated Swales and Trees*

- Implement kerb cut-outs to allow road runoff into swales for treatment and irrigation.
- This enables higher soil moisture content for street trees throughout the year, which contributes to better tree health, larger canopy, reduced urban heat and improved amenity.
- The swales and trees will reduce the discharge of stormwater from the site, facilitate infiltration and reduce pollution loads in the discharged runoff.
- The volume of stormwater utilised by the extensive vegetated swales across the development is 28.4 ML/yr.

*Offsite Stormwater Treatment and Harvesting*

- Kingston City Council have established an offsets scheme for integrated water management projects that require investment. Due to the high fraction imperviousness across the site and low water demand, the best practice environmental management and healthy waterways strategy target shortfall may best be achieved offsite. Contributions to the offset scheme to be discussed with Council.

*Other IWM Opportunities*

- Ecological sustainable development opportunities are proposed within the site, this will include water saving measures in the warehouses through the use of harvested rainwater and energy-efficient appliances and infrastructure.
- Stormwater harvesting is not considered feasible on the site due to the limited water demand. However, water this irrigation water can be provided from a nearby rainwater tank within additional treatment and is therefore the preferred method for

[1] Potable water saving is subject to confirmation of design occupancy of each lot once the tenant is confirmed.

irrigation water supply. The building design should ensure that a rainwater tank is located nearby and can be accessed for irrigation purposes, subject to Council approval and acceptance.

- Opportunities to improve the liveability and amenity should be maximised through the site, with the green wedge creating connections, community amenity and habitat.

# APPENDIX A

# SITE IWM PLAN AND RAINWATER TANK PLAN


**Figure 14: The layout of the proposed IWM plan, including rainwater tanks and vegetated swales.**

# APPENDIX B

# INCITUS FLOOD MODELLING REPORT

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| | | | |
|---|---|---|---|
| To | **Goodman** | From | **Nina Barich** |
| Copy | | Reference | **2227** |
| Date | **22 March 2023** | Pages (including this page) | **15** |
| Subject | **Clayton Business Park Flood Modelling** | | |

Clayton Business Park is a 31 ha parcel of industrial development located between Westall Road, Rayhur Street, Kombi Road, and Centre Road in Clayton. The site is traversed by Melbourne Water's Westall Main Drain. This consists of 2 x 1750 mm diameter pipes along Rayhur Street, before converting to a 3650 mm x 1825 mm box culvert as the drain traverses the lower portion of the site from west to east towards Westall Road. The drain crosses Westall Road in a 3600 mm x 1800 mm box culvert prior to discharging into an open channel on the east side of the road reserve.

## 1 Peak Design Flows

Westall Main Drain has a 273 ha catchment contributing at Westall Road. This includes:

- The site
- 26.7 ha from north of the site, conveyed along Westall Road to the culvert crossing
- 156.9 ha from west and north west of the site conveyed along Rayhur Street
- 44.4 ha crossing the railway line from the south approximately 70 m east of Kombi Road via a 1425 mm diameter pipe culvert and discharging into Rayhur Street
- 9.6 ha crossing the railway line from the south approximately 250 m west of the intersection of Westall Road and Rayhur Street via a 1350 mm diameter pipe culvert and connecting directly to the Westall Main Drain

A RORB model was created to determine the peak 1% Annual Exceedance Probability (AEP) design flows for the Westall Main Drain. The model indicated the following peak 1% AEP design flows:

**Table 1 – Peak Flows for Westall Main Drain**

| Location | Peak 1% AEP Design Flow |
|---|---|
| Corner of Rayhur St and Kombi Road | 18.2 $m^3/s$ |
| Rayhur Street and 1425 mm dia pipe railway crossing | 23.3 $m^3/s$ |
| Rayhur Street and 1350 mm dia pipe railway crossing | 22.9 $m^3/s$ |
| Westall Road crossing | 24.9 $m^3/s$ |

Additional information for the RORB model calibration and catchment can be provided if required.

## 2 Capacity of Existing Infrastructure

A hydraulic analysis of the existing drainage infrastructure indicates that the Westall Main Drain has the capacity to convey approximately 10.2 $m^3/s$ through the 2 x 1750 mm diameter pipes and approximately 13.8 $m^3/s$ through the 3650 mm x 1825 mm box culvert. The crossing of Westall Road can convey the peak 1% AEP design flow at Westall Road with a head loss of approximately 1.56 m, which results in an upstream flood level of the culvert of approximately 51.6 m AHD.

A 5 m x 7 m pit with a pipe grille has been constructed upstream of the culvert crossing of Westall Road, and connects to the Westall Main Drain. It is believed that this pit was constructed to capture the gap flows, i.e., the difference between the 1% AEP design flow and the capacity of Westall Main Drain, for conveyance across Westall Road in the culvert crossing. Analysis of the pit indicates it has the capacity to capture the gap flows for the 1% AEP design storm prior to the crossing of Westall Road.

As the analysis indicates that the Westall Road culvert crossing has the capacity to convey the peak 1% AEP design flow if operating under pressure, and the redevelopment of the site is not intending any modifications to the land use or the average imperviousness of the site, on-site retardation is not required.



## 3 Requirements of Redevelopment

The site is currently subject to inundation in a 1% AEP storm event. Due to this, the redevelopment of the site must comply with the requirements for development in flood prone land. These key requirements are:

- Flood safety – protect human life and health, and provide safety from flood hazard
- Flood damage – minimise flood damage to property and associated infrastructure
- Flood impacts – maintain free passage and temporary storage of flood waters
- Waterway and floodplain protection – protect and enhance the environmental features of waterways and floodplains

### *Flood Safety*

With respect to flood safety, it is important that the redevelopment meets the requirements for site and access safety, which for this redevelopment are:

- Flood Depth ≤ 0.5 m
- Flow Velocity ≤ 2.0 m/s
- Depth x Velocity ≤ 0.4 $m^2/s$

### *Flood Damage*

With respect to flood damage, the redevelopment of the site will need to ensure that the floor levels for the proposed warehouses and buildings are set to a minimum of 300 mm above the 1% AEP flood level.

### *Flood Impacts*

With respect to flood impacts, the redevelopment of the site must ensure that the development does not divert flows to the detriment of adjoining properties, that the development does not result in an increase in velocities to Westall Main Drain, that there is no impact on the flood level to surrounding developments and that the flood plain storage is maintained.

***Waterway and Floodplain Protection***

With respect to waterway and floodplain protection, the redevelopment of the site cannot have any detrimental effects on the values associated with waterways and floodplains. As the receiving Westall Main Drain is a trapezoidal channel with little ecological value, these criteria will not apply.

## 4 Flood Modelling

To assess the impacts of the redevelopment of the site; a 2 Dimensional (2D) hydraulic model has been constructed of the existing site and the proposed development.

The modelled terrain was constructed from feature survey and LiDAR data. Existing and proposed buildings have been modelled as obstructions. The LiDAR data specifications are:

- Vicmap Digital LiDAR 1m DEM Data
- Vertical Accuracy: +/- 10 cm
- Horizontal Accuracy: +/- 20 cm
- Date flown: 28 November 2017 – 27 October 2018

The following assumptions were adopted for the hydraulic models:

- A 1 m x 1 m grid size was adopted
- The model was run for 3 hours to ensure that the peak flow hydrograph for Westall Main Drain is fully run through the subject area
- Time step of 30 seconds to 5 minutes was typically adopted, although the model was run using the courant condition for stability in full momentum run
- Manning's Roughness applied to the model as shown with default roughness of 0.04 to represent the site average
- Buildings have been modelled as obstructions

The model has included the culvert crossing of Westall Road and the pit capture upstream of the crossing. It has excluded the other subsurface drainage infrastructure, as the focus is on the gap flows. A gap flow hydrograph, which has removed 10 $m^3/s$ from the peak 1% AEP flow, has been run through the model from Rayhur Street. **Figure 1** illustrates the hydraulic model for the site.


**Figure 1 – Clayton Business Park Hydraulic Model Setup**

### *Existing Conditions*

An existing conditions model was created for use in comparison with the proposed redevelopment. **Figure 2** illustrates the 1% AEP flood levels extracted from the flood model for the current site conditions.

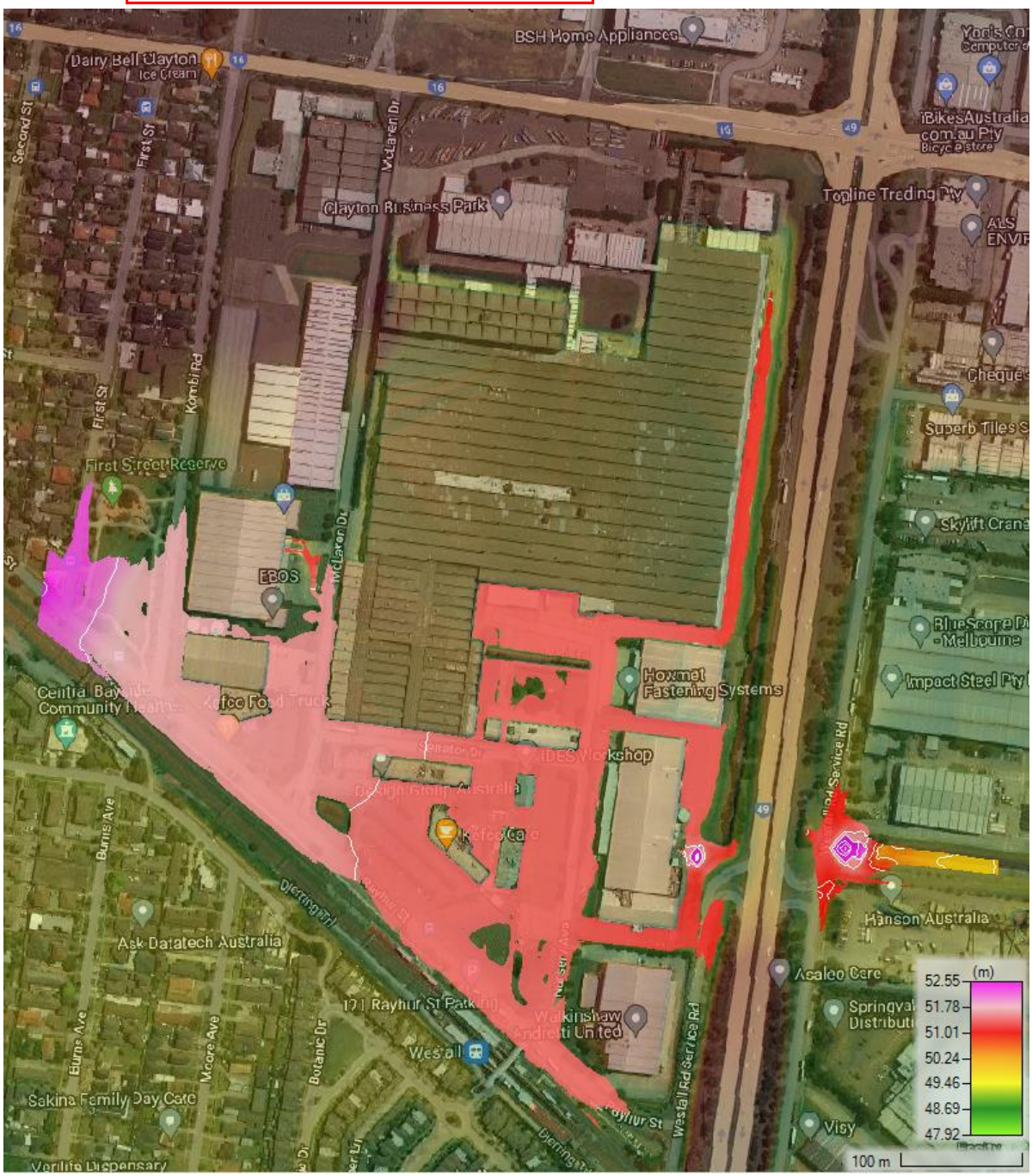


**Figure 2 – Existing 1% AEP Flood Elevations**

**Figure 3** illustrates the existing 1% AEP flood depth through the site.

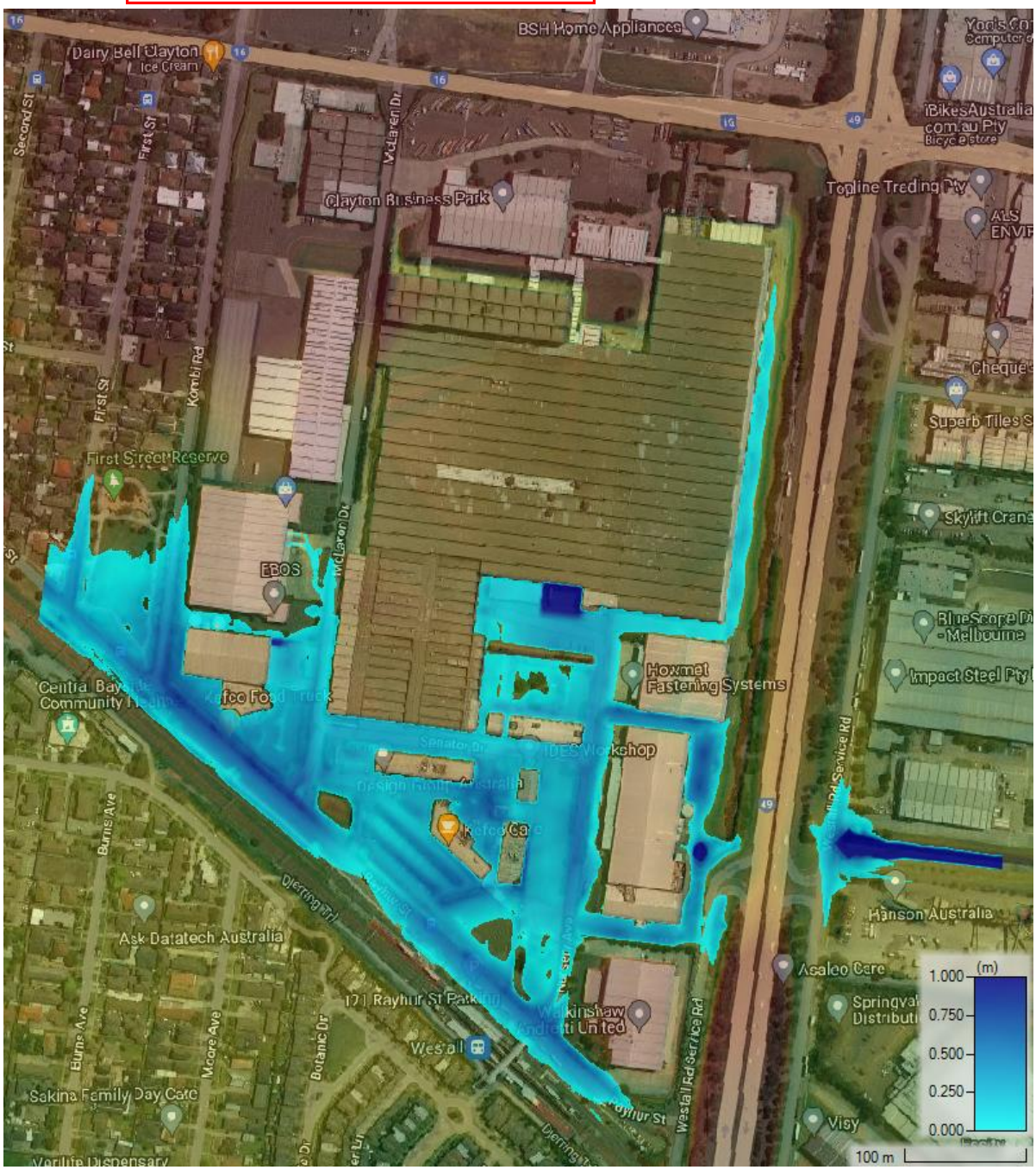


**Figure 3 – Existing 1% AEP Flood Depth**

**Figure 4** illustrates the flood hazard (velocity x flood depth) for the current site development.

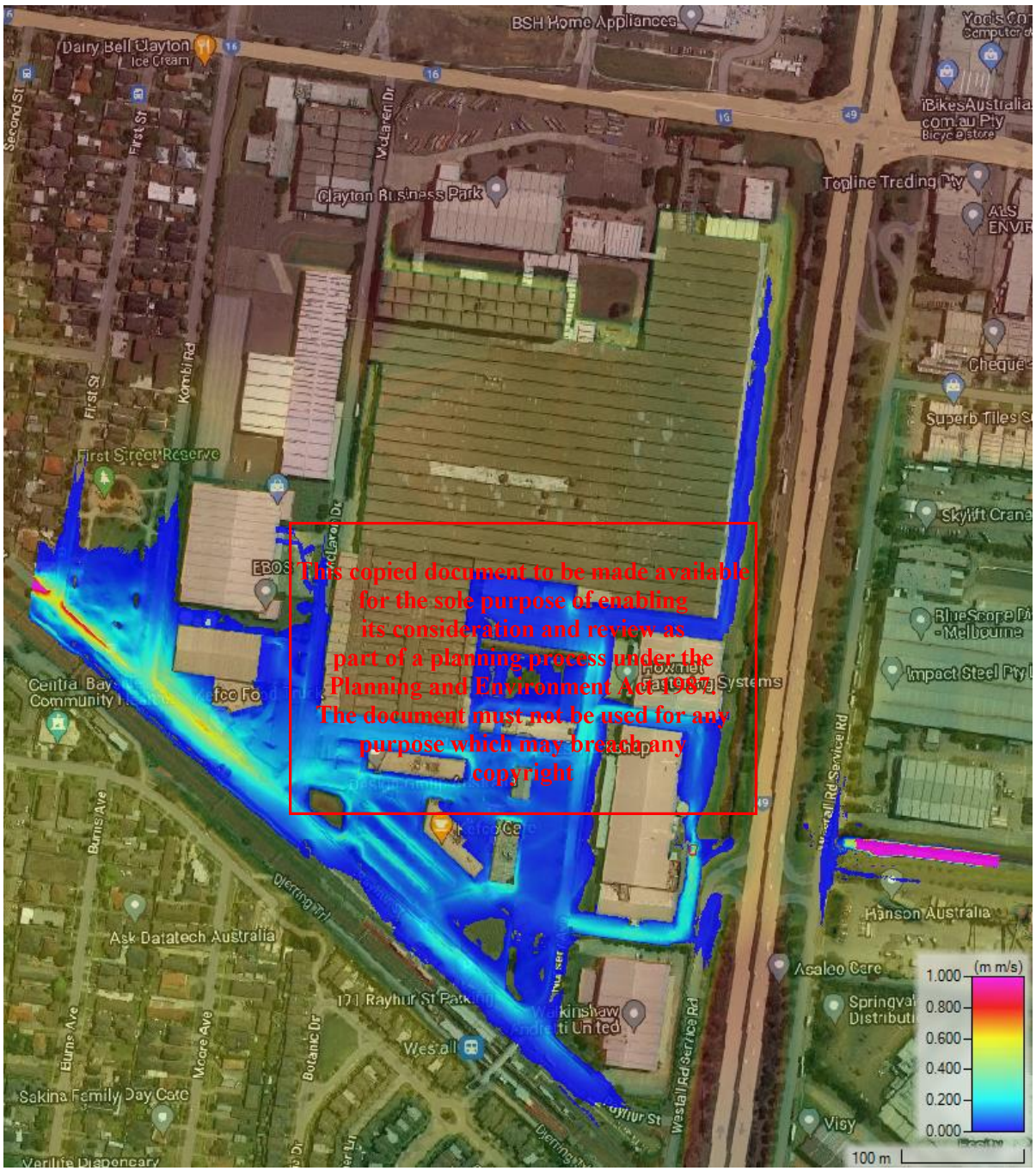




**Figure 4 – Existing 1% AEP Flood Hazard**

### *Proposed Conditions*

The terrain in the model was updated to reflect the proposed new building locations for the site. It should be noted that no updates have been undertaken to the surrounding pavements as this design work has not been completed, and additional flood modelling will be required when it is done.

The model was run without any mitigation to the existing gap flows to assess the impacts. The results indicated that the proposed redevelopment would result in an increase in flood levels adjacent to the site along Rayhur Street of up to 200 mm and Kombi Road of up to 100 mm. The increase to flood elevation has occurred through the significant reduction in the flow path within the site adjacent to

Rayhur Street. No increase to the existing flood levels is acceptable. Therefore, the site must adopt some mitigation measures to prevent the increase.

Mitigation measures may include creating an unobstructed flow path through the site or capturing and piping some additional gap flow through the site. Creating an unobstructed flow path through the site does not match the proposed development plan, and therefore the option of capturing an piping additional gap flows through the site has been considered.

The model was run progressively extracting additional gap flow until no increase in flood level was experienced. This requires the capture and conveyance of up to an additional 5.5 $m^3/s$ of gap flow. This option still requires the safe conveyance of approximately 7.7 $m^3/s$ overland through the site.

**Figure 5** illustrates the difference in flood elevation between the existing conditions and the proposed redevelopment with the piping of an additional 5 $m^3/s$.

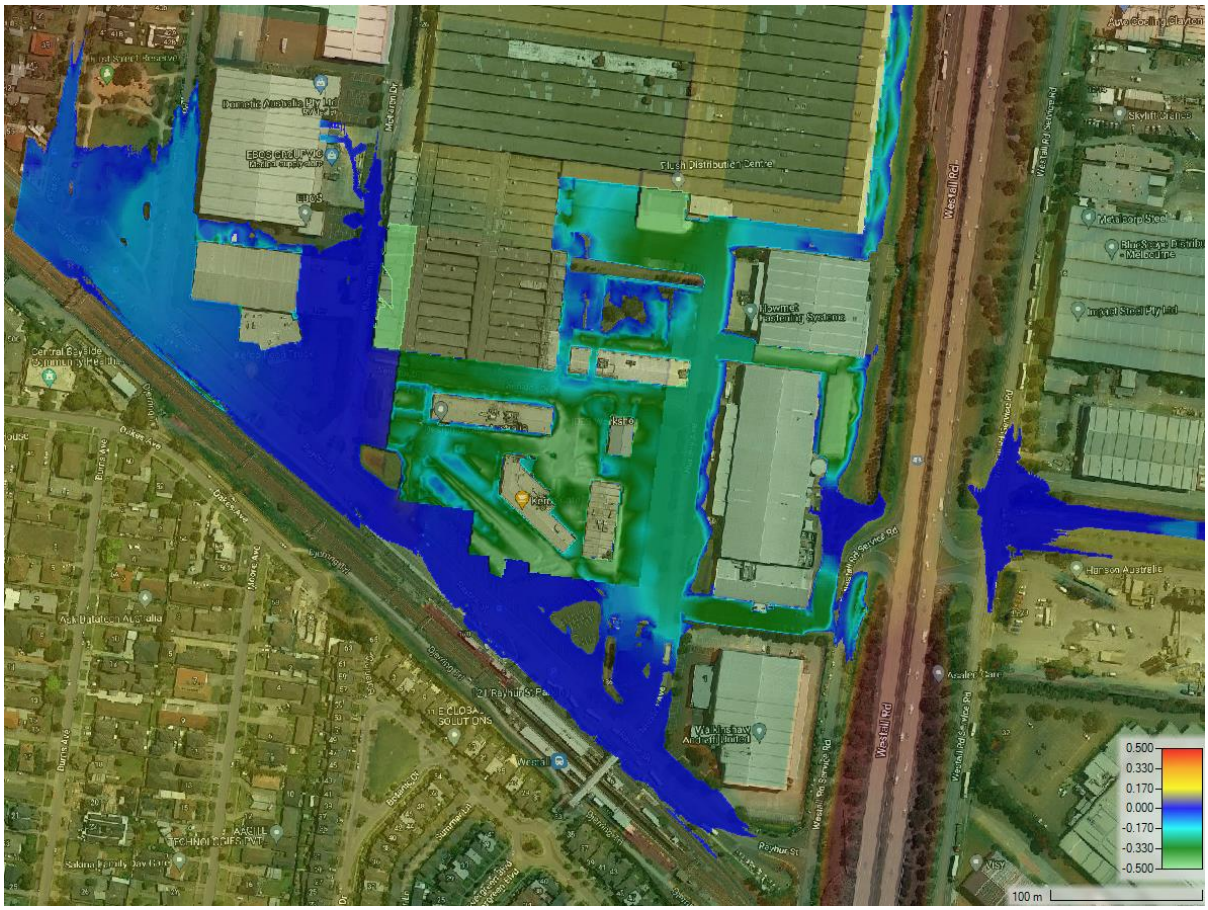


**Figure 5 –1% AEP Flood Elevation Difference**

**Figure 6** illustrates the 1% AEP flood elevation for the proposed redevelopment with the mitigation measure of piping an additional 5.5 $m^3/s$ of overland flow.

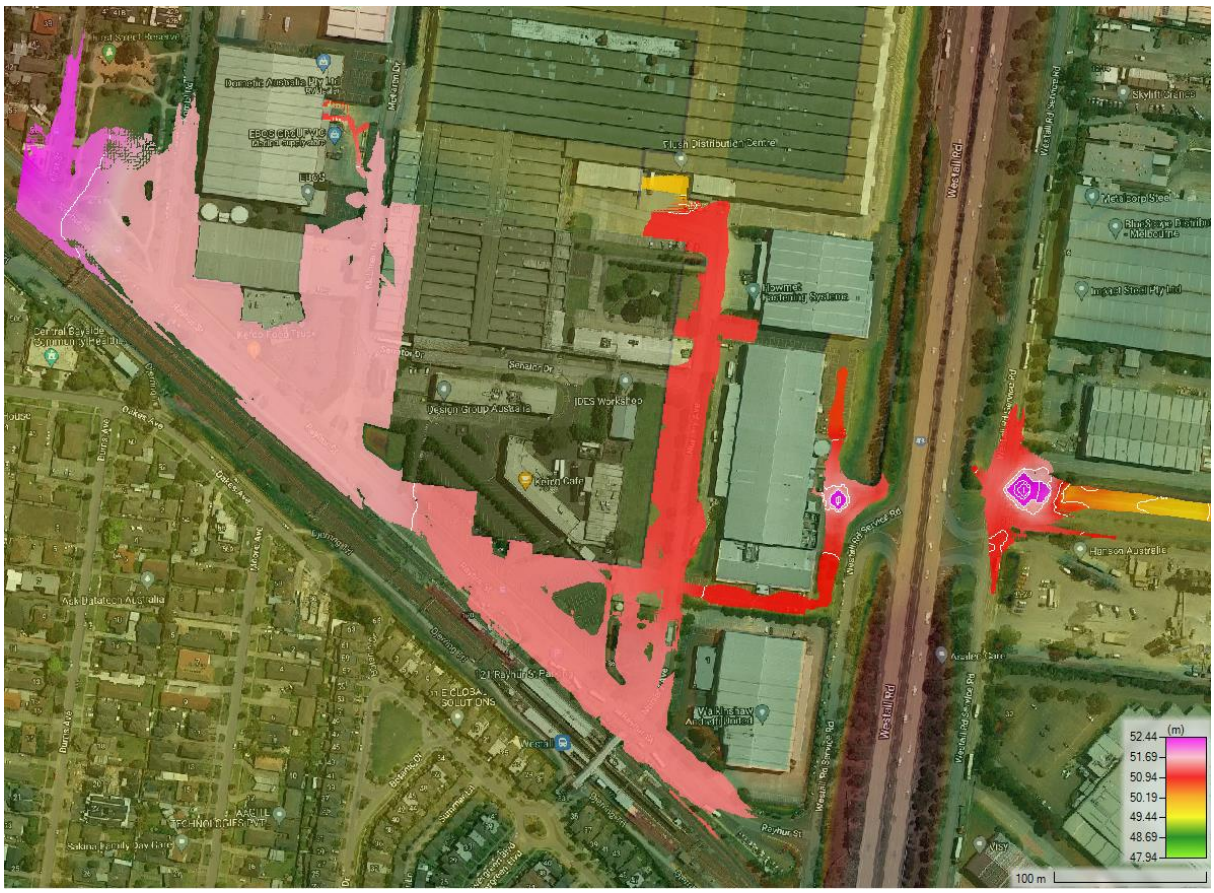


**Figure 6 –Proposed 1% AEP Flood Elevation with Mitigation Measures**

**Figure 7** illustrates the 1% AEP flood depths for the proposed redevelopment with the mitigation measure of piping an additional 5.5 $m^3/s$ of overland flow.

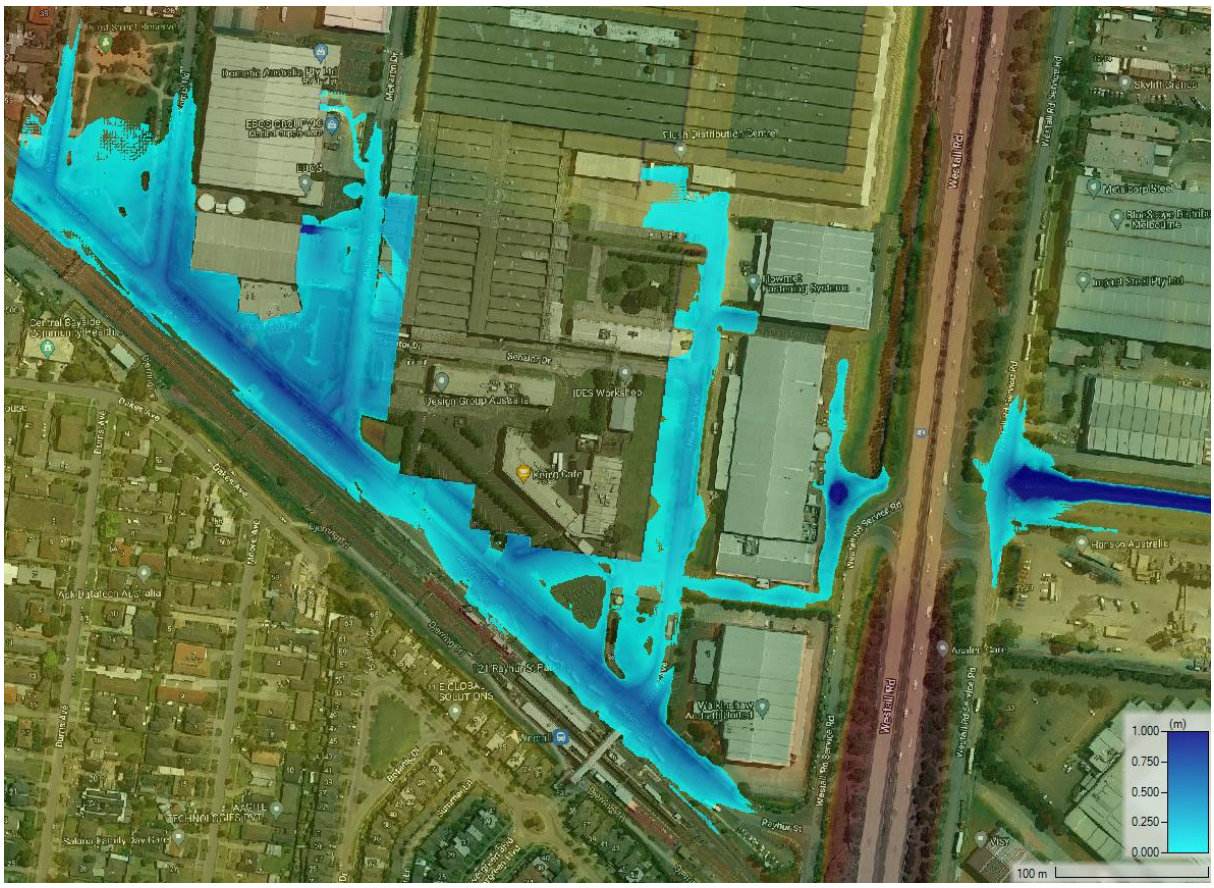


**Figure 7 –Proposed 1% AEP Flood Depth with Mitigation Measures**

**Figure 8** illustrates the 1% AEP flood velocity for the proposed redevelopment with the mitigation measure of piping an additional 5.5 $m^3/s$ of overland flow.

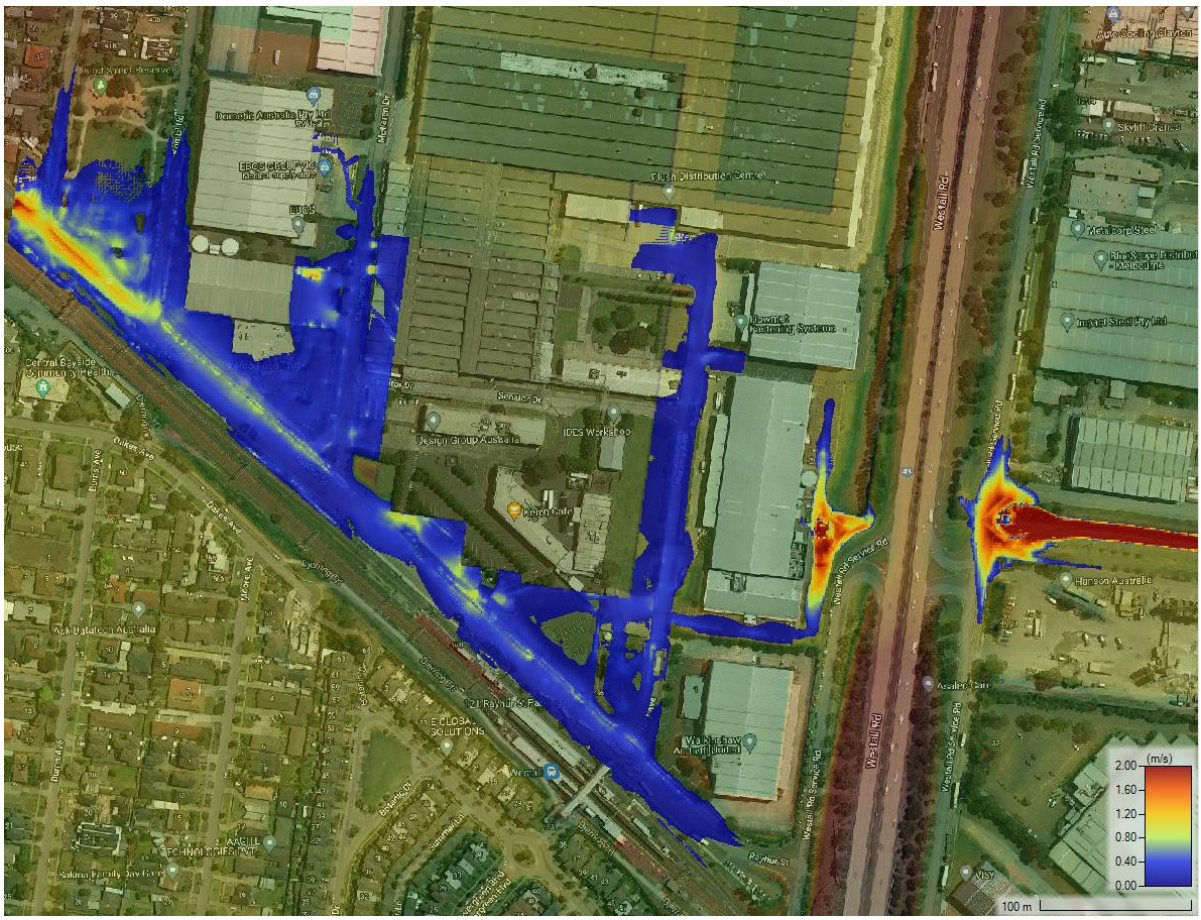


**Figure 8 –Proposed 1% AEP Flood Velocity with Mitigation Measures**

**Figure 9** illustrates the 1% AEP flood hazard (depth x velocity) for the proposed redevelopment with the mitigation measure of piping an additional 5.5 $m^3/s$ of overland flow.

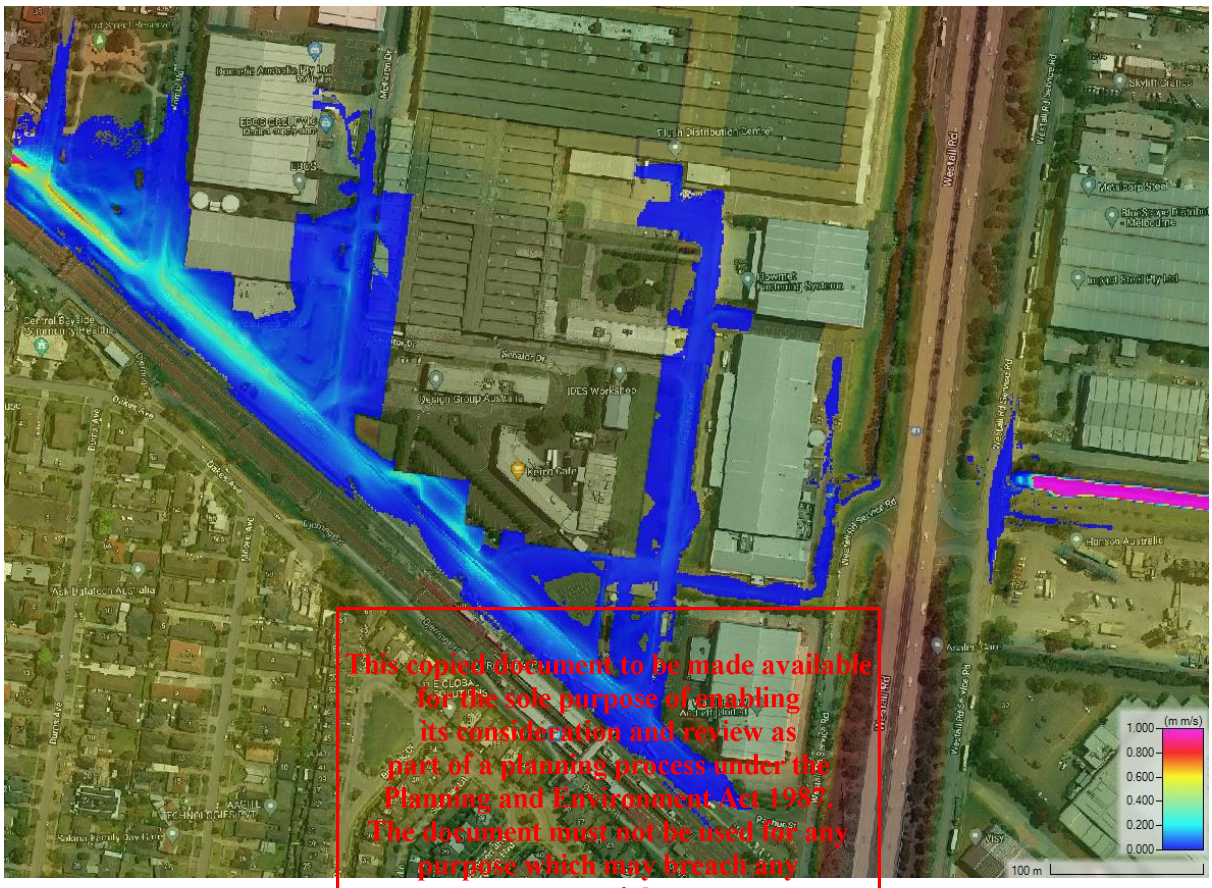




**Figure 9 –Proposed 1% AEP Flood Hazard with Mitigation Measures**

## 5 Flood Mitigation Works

The redevelopment of the site must capture and convey an additional 5 $m^3/s$ in a subsurface system to ensure no increase to flood elevations to surrounding properties. Alternatively, an additional offset to the built form from Rayhur Street is required together with some piping of gap flows.

The additional gap flows will need to be captured in a grated pit around Kombi Road, or McLaren Drive. The pit will need to be depressed to capture the flow. Selecting the ideal location for the capture pit is difficult due to level constraints to match into the existing large pit located on Westall Road. It is proposed to pipe the 5.5 $m^3/s$ between the capture pit and connect it to the existing large pit on Westall Road.

Locating the capture pit around Kombi Road would require negotiations with Council as the pit would likely be located outside of the site on Council land. Locating the pit in Council land would ensure no afflux due to the future joining of the warehouses on Kombi Road.

Locating the pit at McLaren Drive would keep control of the additional drainage works within the development. This would also enable a better longitudinal grade for the proposed pipeline. The exact location of the pit and the future pipe is subject to a functional design, based on survey of the exact location of the Westall Main Drain and the location of the proposed works within the site at MGA coordinates base.

A 3 m x 3 m grated pit located with the finished surface depressed 550 mm below the surrounding ground levels is required to capture the additional gap flow for subsurface piping. This accounts for

blockage of the inlet. A large increase in the pit size is required to reduce the depth of flow required over the top to capture the flow.

A 2400 mm diameter pipe is required through the site to capture and convey the additional gap flows. It is preferred to align this additional pipe adjacent to the existing Westall Main Drain. Melbourne Water's requirements is for a 1.5 m minimum clearance from the outside diameter of the existing drain to the proposed new drain. A preliminary investigation indicates that there is a possibility of meeting this requirement and aligning the new drain parallel to the existing Westall Main Drain.

The proposed building at 2 McLaren Drive is approximately 3 m away from the property boundary at the pinch point. The proposed drain may need to be partially located within the road reserve to achieve an adequate clearance from this proposed building, or the building footprint marginally reduced adjacent to Rayhur Street to facilitate the new drain adjacent to the Westall Main Drain.

Alternatively, the new drain will need to be constructed north along McLaren Drive, east through the proposed east – west internal road and south along Westall Road.

It is proposed to connect the new 2400 mm diameter pipe into the existing 5 m x 7 m pit located in Westall Road. The new pipeline will have a longitudinal grade of between 1 in 1500 and 1 in 2000, subject to detailed design.

## 6 Addressing Development in Flood Prone Land

The site can address the requirements of development in flood prone land for the redevelopment through the following.

***Flood Safety***

Preliminary modelling with the additional piping of 5.5 m3/s results in the maximum flood depth within the site should be than 0.5 m, dependent upon the revised civil design for the site, and is therefore okay. The location of the proposed additional entrance from Rayhur Street has a flood depth of less than 0.5 m in Rayhur Street and will be okay.

The peak 1% AEP velocities for the gap flow through the site is less than 2 m/s and is therefore okay.

The flood hazard for the gap flows through the site is less than 0.4 $m^2/s$ and is therefore okay.

The proposed redevelopment will be situated on land with a low overall hazard and is therefore okay.

The proposed redevelopment cannot contain hazardous materials within the area that is subject to inundation in a 1% AEP storm event.

The proposed redevelopment is for industrial purposes and therefore is not deemed to be for vulnerable persons or for services needed to function continuously.

### *Flood Damage*

The floor levels for the proposed redevelopment need to be set a minimum of 300 mm above the 1% AEP flood level. The following is the proposed minimum floor levels for the redevelopment, subject to further refinement with the design of the pavement surrounding the proposed buildings.

**Table 2 – Proposed Minimum Finished Floor Levels**

| Location | Peak 1% AEP Flood Elevation (m AHD) | Proposed Finished Floor Level (m AHD) |
|---|---|---|
| 1 McLaren Drive & 3 McLaren Drive | 51.61 | 51.91 |
| 2 – 8 McLaren Drive | 51.60 | 51.94 |
| 1 - 5 Nursery Avenue | 51.42 | 51.72 |
| 7 Nursery Avenue | 51.14 | 51.44 |
| 2 Nursery Avenue | 51.42 | 51.72 |
| 4 Nursery Avenue | 51.52 | 51.82 |
| 6 Nursery Avenue | 50.86 | 51.16 |
| 8 Nursery Avenue | 51.08 | 51.38 |
| 9, 10 & 11 Nursery Avenue | 51.18 | 51.48 |

The proposed buildings affected by flooding should be constructed from flood resistant materials. The essential building services through the site to the proposed buildings within the land subject to inundation will need to be flood proofed.

### *Flood Impacts*

Through the capture and subsurface conveyance of an additional 5.5 $m^3/s$ of gap flow, the development has demonstrated that there is no increase in flood level to the surrounding properties. The development is not diverting any flows to the detriment of adjoining properties. The lost flood plain storage between the existing development and the proposed redevelopment is provided in the additional subsurface pipe drainage.

## 7 Summary

The proposed redevelopment of Clayton Business Park must meet the requirements of development in flood prone land. As the redevelopment is proposing an increase in building footprints through the existing flood plain, the development will need to capture and convey some additional gap flows in a subsurface system through the site.

Flood modelling has indicated that the capture and subsurface conveyance of an additional 5.5 $m^3/s$ of gap flow will not impact the surrounding land. This flow will need to be captured in a 3 m x 3 m grated pit, proposed to be located around the intersection of McLaren Drive and Rayhur Street. The pit RL will need to be set at 550 mm below the surrounding levels to capture the flow.

A 2400 mm diameter pipe is required to connect the capture pit to the large existing pit in Westall Road. The preferred alignment for this pipe is parallel to the existing Westall Main Drain. Further survey of the existing Westall Main Drain is required to ensure appropriate clearances for this drain can be achieved from the Westall Main Drain and the proposed building footprints.

Further flood modelling will be required to demonstrate that the site meets the requirements of development in flood prone land once the internal civil design is completed.