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Stage 1, Axxess Corporate Park, Mount Waverley

STORMWATER MANAGEMENT STRATEGY

September 2022

DCE Ref: 22058

FOR

dexus

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Executive Summary

This report outlines the stormwater drainage and management strategy for the development of Stage 1, comprising Lots 1 and 2 at 170 Forster Road, Mount Waverley.

Stage 1, the subject site, is located within the City of Monash and will be developed such that the City of Monash and Melbourne Water stormwater requirements are achieved. The proposed development will comprise industrial and commercial development.

Underground drainage within the proposed development will be designed to convey minor event flows up to and including the 10% Annual Exceedance Probability (AEP) flows in accordance with council requirements.

For major events, defined as flows greater than the 10% AEP event, up to and including the 1% AEP, safe overland flow paths will be provided to direct stormwater to adjacent roads.

The City of Monash has advised that no detention or contribution is required owing to the site being in an existing industrial area. City of Monash correspondence is included in Appendix A.

Stormwater quality treatment will be provided to ensure that stormwater is treated to best practice environmental management (BPEM) targets prior to leaving the site.

Consideration needs to be given to the fact that as there are multiple land parcels within the subject site, they may be subject to individual requirements for legal points of discharge and stormwater treatment. Stormwater management at the subject site will be undertaken in a way that corresponds with the planning and future development of other stages of development.

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1. Introduction

This report presents the stormwater drainage and management strategy for the proposed development of the subject site, Stage 1 of Axxess Corporate Park. Stage 1 comprises proposed lots 1 and 2. The subject site is located within Mount Waverley, comprises approximately 6 ha and is located within the City of Monash.

The subject site is currently zoned for industrial use. Industrial/commercial development exists at at the subject site in the existing condition. The proposed development will also be industrial/commercial land use. Figure 1 shows the subject site in the existing condition.

The subject site comprises 6 ha and slopes generally towards the north-west to Forster Road. This stormwater management strategy will demonstrate that the subject site can appropriately manage stormwater in the developed condition and accommodate all required infrastructure.

The subject site is part of the Axxess Corporate Park development. A stormwater management strategy (SWMS) for the entire development has been prepared by DCE. 22058jul0422-SWMS Rev A (DCE, 2022) has been submitted to Council.

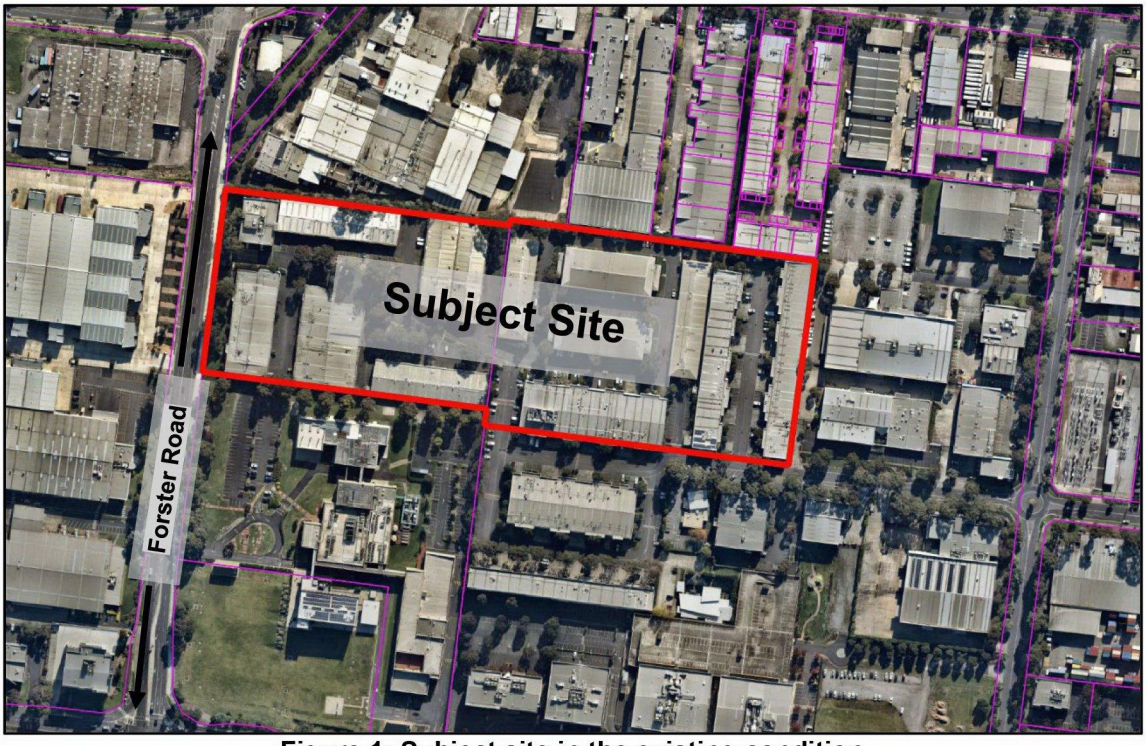

Figure 1: Subject site in the existing condition

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2. Site Overview

2.1. Existing condition

In the existing condition, the subject site land use is industrial. Publicly available elevation contours indicates that the subject site drains north-west to Forster Road. Figure 2 shows the subject site topography.

Figure 2: Subject site topography

A Before-You-Dig enquiry has indicated that there is existing Council infrastructure within the Forster Road adjacent to the subject site. Figure 3 shows the location of the existing council underground drainage infrastructure. Complete Council drainage plans are included in Appendix A.

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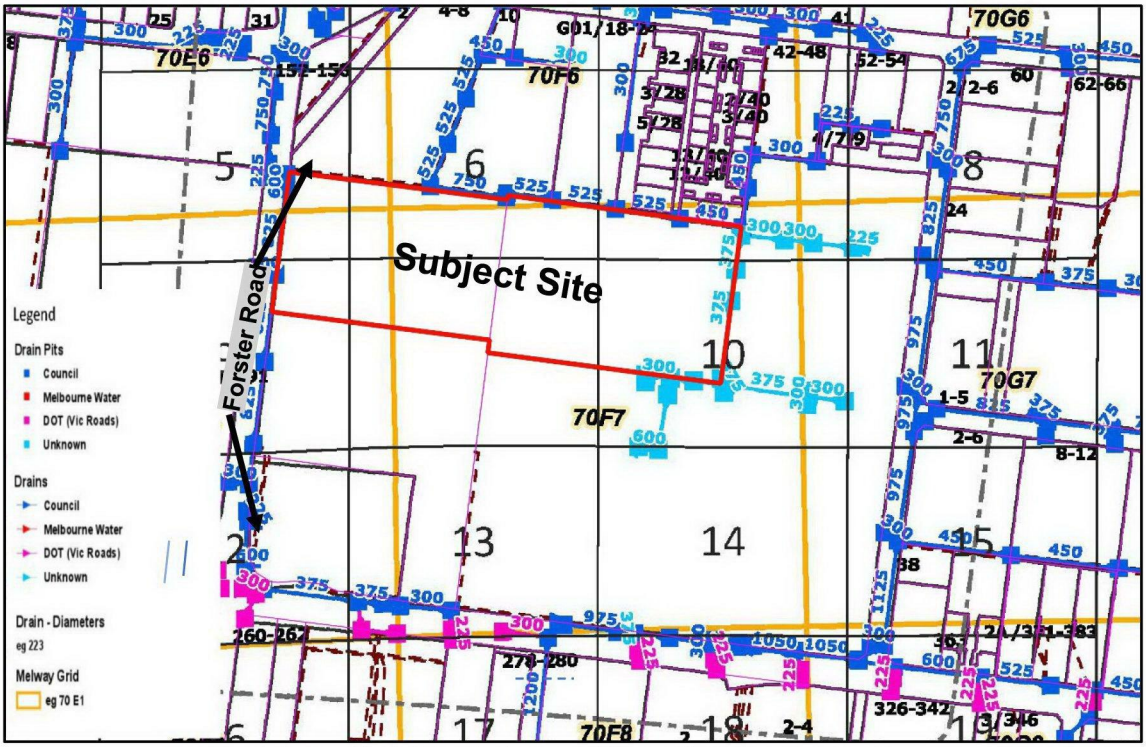

Figure 3: Subject site and Council drainage assets

During detailed design, it will need to be assessed if the existing Council infrastructure within the site can be retained or if it will need to be decommissioned. Since the site is currently used for industrial purposes, it is likely that there is existing underground drainage within the subject site that is not indicated in the BYD, and that these have been sized to cater for minor flows up to the 10% AEP. It is also expected that existing roads and other overland flow paths have been sized to convey the gap flows (i.e., 1% AEP – 10% AEP flows)

In the existing condition, the site generally slopes to the north-west. The BYD information indicates that there is an existing Council underground drain at the north-west of the subject site. The existing 825-mm diameter stormwater pipe on Forster Road is the assumed Legal Point of Discharge for the site. This will need to be confirmed with the City of Monash. Existing flows have been calculated for the entire subject site at a single outlet at the north-west boundary of the subject site. Figure 4 shows the existing catchment and the location of peak flow calculations.

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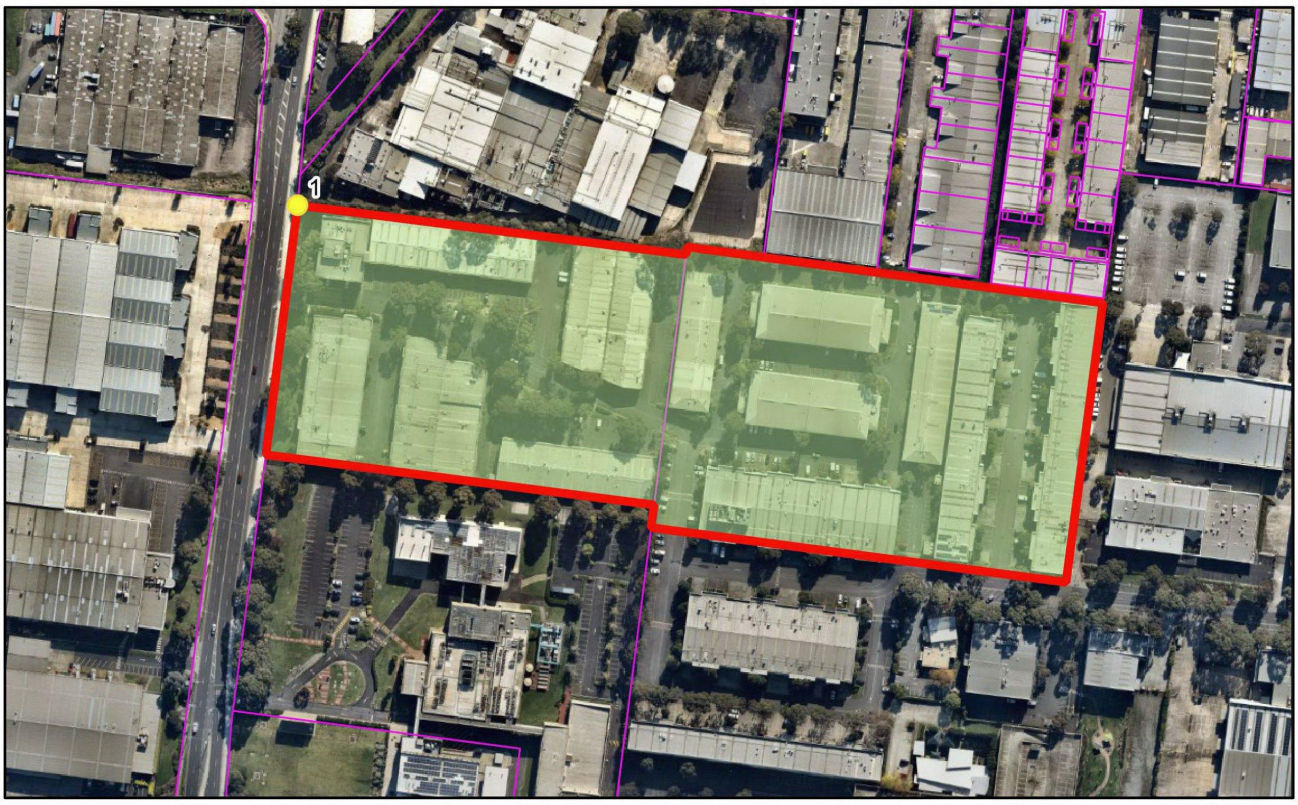

Figure 4: Existing catchment plan showing location of peak flow calculation

Existing condition flows for the subject site have been calculated and are shown in Table 1. Details of the drainage calculations are included as Appendix B.

Table 1: Existing flows at the subject site

Catchment		10% AEP flow (m^3/s)	1% AEP flow (m^3/s)
Subject Site		0.78	1.74

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2.2. Development Plan

The development plan for the subject site incorporates industrial lots and an internal road. Figure 5 shows the development plan for the subject site. A full-size development plan is included as Appendix C.

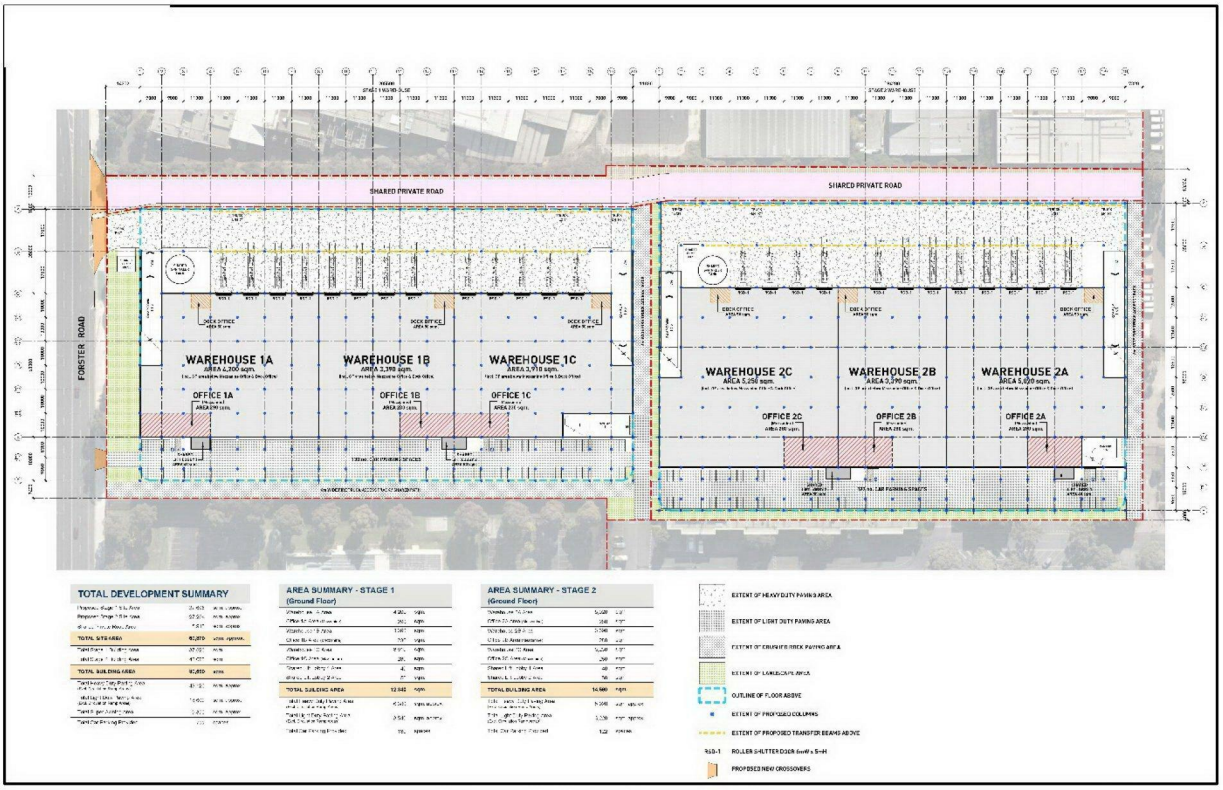

Figure 5: Development plan

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3. Stormwater Management

The subject site is located within the City of Monash and is subject to Council stormwater guidelines. Major and minor flows have been calculated for both existing and developed conditions for the development. Flows have been calculated based on the City of Monash stormwater guidelines.

All flow calculations have been completed using the Rational Method, reflecting industry best practice and in accordance with Australian Rainfall and Runoff (2019) (ARR19) guidance.

3.1. Proposed Development Condition

In the developed condition, the subject site is to remain as an industrial use in the proposed development. A full-size plan of the proposed development is included as Appendix C.

As the subject site is proposed to be developed for industrial use, minor internal drainage will be sized to cater for the 10% Annual Exceedance Probability (AEP). Minor drainage from the subject site will be conveyed to existing Council drainage at the north-western boundary of the subject site.

Major overland flow paths will be sized to direct flows in excess of the capacity of the minor drainage to existing overland flow paths within the existing access road. Stormwater drainage will be managed as part of the development.

Design of underground drainage and overland flow paths within the subject site will cater for external flows from other stages of the Axxess Corporate Park development. This report defines minor flows as stormwater flows up to and including the 10% AEP Annual Exceedance Probability (AEP). Major flows are defined as greater than the 10% AEP flow up to and including the 1% AEP flow. All calculations and drainage design in this report are compliant with ARR19 methodology and reflect industry Best Practice approaches.

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Figure 6: Developed catchment plan showing location of peak flow calculation.

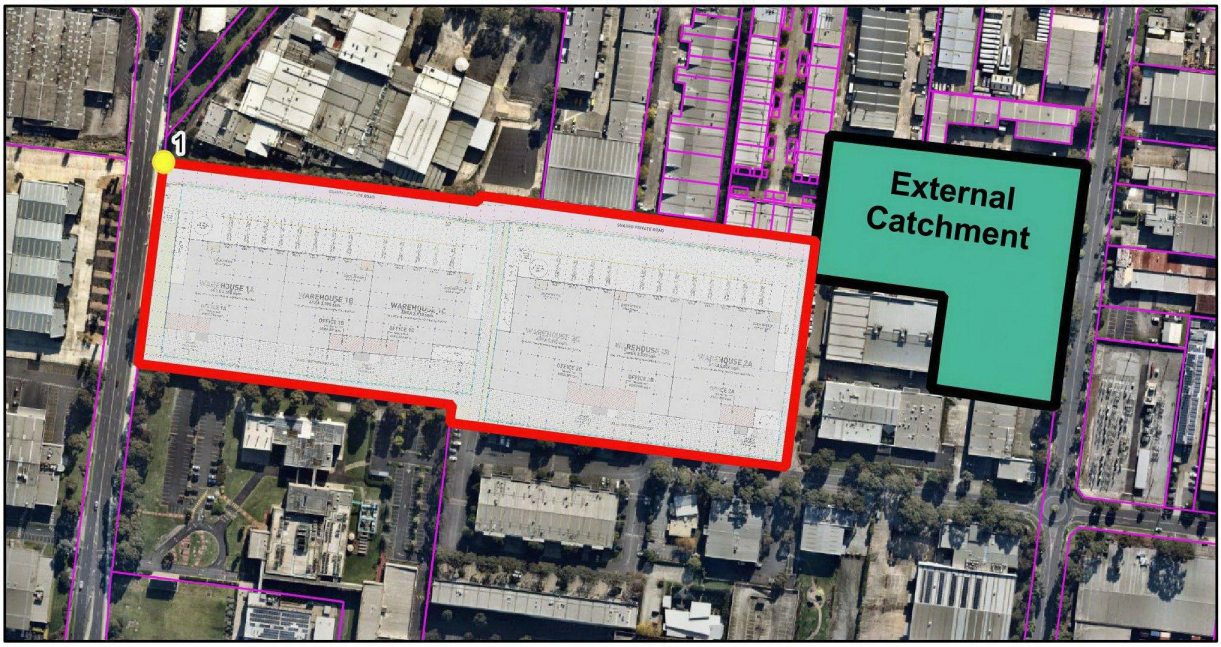

Figure 7: Developed catchment plan showing the external catchment

3.2. Minor Event Flows

Minor event flows will be managed within the development prior to discharge to existing Council drainage. Minor flows, up to and including the 10% AEP event will be directed to existing Council drainage assets at the north-western boundary of the subject site. This report defines minor event flows for industrial developments as 10% AEP flows. Complete drainage calculations are included in Appendix B.

The minor drainage system will be designed to control stormwater flows under normal operating conditions and minor rainfall events. The exact configuration of the minor drainage system will be determined during detailed design. The flows presented in this report will be refined during detailed design.

3.2.1. Minor Flow Calculation

Minor peak 10% AEP developed flow is shown in Table 2.

Table 2: Developed minor flows

Catchment	Location	10% AEP flow (m^3/s)
Subject Site	1	0.8
Subject Site and External Catchment	1	1.1

3.2.2. Management of Minor Flows

Minor flows will be managed at the precinct level. Minor drainage for each lot will connect to underground drainage within the proposed road and then to existing Council drainage at the north-western boundary of the subject site.

As part of the proposed development works, Dexus have noted that they wish to make provision to subdivide Lots 1 & 2 in the future. In order to subdivide the lots in the future, each lot must be individually serviced and have its own legal point of discharge. As a result, it is likely that a drainage easement will be required through either Lot 1 or along the private road to ensure that a discharge point is created for Lot 2.

Further advice should be sought from a relevant town planner and licensed surveyor. Stormwater quality treatment and on-site detention will be provided for the subject site prior to discharge to Council assets. Stormwater quality treatment is detailed in Section 4. Figure 8 shows indicative minor event flow paths and the direction of flow.

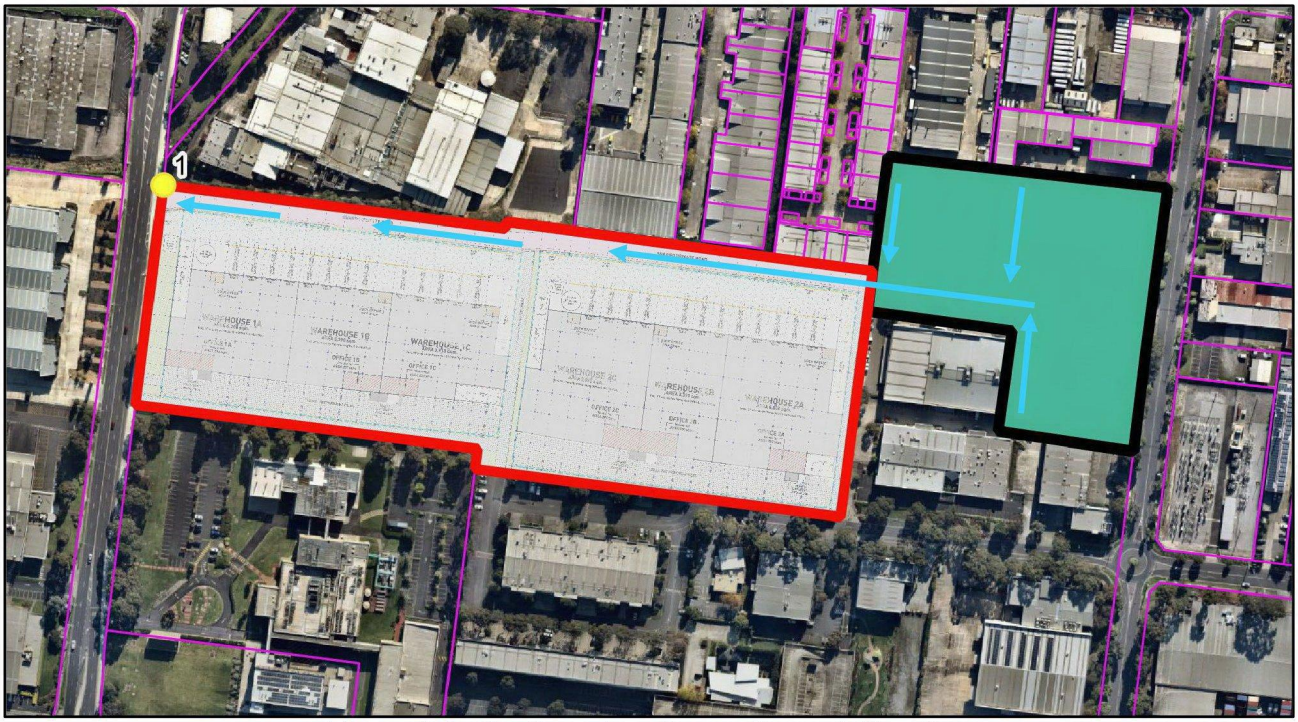

Figure 8: Indicative minor flow paths and directions

3.3. Major Event Flows

Major flows, greater than the 10% AEP and up to and including the 1% AEP, will be conveyed safely overland through the subject site, ensuring no damage to property or risk to people.

3.3.1. Major Event Flow Calculations

Major flows from the subject site will be conveyed safely through the subject site to Forster Road. The 1% AEP developed flow is shown in Table 3. Complete drainage calculations are included in Appendix B.

Table 3: Developed major flows

Catchment	Location	1% AEP flow (m^3/s)
Subject Site	1	1.7
Subject Site and External Catchment	1	2.4

3.3.2. Management of Major Flows

Major event flows will be conveyed safely overland via the proposed internal road network to Forster Road. The overland flow paths within the subject site will be designed such that Melbourne Water's Guidelines for Development in Flood-prone Areas (Melbourne Water, 2007) criteria for safe overland

flow depth (< 0.35 m), velocity (< 1.5 m/s), and depth x velocity (< 0.35 m2/s) criteria are met. The design of the development will ensure sufficient protection from 1% AEP flows to finished floor levels.

Figure 6 shows indicative major event flow paths. The direction of flow is also noted.

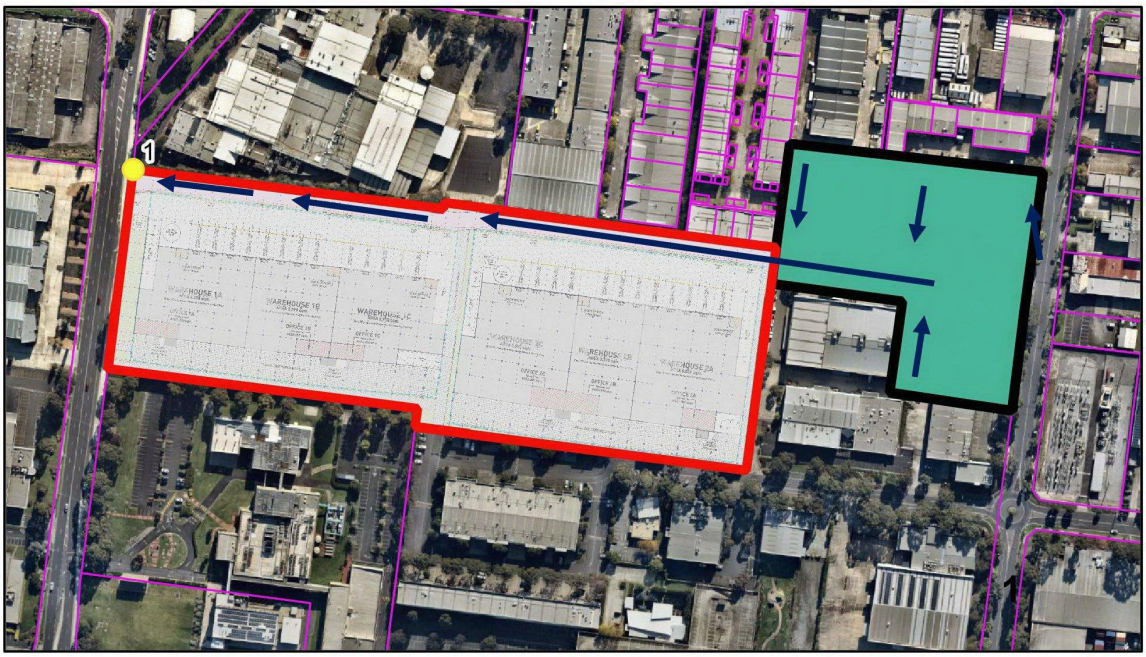

Figure 9: Indicative major flow paths and direction

3.4.Rare Event Flows (0.2% AEP)

During development of the SWMS for the subject site, DCE was asked to consider management of rare event (0.2% AEP or 1-in-500) flows. Rare event flows will be used to inform finished floor levels to ensure adequate protection to properties in rare events.

As shown in Table 4, rare event flows for the subject site and external catchment (Axxess Corporate Park Catchment A) have been calculated. The rare event flows will inform the civil design of the proposed internal road and will be used to set finished floor levels.

Table 4: Developed rare (1-in-500) flows

Catchment	Location	0.2% AEP (1-in-500) flow (m^3/s)
Subject Site	1	2.711
Subject Site and External Catchment	1	3.644

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3.5.On-site Detention (OSD)

The City of Monash has advised that on-site detention (OSD) does not need to be provided. The site is currently used for industrial use, and it will be redeveloped for industrial use. City of Monash correspondence is included in Appendix A.

3.6. External Catchments

As shown in Figure 7, the subject site is part of Axxess Corporate Park Catchment A. Provision for minor, major, and rare flows from the remainder of Catchment A has been made within the subject site. Minor underground drainage and overland flow paths will be designed to convey complete Catchment A flows.

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4. Stormwater Quality Treatment

The subject site is proposed to be developed for industrial use. Stormwater quality treatment is required to treat flows to Best Practice Environmental Management (BPEM) standards. The stormwater quality treatment satisfies planning requirements for stormwater quality treatment.

Two raingardens (bioretention systems) will be used to treat runoff from all areas of the subject site. The raingardens have been sized using MUSIC modelling. The complete MUSIC model is available upon request as an electronic attachment to this report. The MUSIC model inputs and results are included in Appendix E.

Figure 10 shows the MUSIC model schematic and the proposed locations of the raingardens. Note that the development plan of the subject site will be updated to allocate area for the raingardens. The indicative location and size of each raingarden is shown in Figure 11. Figure 12 shows an example of a similar raingarden within an industrial development. Table 5 shows the required size of the raingardens for the proposed development.

Table 5: Raingardens Treatment Effectiveness and Size

Catchment	Total Suspended Solids (% Reduction)	Total Phosphorus (% Reduction)	Total Nitrogen (% Reduction)	Gross Pollutants (% Reduction)	Raingarden Area (m^2)
Lot 1 and internal road	80.8	60.8	50.1	100	120
Lot 2	81.6	60.9	50.4	100	100

Downspouts can direct roof runoff overland to the respective inlets of the proposed raingardens. The grading of carparks and other hardstand area will also direct runoff to raingardens. Raingardens will be designed to ensure that flows in excess of the treatment capacity of the raingardens are captured by underground drainage prior to discharge to the Council drainage network.

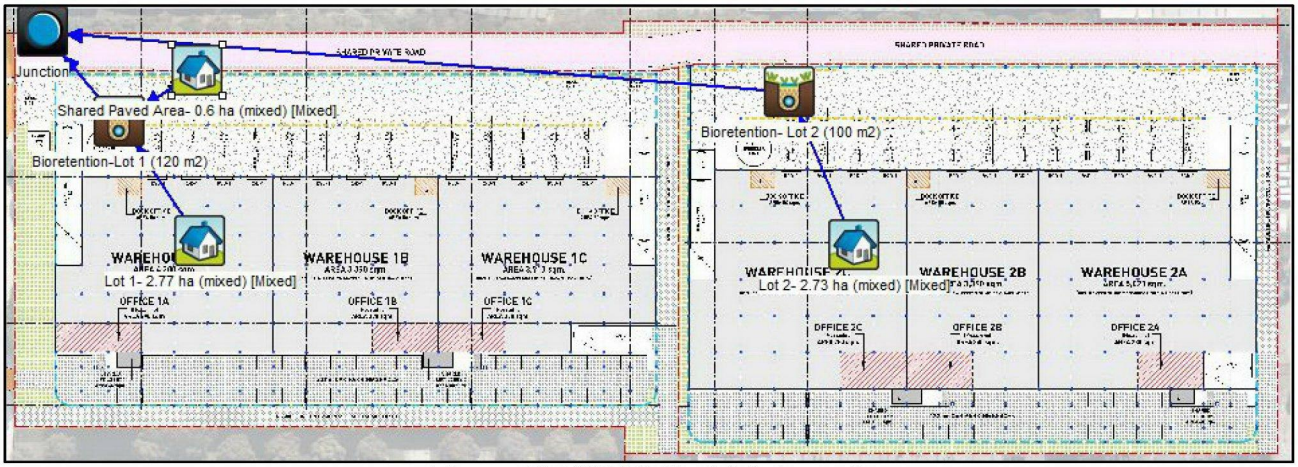

Figure 10: MUISC Model Schematic

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Figure 11: Indicative location and size of each raingarden

Figure 12: Example of Raingarden in An Industrial Development

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5. Conclusion

This report outlines the stormwater drainage and management strategy for the proposed development of the subject site, Stage 1, Lots 1 and 2, of the Axxess Corporate Park, located at 170 Forster Road, Mount Waverley. The subject site will comprise approximately 6 ha of industrial development.

In minor events, up to and including the 10% AEP event, stormwater will be directed to existing Council underground drainage assets at the north-western boundary of the subject site. Council guidelines define minor event flows for industrial developments as being 10% AEP flows.

In major events (greater than the 10% AEP and up to and including the 1% AEP), overland flow will be conveyed safely overland through the subject site, ensuring no damage to property or risk to people.

All overland flow paths will be sized during detailed design to ensure appropriate protection is provided to the development's finished floor levels.

Stormwater quality treatment will be provided for the subject site. It is provided that raingardens be used to treat stormwater from the subject site.

Consideration needs to be given to the fact that as there are multiple land parcels within the subject site, they may be subject to individual requirements for legal points of discharge and stormwater treatment. This SWMS for Stage 1, comprising Lots 1 and 2, allows for overland (major) and underground (minor) flows from Axxess Corporate Park Catchment A to be safely conveyed through the subject site.

This strategy presents a concept drainage design and may be refined during detailed design.

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Appendices

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Appendix A: Monash City Council Assets and Correspondence

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Job No: 32045311
Location: 28 Ricketts Road, Mount Waverley, VIC 3149

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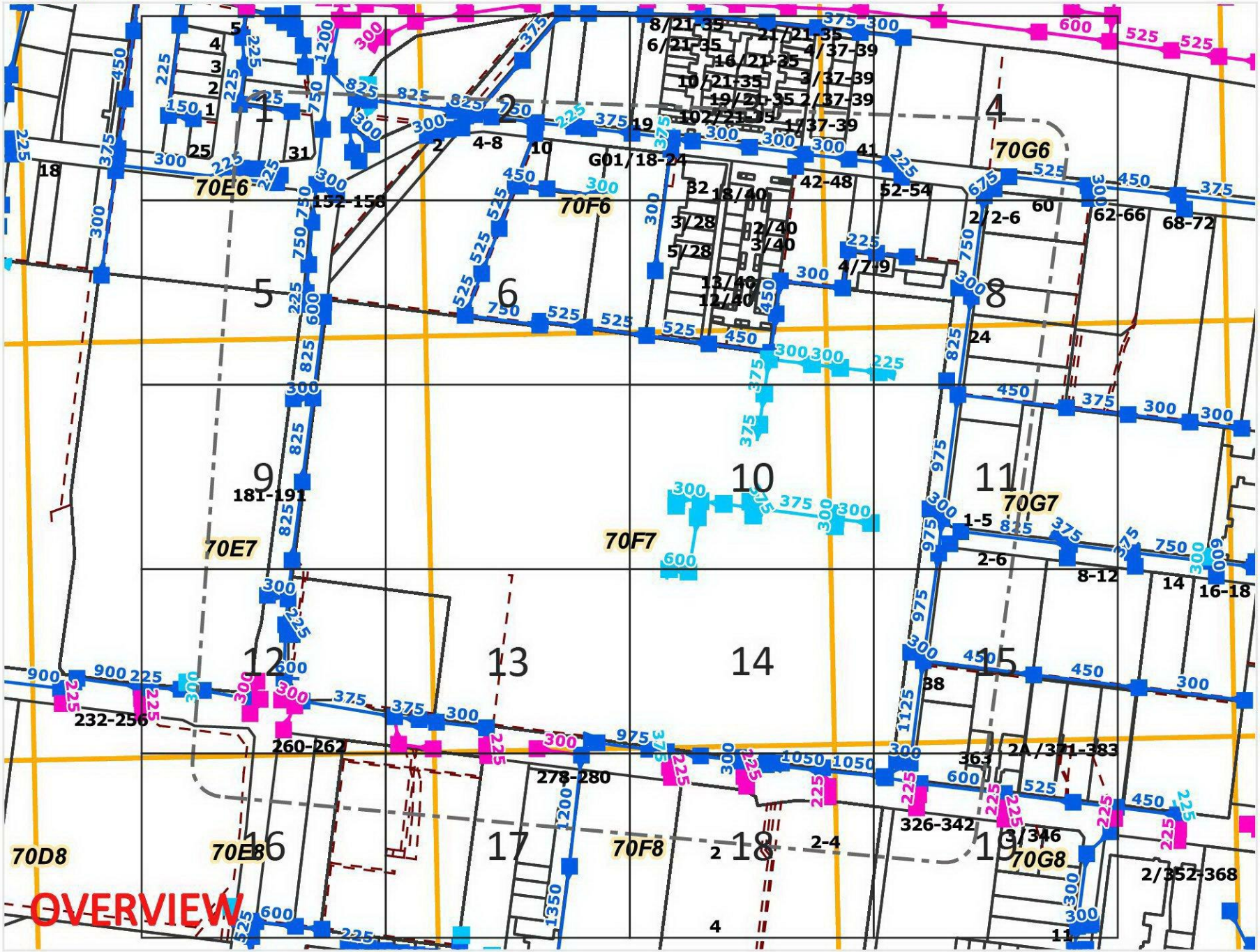

Legend

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- DOT (Vic Roads)
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Drain - Diameters
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Melway Grid
eg 70 E1

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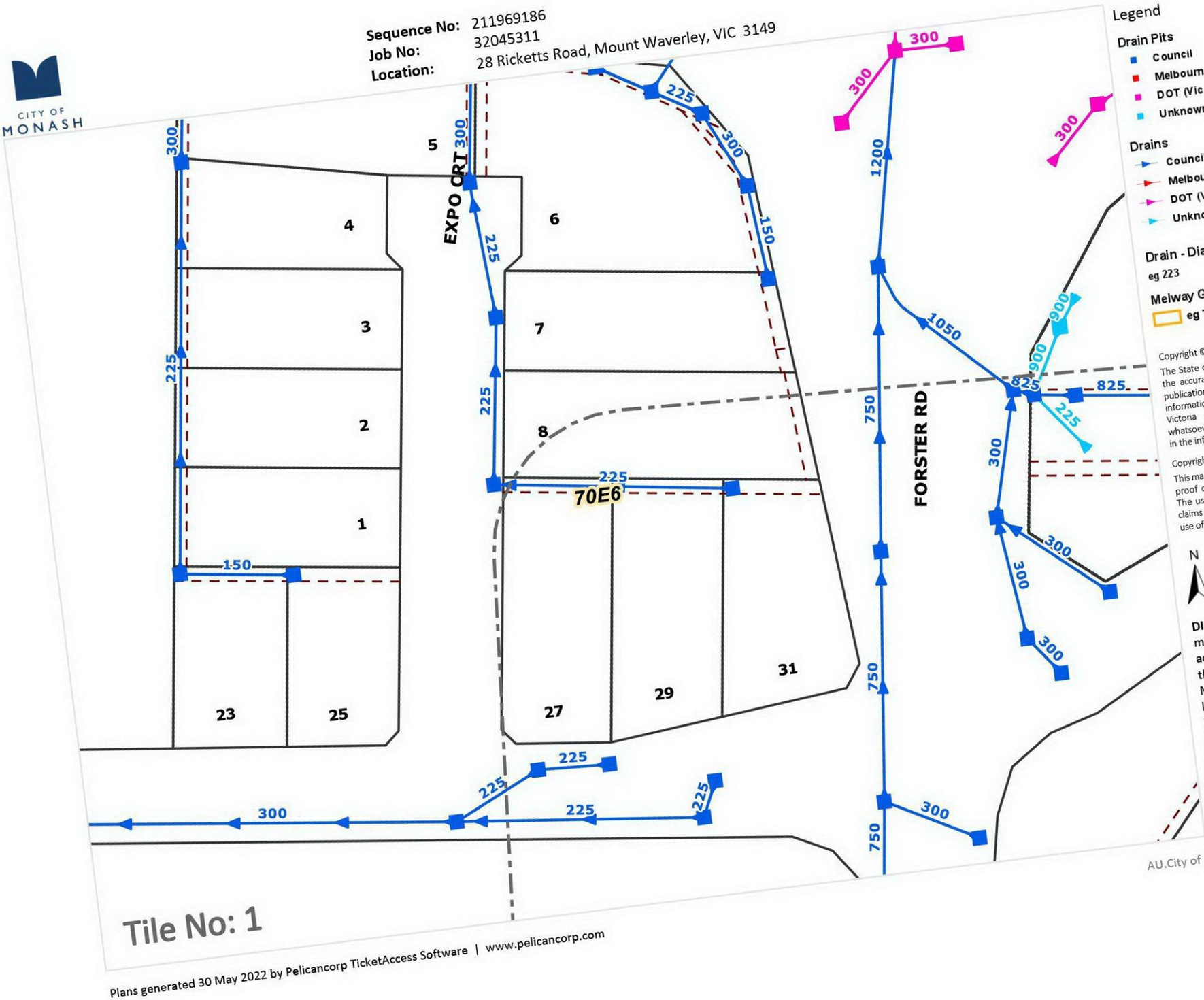

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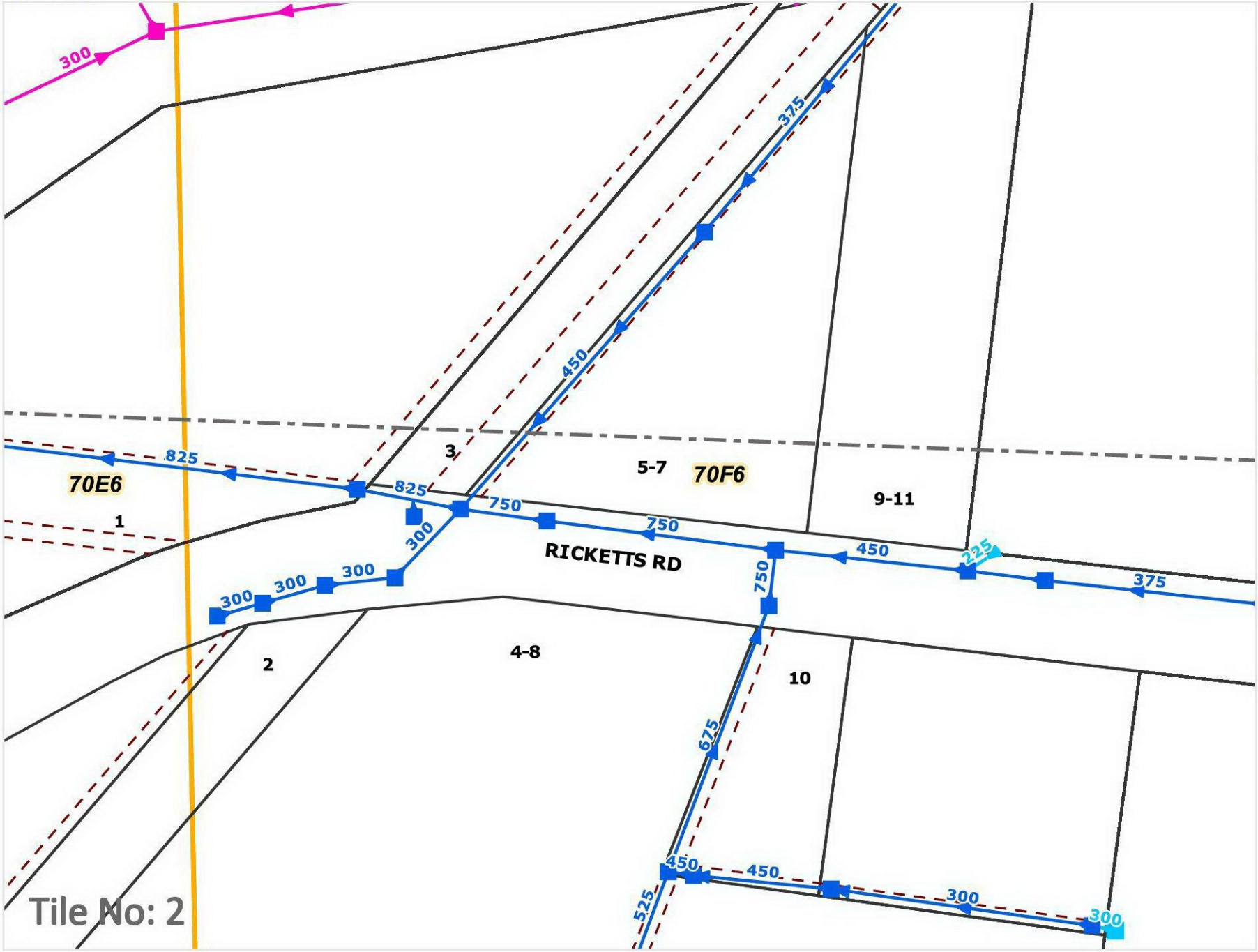

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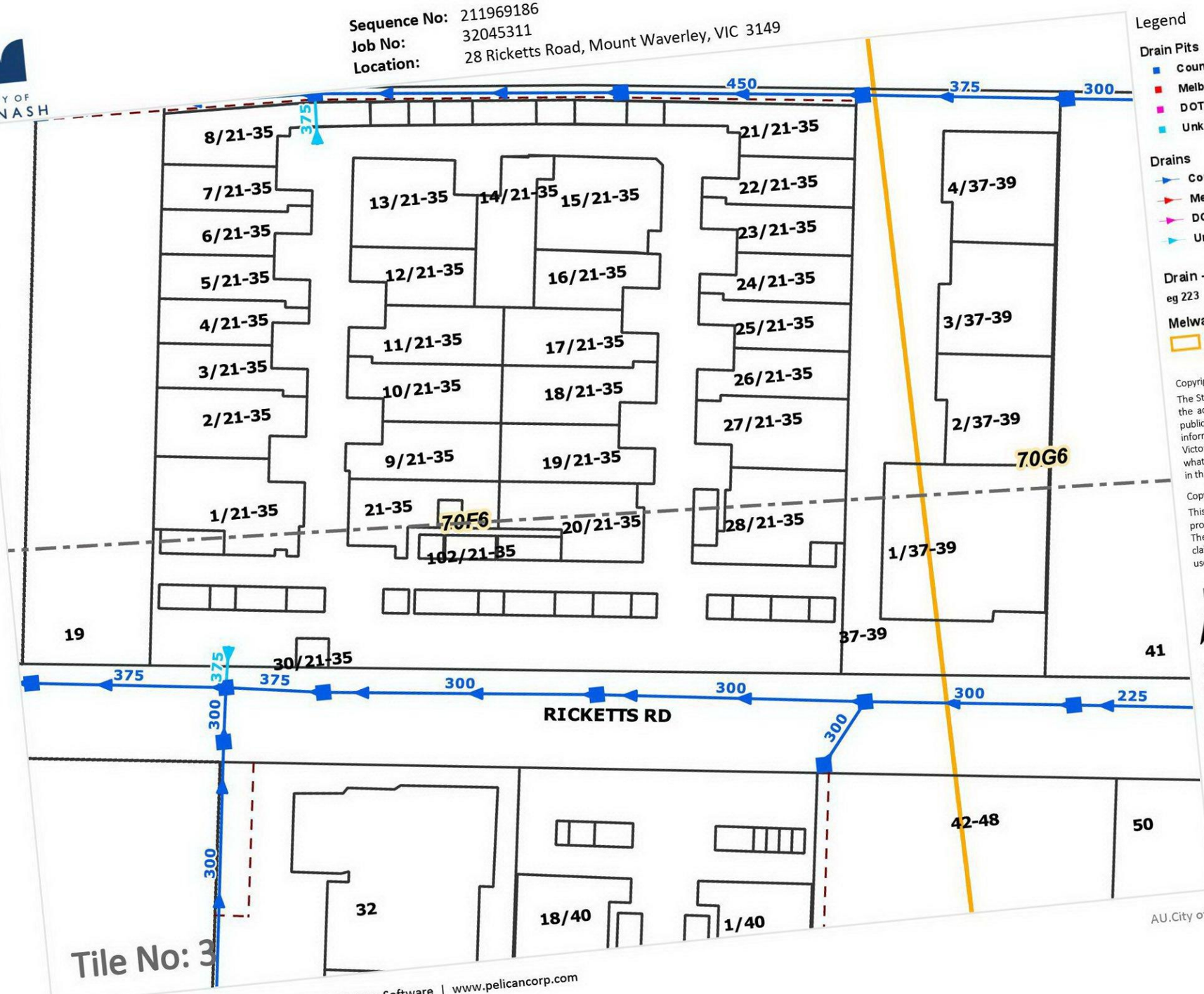

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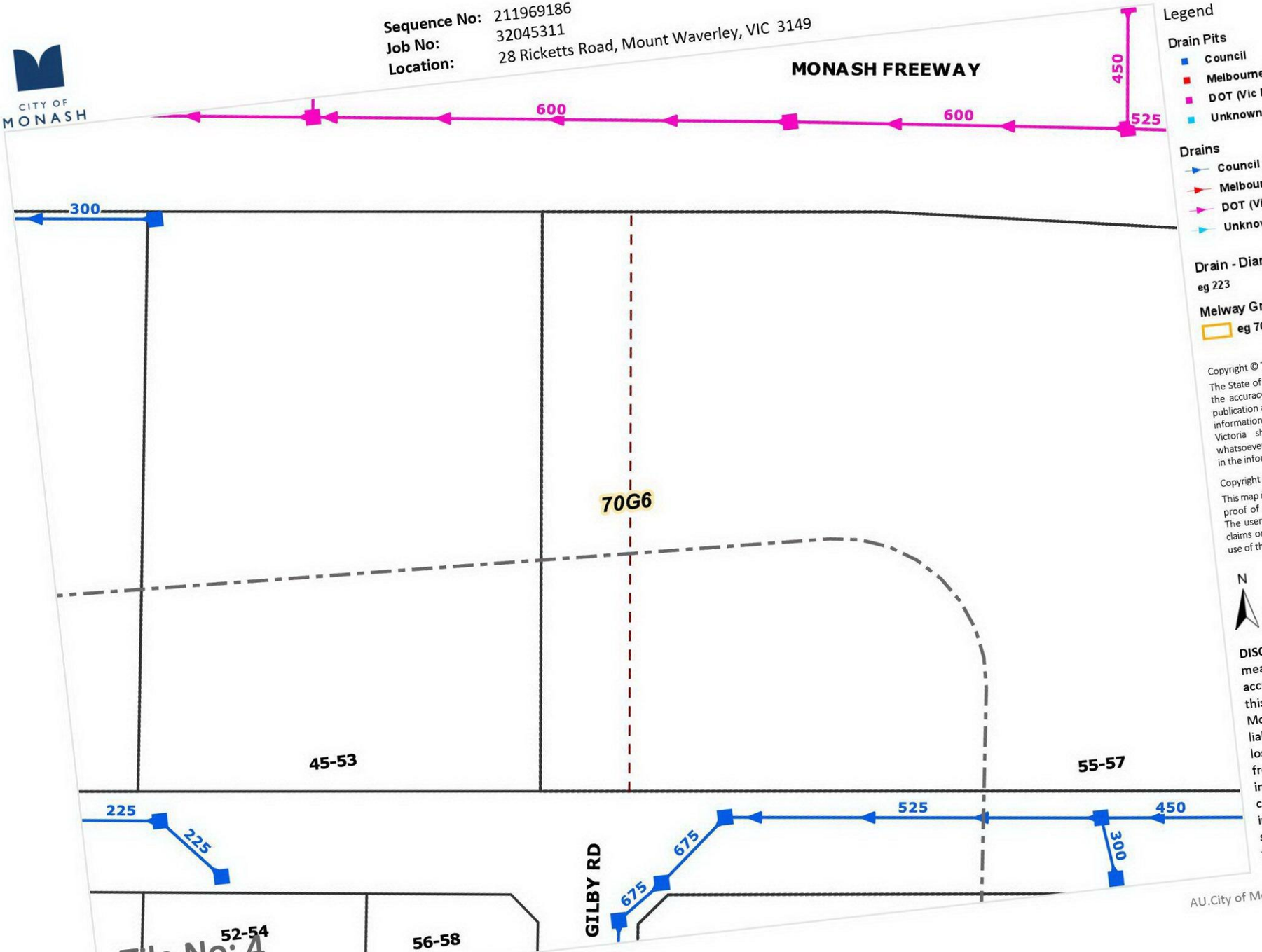

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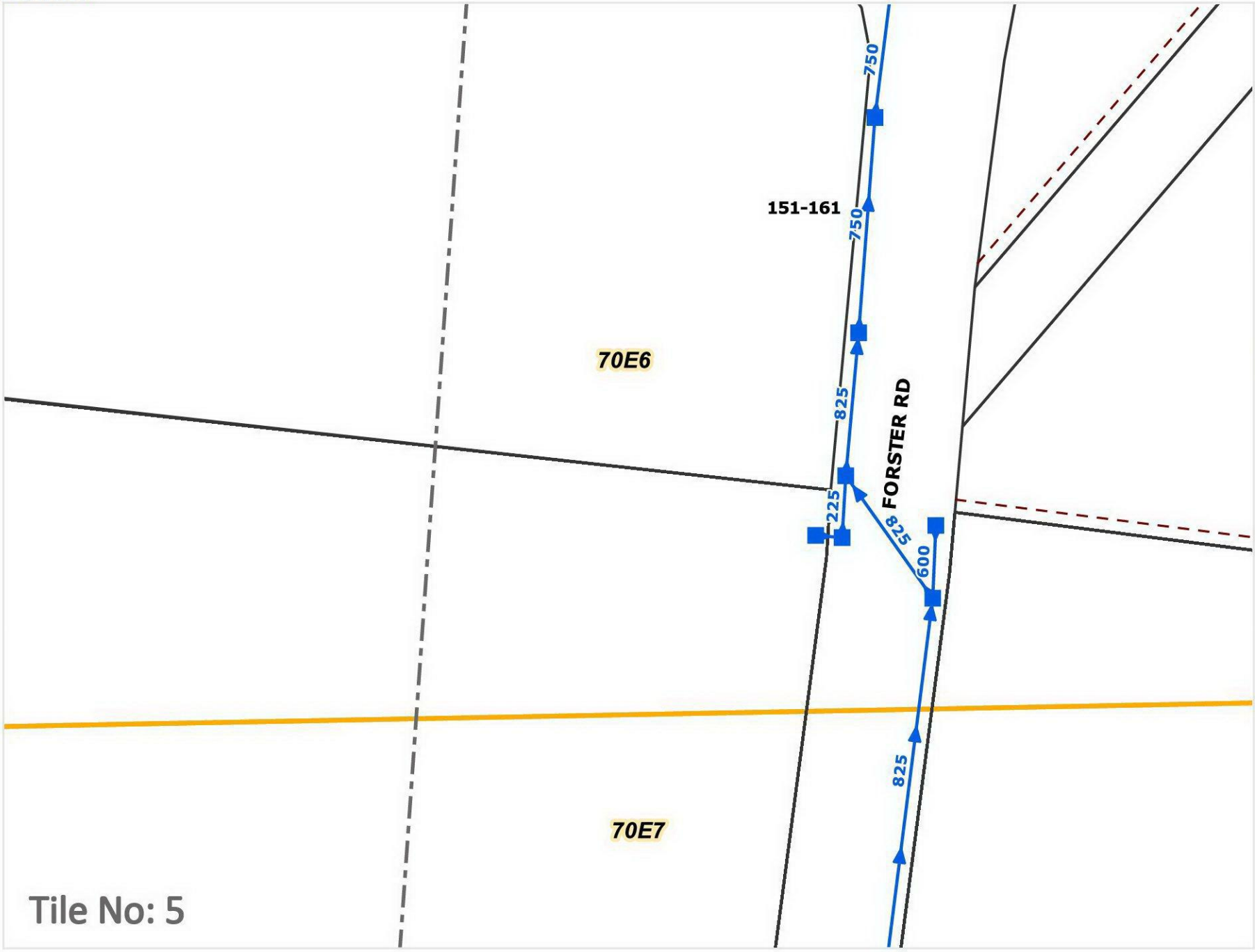

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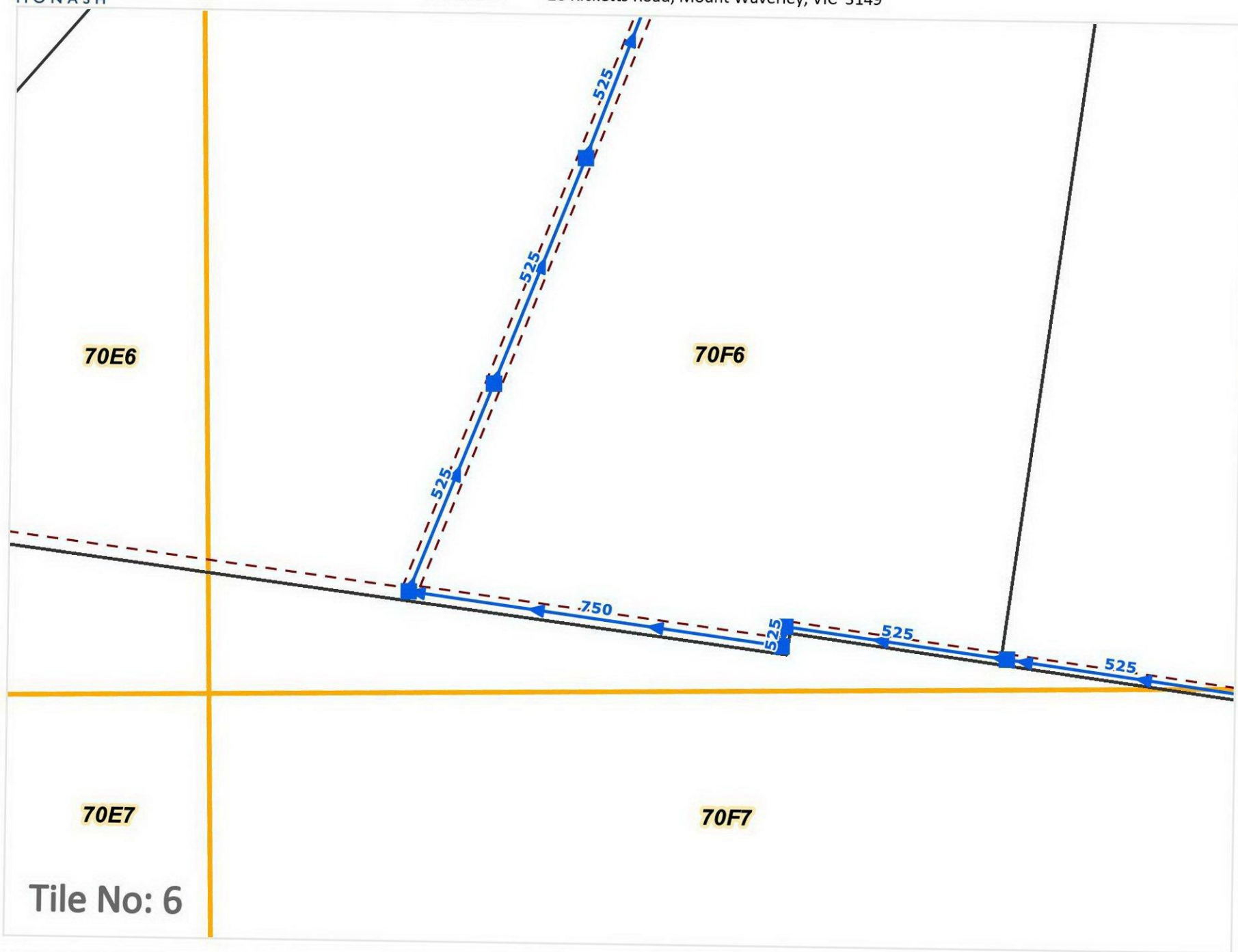

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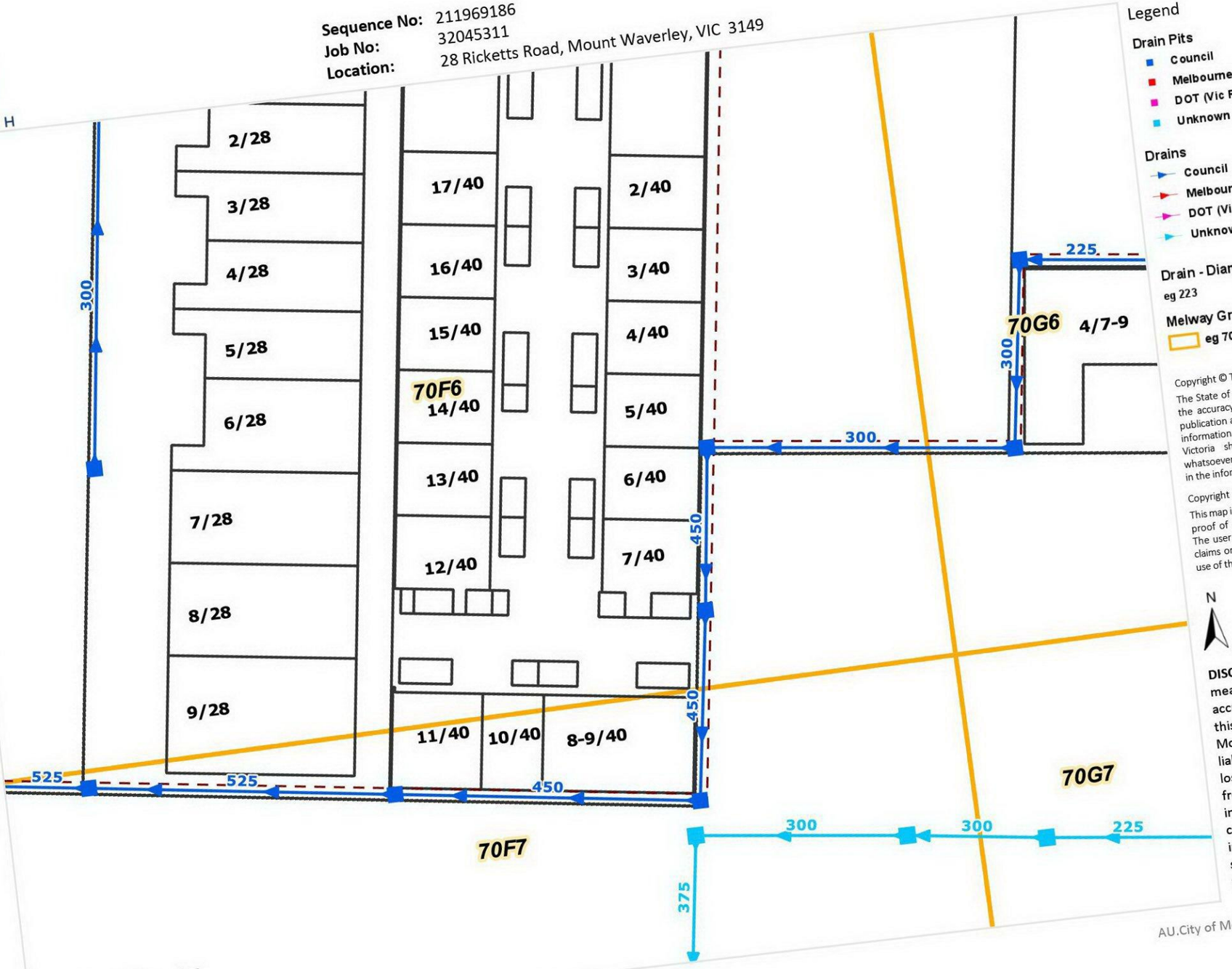

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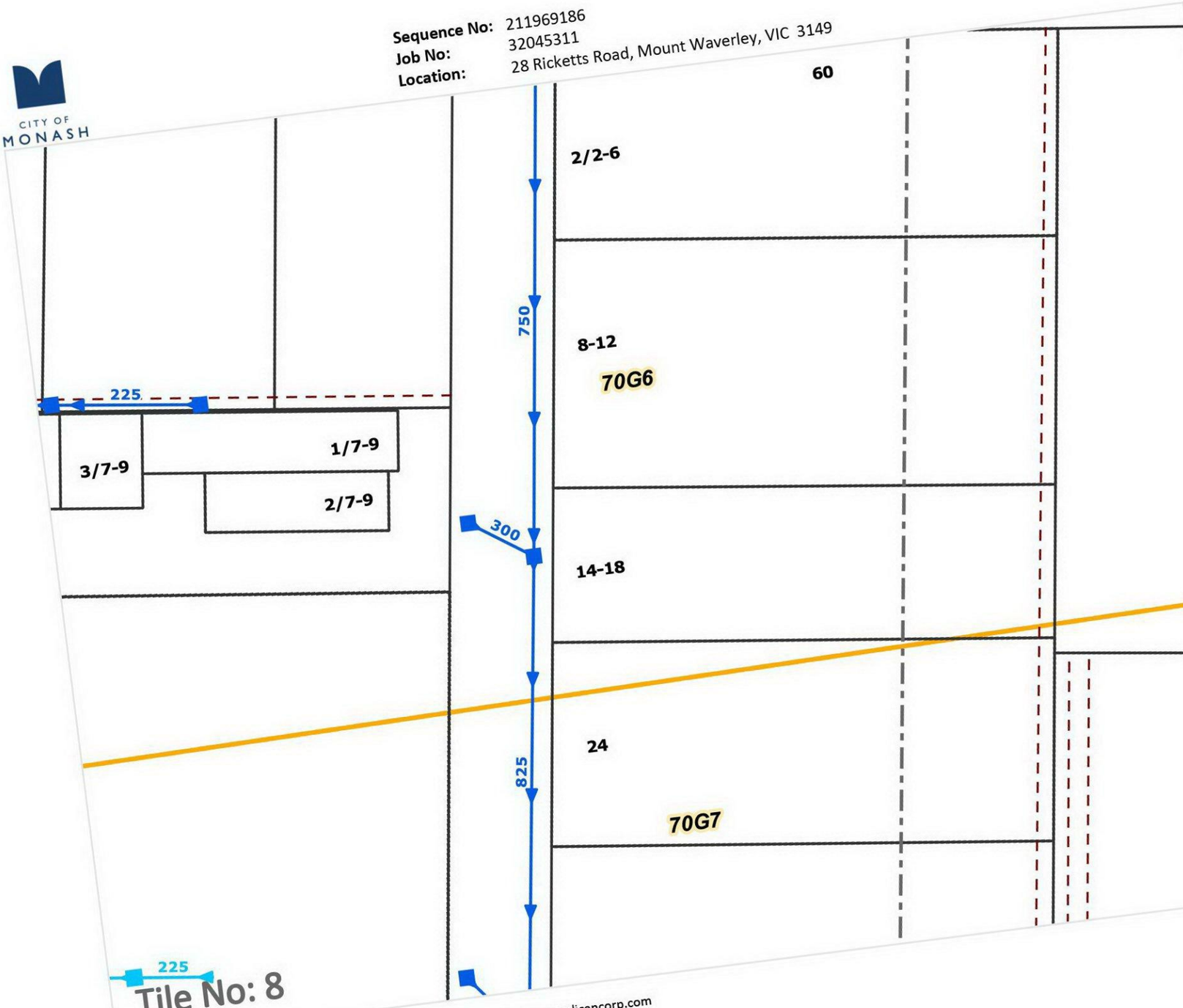
Sequence No: 211969186
Job No: 32045311
Location: 28 Ricketts Road, Mount Waverley, VIC 3149



Tile No: 8

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Legend

Drain Pits
- Council
- Melbourne Water
- DOT (Vic Roads)
- Unknown

Drains
- Council
- Melbourne Water
- DOT (Vic Roads)
- Unknown

Drain - Diameters
eg 223

Melway Grid
eg 70 E1

N

Scale: 1:1000
Expires: 27 Jun 2022

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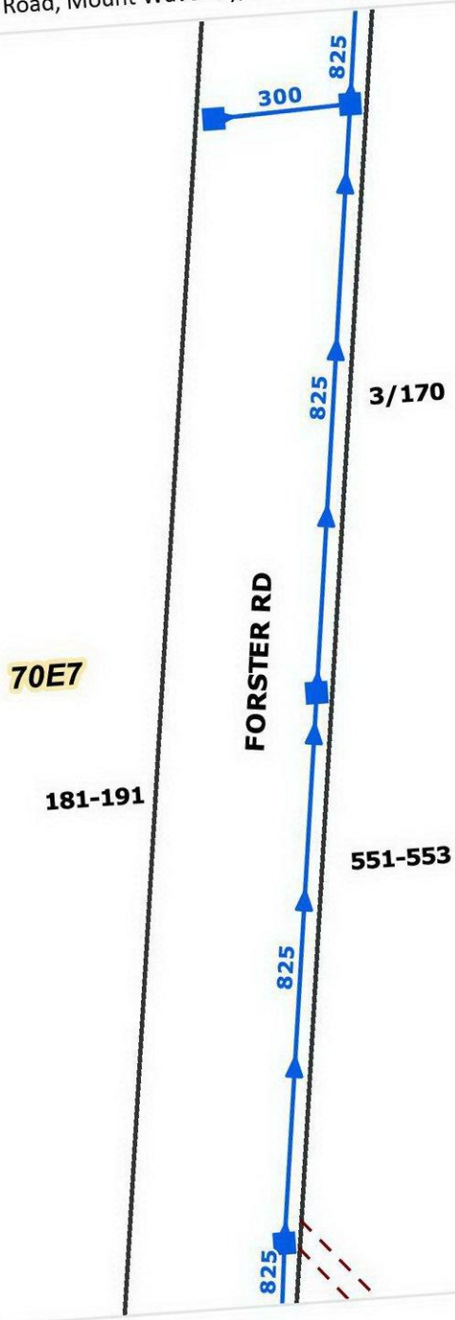
D22-412331

CITY OF MONASH

Sequence No: 211969186
Job No: 32045311
Location: 28 Ricketts Road, Mount Waverley, VIC 3149



Legend

Drain Pits
- Council
- Melbourne Water
- DOT (Vic Roads)
- Unknown

Drains
- Council
- Melbourne Water
- DOT (Vic Roads)
- Unknown

Drain - Diameters
eg 223

Melway Grid
eg 70 E1

N

Scale: 1:1000
Expires: 27 Jun 2022

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Tile No: 9

D22-412331

CITY OF MONASH

Sequence No: 211969186
Job No: 32045311
Location: 28 Ricketts Road, Mount Waverley, VIC 3149

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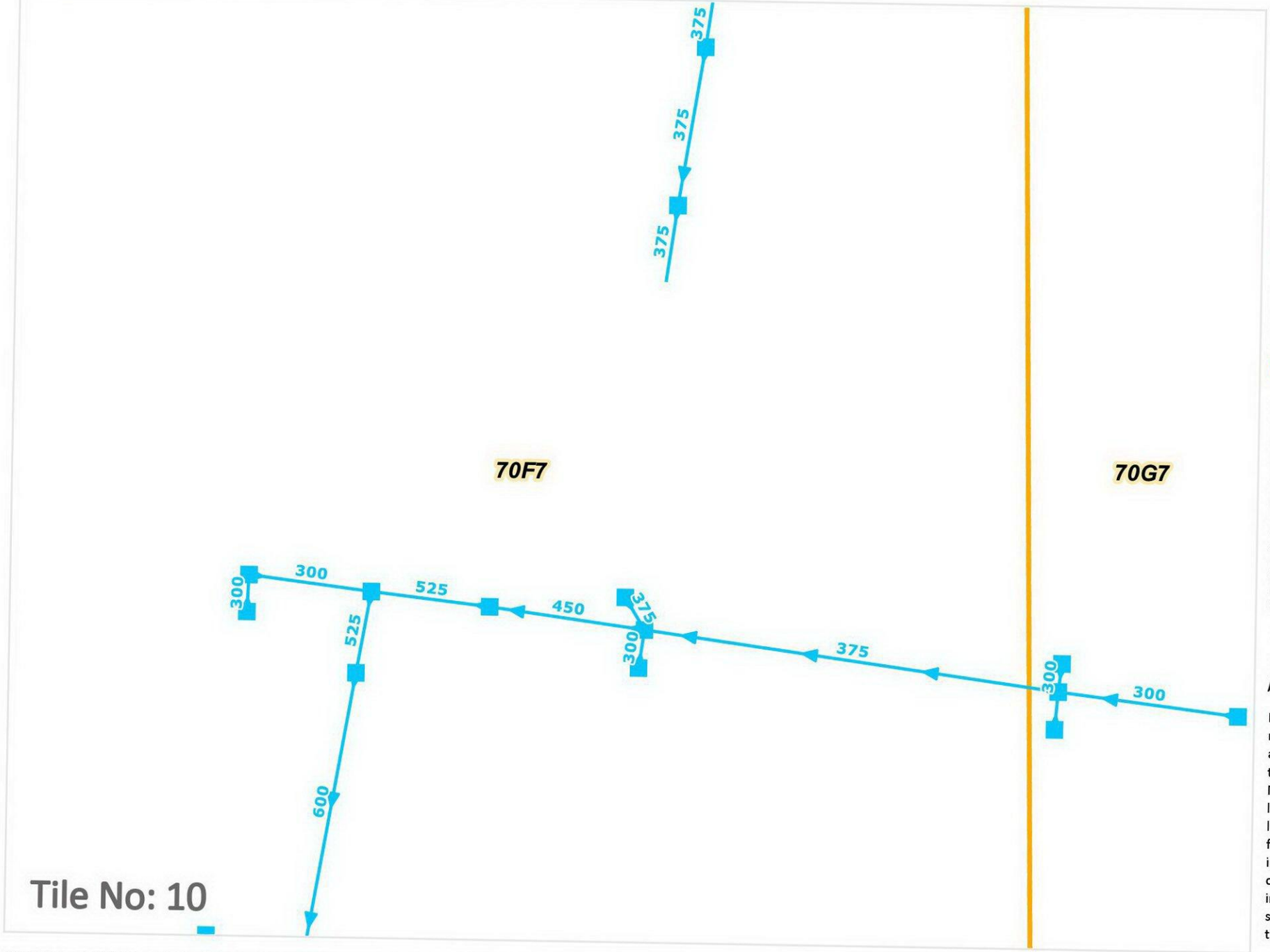

Legend

Drain Pits
- Council
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- Council
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Drain - Diameters
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Scale: 1:1000
Expires: 27 Jun 2022

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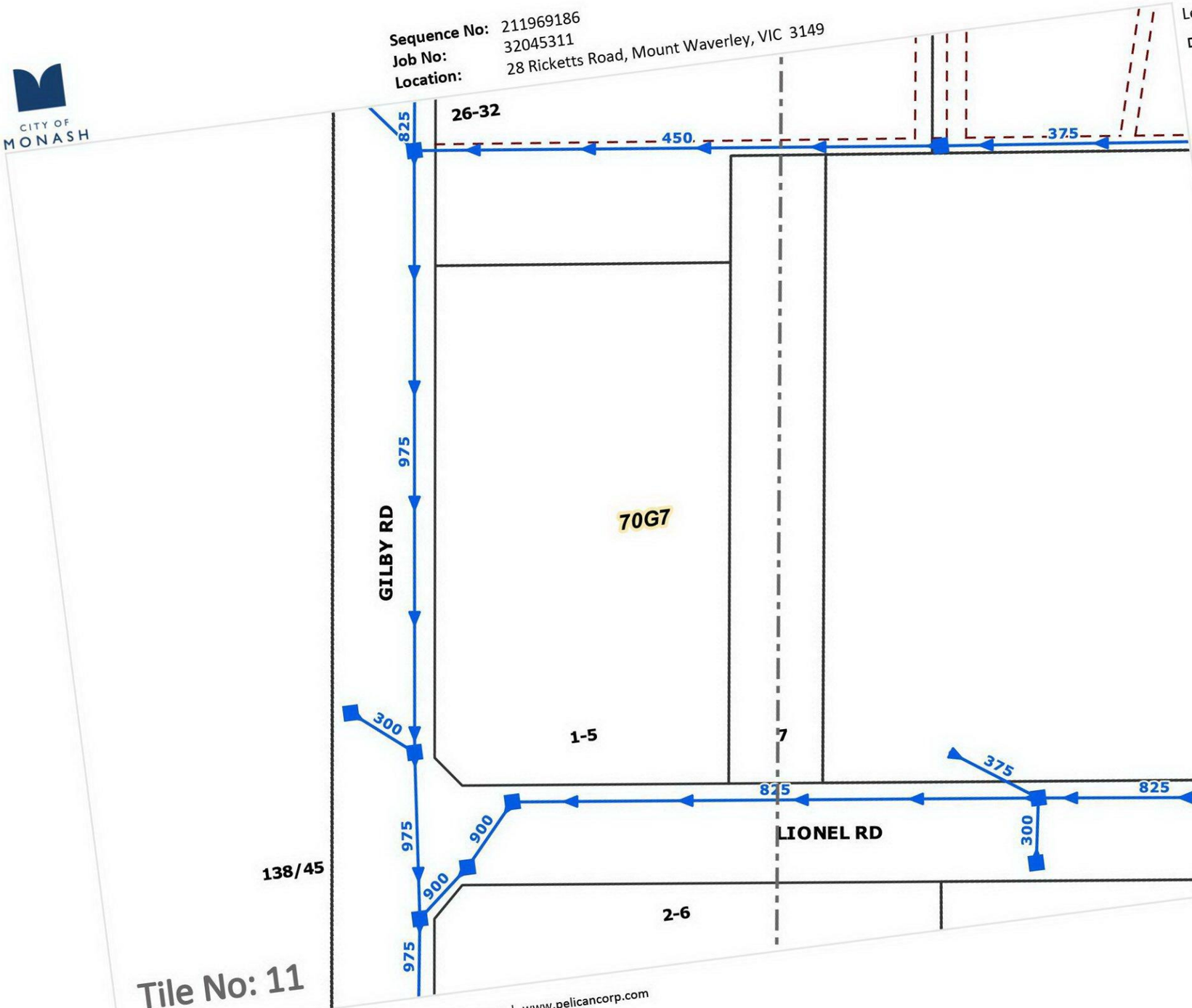

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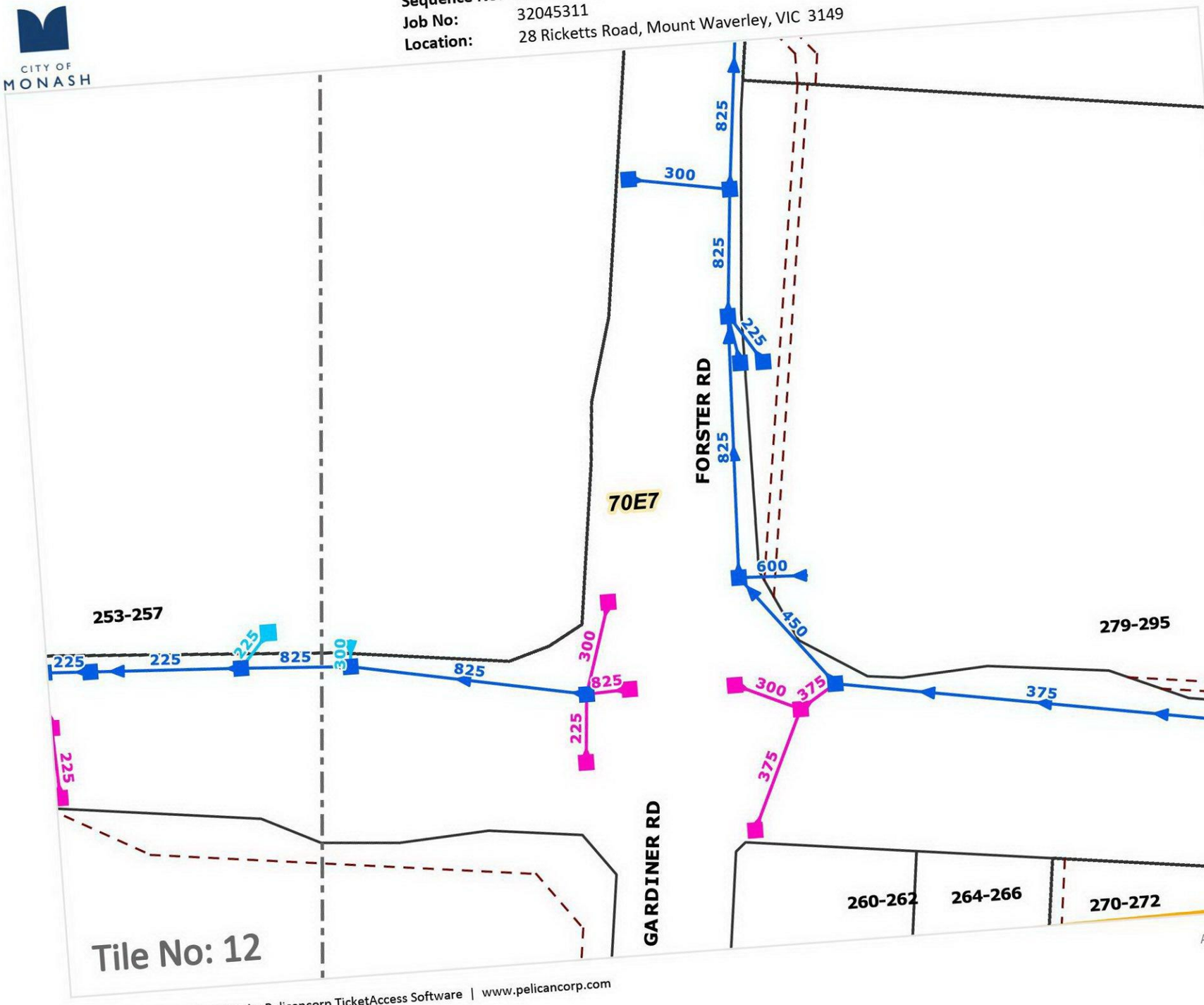

Legend

Drain Pits
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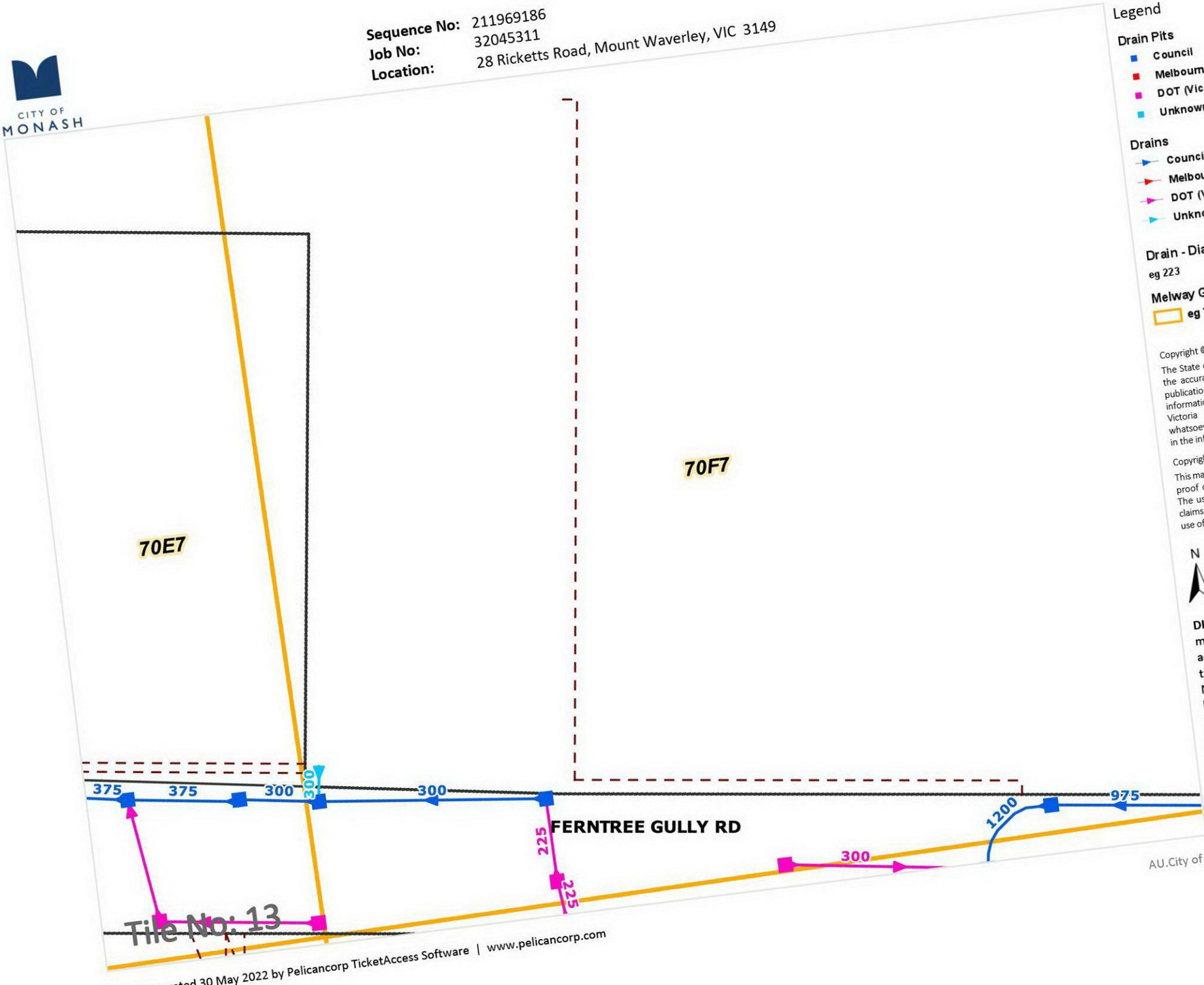

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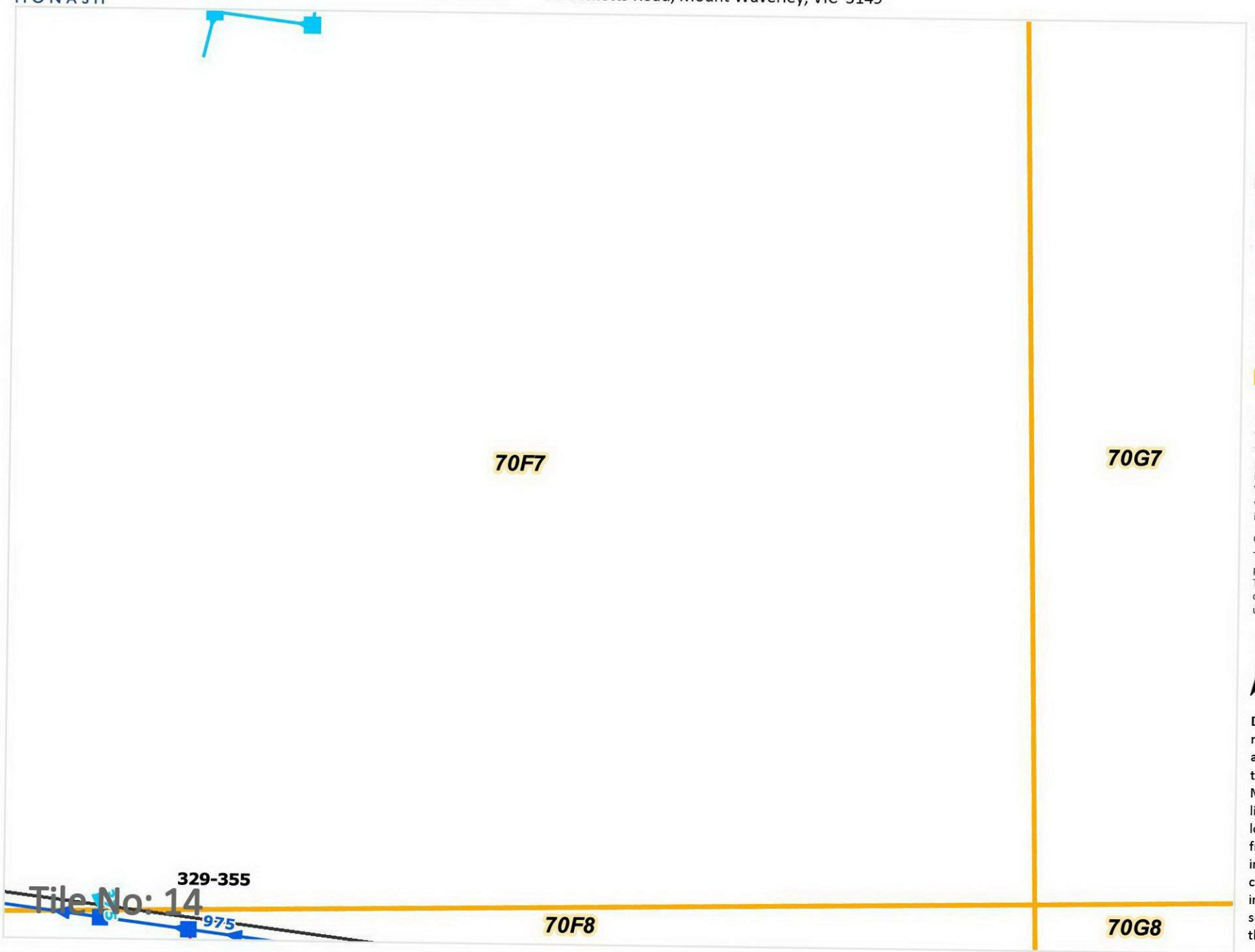

Tile No: 14

Legend

Drain Pits
- Council
- Melbourne Water
- DOT (Vic Roads)
- Unknown

Drains
- Council
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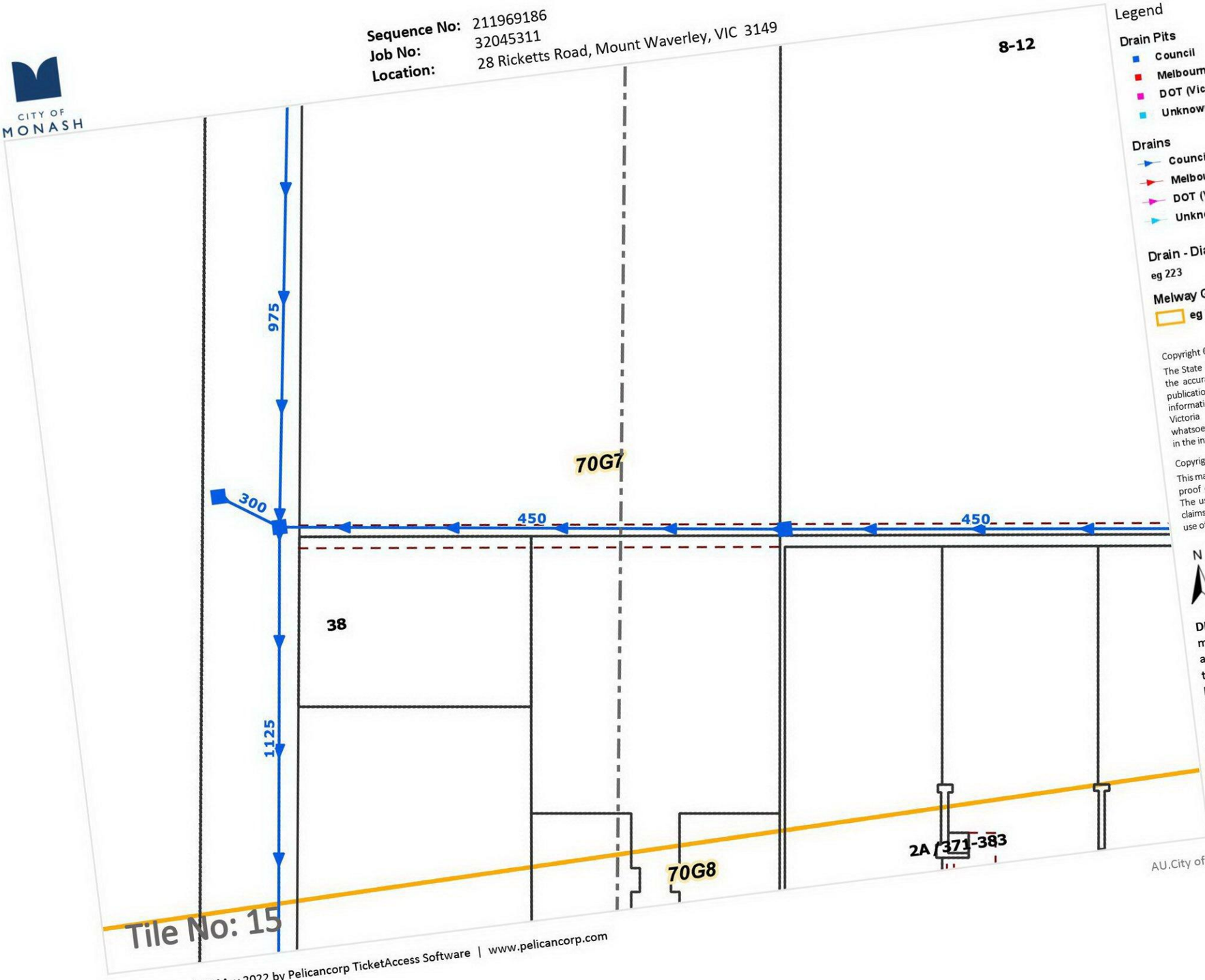

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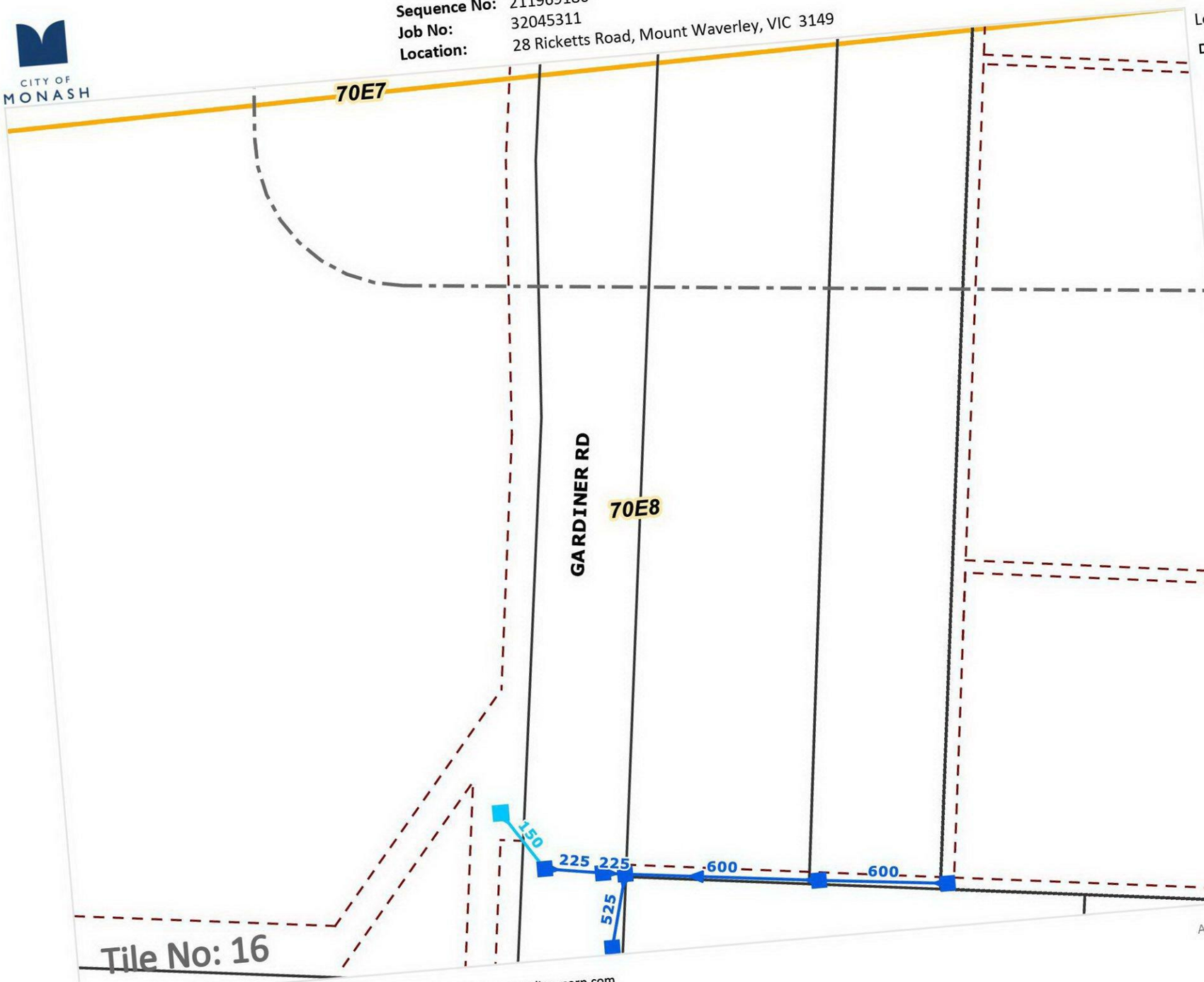

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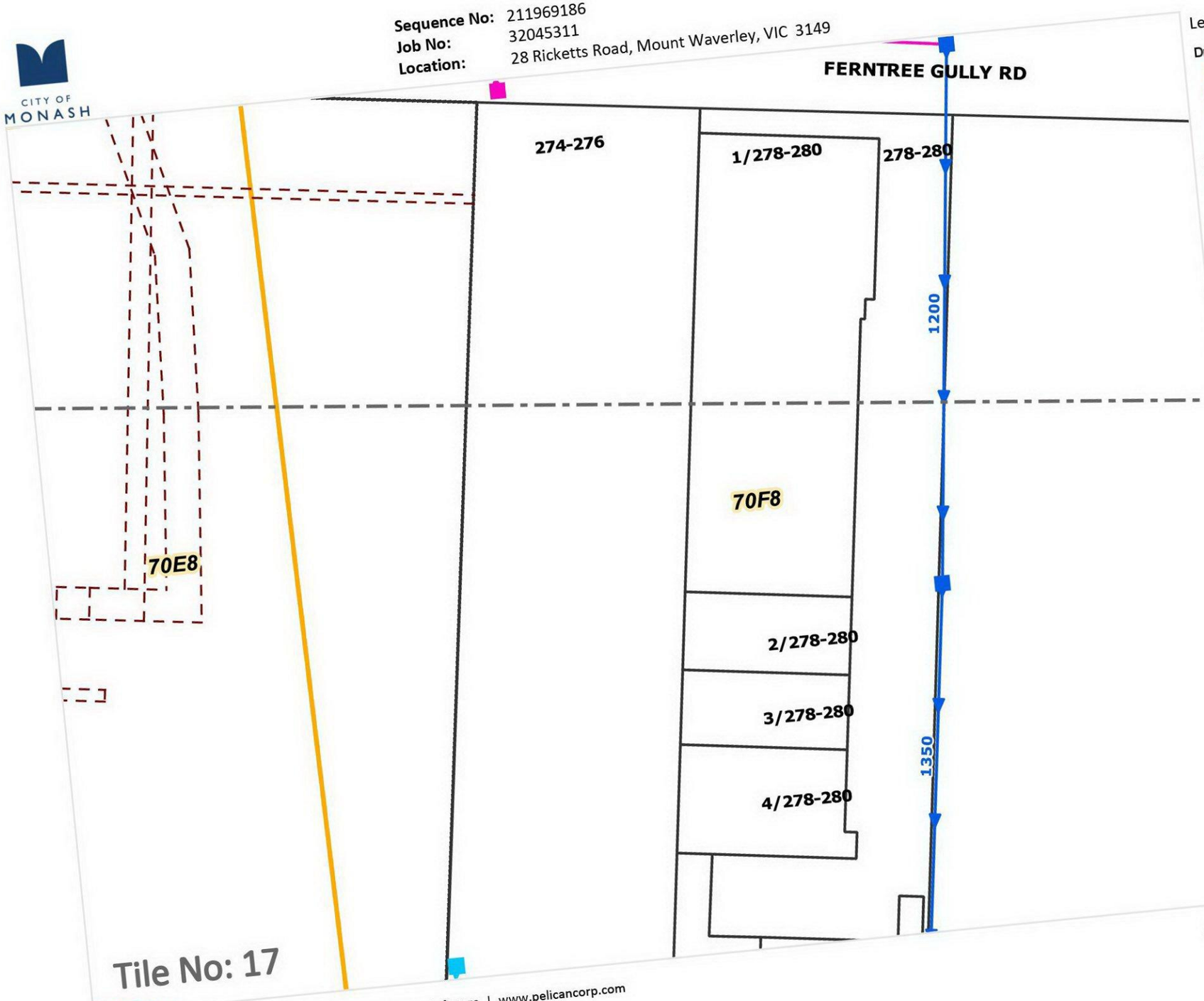

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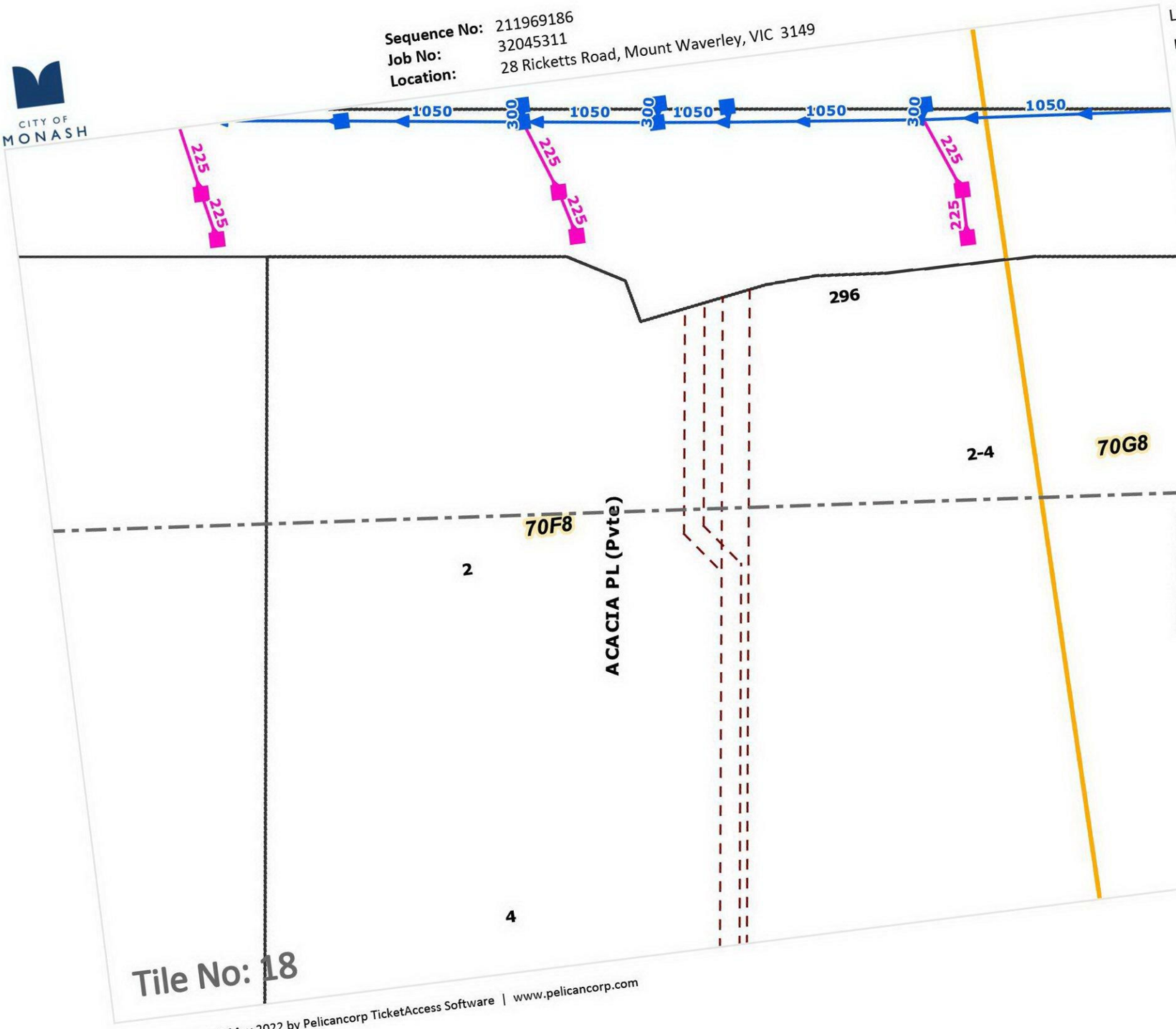

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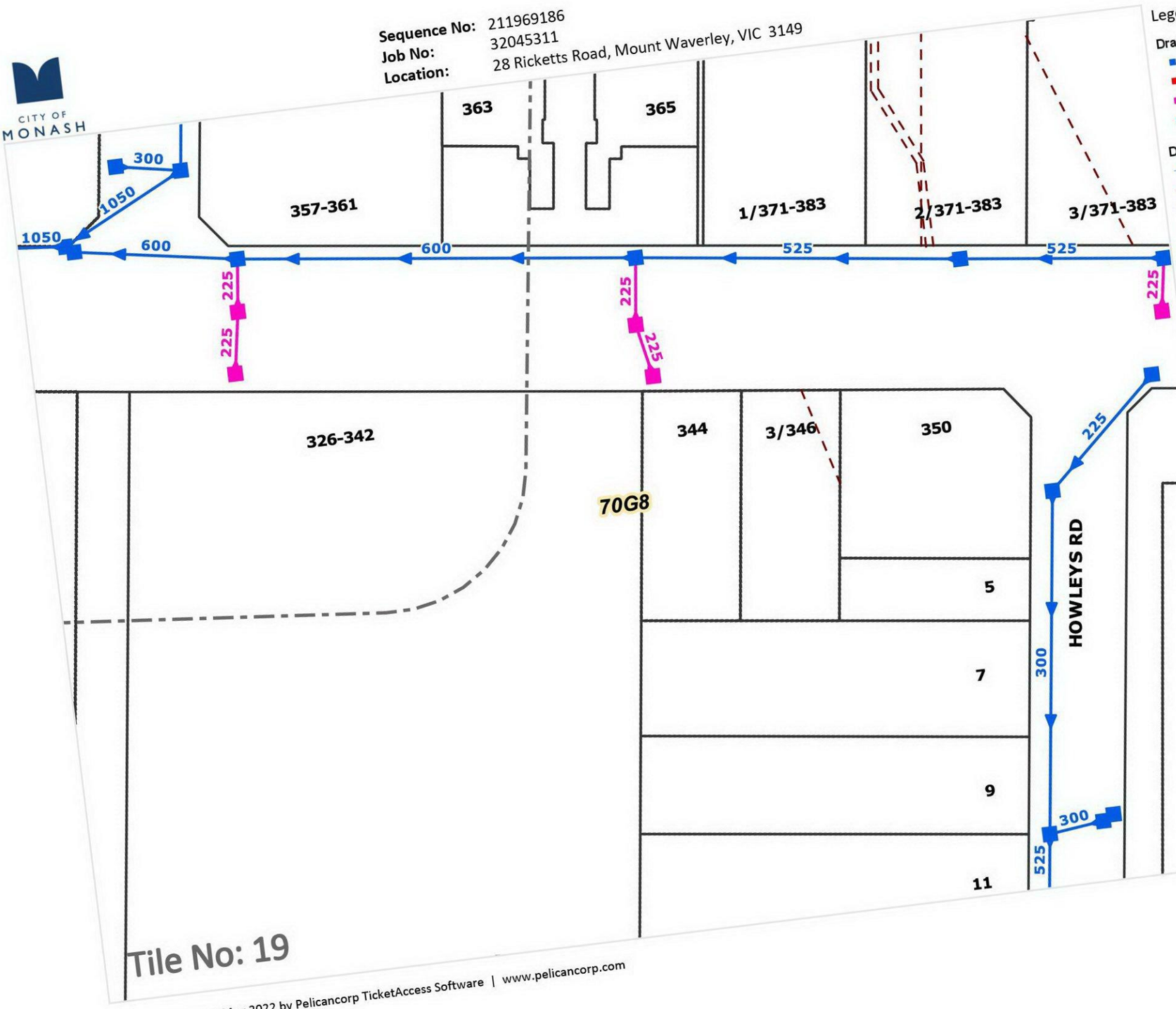

Legend

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Tile No: 19

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D22-412331

From: Anuja Adhikari
To: Sana Khaji
Subject: Drainage Advice - On-site Detention Design Flow
Date: Wednesday, 24 August 2022 10:02:16 AM
Attachments: image003.png
image004.png
image005.png
image006.png
image008.png
ATT00001.png

Hi Sana

Please be advised that there will be no detention or contribution required for the development at this site as this is a industrial area.

So you can procced with the design as per the building regulation and As3500.

Please follow below link if you wish to refer to Council's guide lines.

If the proposed development requires a planning permit to be obtained, drainage plans will need to be submitted for Council's approval as per the drainage permit condition. Refer below link for all the details.

https://www.monash.vic.gov.au/files/assets/public/edms/planning-development/asset-protection/city-of-monash-engineering-plan-checklist.pdf

Engineering Plan Checking Application | City of Monash

Thank you

Anuja

CITY OF MONASH

Anuja Adhikari
Development & Transport Engineer
Email: Anuja.Adhikari@monash.vic.gov.au
Phone: 03 9518 3440
Mobile: 0400 149 174

National Relay Service: 1800 555 660
293 Springvale Road, Glen Waverley, VIC 3150
www.monash.vic.gov.au

From: Sana Khaji <sanak@dceng.com.au>
Sent: Thursday, 18 August 2022 3:06 PM
To: Anuja Adhikari <Anuja.Adhikari@monash.vic.gov.au>
Subject: RE: Drainage Advice - On-site Detention Design Flow

Hi Anuja,

Just wanted to follow up and see if you have any advice regarding to the following address industrial development: 170 Forster Road, Mount Waverly.

Kind regards,

Sana Khaji
Junior Engineer

DALTON CONSULTING ENGINEERS PTY LTD

melbourne . geelong . brisbane
wurundjeri . wadawurrung . turrbal

D +61 3 9813 7453
T +61 3 9813 7400
E sanak@dceng.com.au

From: Sana Khaji <sanak@dceng.com.au>
Sent: Wednesday, 20 July 2022 12:34 PM
To: Anuja Adhikari <Anuja.Adhikari@monash.vic.gov.au>
Subject: RE: Drainage Advice - On-site Detention Design Flow

Hi Anuja,

Thanks for your response. The Address of the proposed development is :170 Forster Road, Mount Waverly. Can you also let me know if there is a specific guideline for the stormwater or drainage design for Monash City Council ?

Kind regards,

Sana Khaji
Junior Engineer

DALTON CONSULTING ENGINEERS PTY LTD

melbourne . geelong . brisbane
wurundjeri . wadawurrung . turrbal

D +61 3 9813 7453
T +61 3 9813 7400
E sanak@dceng.com.au

From: Anuja Adhikari <Anuja.Adhikari@monash.vic.gov.au>
Sent: Wednesday, 20 July 2022 11:57 AM
To: Sana Khaji <sanak@dceng.com.au>
Subject: Drainage Advice - On-site Detention Design Flow

Hi Sana

If the development is within the industrial area and is fully impervious, Council does not require any detention system to be installed.

Can you provide me with the address of the proposed development. I will provide detailed response specific for your development site.

Thank you

Anuja

CITY OF MONASH

Anuja Adhikari
Development & Transport Engineer

Email: Anuja.Adhikari@monash.vic.gov.au
Phone: 03 9518 3440
Mobile: 0400 149 174

National Relay Service: 1800 555 660
293 Springvale Road, Glen Waverley, VIC 3150
www.monash.vic.gov.au

From: Sana Khaji <sanak@dceng.com.au>
Sent: Thursday, 7 July 2022 12:02 PM
To: mail@monash.vic.gov.au
Subject: On-site Detention Design Flow

Hi,
My name is Sana, and I am working as a civil engineer at Dalton Consulting Engineers (DCE). I am preparing a stormwater management strategy report and I need to calculate the on-site detention storage based on the City of Monash requirements. The subject site that I am working on its report is in industrial use and will be re-developed for industrial use. Can you please let me know what is the required design flow for on-site detention storage sizing? Is that 1.5 ARI?

Kind regards,

Sana Khaji
Junior Engineer

D22-412331

DALTON CONSULTING ENGINEERS PTY LTD

melbourne . geelong . brisbane
wurundjeri . wadawurrung . turrbal

D +61 3 9813 7453
T +61 3 9813 7400
E sanak@dceng.com.au

DALTON CONSULTING ENGINEERS

Appendix B: Drainage Calculations

D22-412331

DALTON
CONSULTING
ENGINEERS

Stormwater Calculations

Axxess Corporate Park- Mt. Waverly

Revision B- September 2022

dexus

DALTON
CONSULTING
ENGINEERS

Level 3, 678 Victoria Street
Richmond VIC 3121

T +61 3 9813 7400
E info@dceng.com.au
W dceng.com.au

ABN 78 429 221 049

MAJOR STORM EVENT CATCHMENT PLAN

PROJECT DETAILS	
Job Description:	Axxess Corporate Park- Mount Waverly
Job Number:	22058
Compiled by:	S Khaji
Date:	12/09/2022

Existing Catchment Plan

Developed Catchment Plan

MAJOR STORM EVENT HYDROLOGY COMPUTATIONS

PROJECT DETAILS		
Job Description:	Axxess Corporate Park- Mount Waverly	
Job Number:	22058	
Compiled by:	S Khaji	
Date:	12/09/2022	
Council:	OTHER	
Minor Storm Frequency 1:	10% AEP	
Minor Storm Frequency 2:	20% AEP	
Major Storm Frequency:	1% AEP	
Blockage Factor (%):		

C'10	0.151008839

RAINFALL DATA							
Source	Australian Bureau of Meteorology Website-IFD Data						
Latitude	-37.897902	Longitude	145.133525	Zone	0	Date	29/06/2022

CATCHMENT DETAILS (ALL AREAS IN HECTARES)									
	Sub-Catch 1	Sub-Catch 2	Sub-Catch 3	Sub-Catch 4	Sub-Catch 5				
Name	Industrial	Open Space	Local Roads	Major Roads	Impervious				
Fraction Imp. (f)	0.9	0.1	0.7	0.8	1				
C'10	0.825	0.226	0.675	0.750	0.900				
C Minor 1	0.825	0.226	0.675	0.750	0.900				
C Minor 2	0.784	0.215	0.642	0.713	0.855				
C Major	0.990	0.271	0.810	0.900	1.080				
Existing Catchment	6.0					Minor 1/2?	Minor 1 Ae	Minor 2 Ae	Major Ae
Developed Catchment	6.0					1	4.951	0.000	5.941
Developed Catchment+ External	8.2					1	4.951	0.000	5.941
D						1	6.766	0.000	8.119
E						1	0.000	0.000	0.000
F						1	0.000	0.000	0.000
G						1	0.000	0.000	0.000
H						1	0.000	0.000	0.000
I						1	0.000	0.000	0.000
J						1	0.000	0.000	0.000
K						1	0.000	0.000	0.000
L						1	0.000	0.000	0.000
M						1	0.000	0.000	0.000
N						1	0.000	0.000	0.000
O						1	0.000	0.000	0.000
P						1	0.000	0.000	0.000
Q						1	0.000	0.000	0.000
R						1	0.000	0.000	0.000
S						1	0.000	0.000	0.000
T						1	0.000	0.000	0.000

TIME OF CONCENTRATION
Based on the Kinematic Wave Equation:

$$To\ I^{0.4} = 6.94\frac{(L\ x\ n)^{0.6}}{S^{0.3}}$$

Where....
T = Overland Flow Time (min)
I = Rainfall Intensity, (mm/hr)
L = Length of flow path, (m)
n = Manning
S = Slope, (m/m)

PEAK FLOW
Based on the Rational Method:

$$Q = CIA$$

Where....
Q = Peak Flow (cu.m/s)
C = Co-Efficient of Runoff
I = Rainfall Intensity, (mm/hr)
A= Area (hectares)

FLOW CALCULATIONS

Section	Contributing Catchments			D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	Length (m)	Initial T (min)	Surface	n	S = Slope (m/m)	Minor 1 ToC (min)	Minor 1 I (mm/hr)	Minor 1 Ae (ha)	Minor 1 Q (m3/s)	Minor 2 ToC (min)	Minor 2 1 (mm/hr)	Minor 2 Ae (ha)	Minor 2 Q (m3/s)	Major ToC (min)	Major I (mm/hr)	Major Ae (ha)	Major Q (m3/s)	Q Overland (m3/s)
	Existing Catchment	Developed Catchment	Developed Catchment+ External																																				
1 (Existing)	Y																				523	5.0	Asphalt	0.015	0.013	21.369	56.719	4.951	0.78	22.977	46.019	0.000	0.000	17.702	105.555	5.941	1.74	1.0
1 (Developed)		Y																			550	5.0	Asphalt	0.015	0.013	22.351	55.180	4.951	0.76	24.063	43.698	0.000	0.000	18.444	102.163	5.941	1.69	0.9
1			Y																		581	5.0	Asphalt	0.015	0.017	21.188	56.719	6.766	1.07	22.779	46.019	0.000	0.000	17.567	105.555	8.119	2.38	1.315

D22-412331

RAINFALL DATA

Source	Australian Bureau of Meteorology Website-IFD Data						
Latitude	-37.897902	Longitude	145.133525	Zone		Date	29/06/2022

	Annual Exceedance Probability (AEP) Coefficients									
	4EY	2EY	1EY	0.2EY	50% AEP#	20% AEP*	10% AEP	5% AEP	2% AEP	1% AEP
C0	-1.33E-01	1.87E-01	4.72E-01	9.09E-01	5.84E-01	8.89E-01	1.07E+00	1.22E+00	1.41E+00	1.55E+00
C1	8.62E-01	8.16E-01	7.71E-01	7.20E-01	7.55E-01	7.20E-01	6.77E-01	6.36E-01	5.13E-01	4.20E-01
C2	-5.00E-02	-2.48E-03	3.55E-02	8.10E-02	5.14E-02	8.10E-02	1.25E-01	1.69E-01	3.12E-01	4.19E-01
C3	-2.01E-02	-4.19E-02	-5.64E-02	-6.70E-02	-6.10E-02	-6.70E-02	-8.26E-02	-9.81E-02	-1.57E-01	-2.01E-01
C4	6.26E-03	1.06E-02	1.29E-02	1.29E-02	1.33E-02	1.29E-02	1.51E-02	1.75E-02	2.85E-02	3.67E-02
C5	-6.67E-04	-1.05E-03	-1.20E-03	-9.91E-04	-1.18E-03	-9.91E-04	-1.13E-03	-1.28E-03	-2.23E-03	-2.95E-03
C6	2.48E-05	3.72E-05	4.05E-05	2.60E-05	3.79E-05	2.60E-05	2.83E-05	3.18E-05	6.31E-05	8.69E-05

NOTE:

The coefficients can be applied to estimate the design rainfall depth for a full range of durations from 1 minute to 7 days.

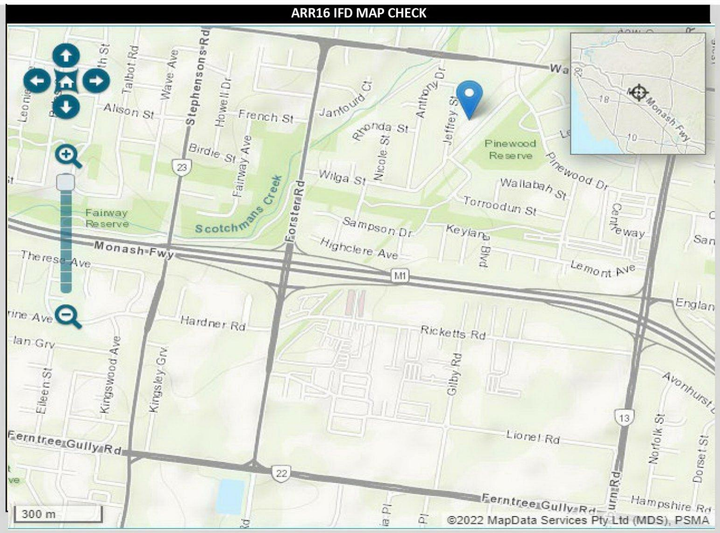
It is recommended that only three significant figures are used when undertaking calculations using design rainfalls generated in this way.

The 50% AEP IFD does not correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.

* The 20% AEP IFD does not correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Duration (mins)	4EY	2EY	1EY	0.2EY	50% AEP	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP
1	52.532	72.319	96.166	148.874	107.569	145.955	174.418	204.242	246.976	282.303
2	46.346	62.852	82.145	125.015	91.409	122.563	144.594	167.246	195.399	217.657
3	41.700	56.505	73.673	112.345	82.044	110.142	130.216	150.924	177.629	198.954
4	38.086	51.611	67.258	102.991	75.000	100.972	119.763	139.241	165.393	186.530
5	35.187	47.670	62.106	95.476	69.338	93.604	111.339	129.796	155.325	176.153
6	32.800	44.409	57.840	89.210	64.637	87.461	104.266	121.812	146.589	166.944
7	30.793	41.657	54.231	83.866	60.650	82.221	98.192	114.908	138.854	158.628
8	29.077	39.296	51.129	79.236	57.215	77.682	92.897	108.850	131.934	151.066
9	27.589	37.244	48.428	75.174	54.217	73.700	88.226	103.478	125.701	144.168
10	26.284	35.440	46.051	71.575	51.574	70.172	84.067	98.674	120.055	137.856
11	25.127	33.840	43.940	68.360	49.222	67.020	80.337	94.348	114.918	132.067
12	24.093	32.409	42.050	65.467	47.113	64.183	76.969	90.429	110.224	126.743
13	23.162	31.119	40.346	62.846	45.209	61.614	73.910	86.858	105.920	121.835
14	22.319	29.951	38.801	60.460	43.481	59.275	71.117	83.591	101.958	117.298
15	21.550	28.886	37.393	58.277	41.904	57.134	68.555	80.589	98.300	113.094
16	20.846	27.911	36.102	56.270	40.458	55.167	66.197	77.819	94.913	109.190
17	20.199	27.014	34.915	54.418	39.127	53.351	64.017	75.255	91.767	105.555
18	19.600	26.185	33.819	52.704	37.896	51.670	61.995	72.874	88.837	102.163
19	19.045	25.418	32.803	51.111	36.755	50.108	60.114	70.656	86.102	98.992
20	18.529	24.704	31.858	49.626	35.693	48.653	58.360	68.585	83.544	96.022
21	18.047	24.037	30.977	48.239	34.702	47.293	56.719	66.647	81.145	93.233
22	17.596	23.415	30.153	46.940	33.775	46.019	55.180	64.827	78.891	90.611
23	17.172	22.830	29.380	45.720	32.906	44.823	53.735	63.117	76.770	88.140
24	16.774	22.281	28.654	44.572	32.089	43.698	52.373	61.505	74.769	85.809
25	16.399	21.764	27.970	43.489	31.319	42.636	51.089	59.983	72.879	83.606
26	16.044	21.276	27.325	42.466	30.592	41.634	49.875	58.545	71.091	81.522
27	15.708	20.814	26.715	41.498	29.905	40.685	48.725	57.182	69.397	79.545
28	15.390	20.376	26.137	40.581	29.254	39.785	47.635	55.889	67.789	77.670
29	15.088	19.961	25.589	39.710	28.636	38.931	46.600	54.660	66.261	75.887
30	14.800	19.566	25.068	38.881	28.049	38.119	45.615	53.492	64.807	74.191
31	14.526	19.190	24.573	38.092	27.490	37.345	44.677	52.378	63.423	72.575
32	14.265	18.832	24.101	37.340	26.957	36.608	43.782	51.316	62.102	71.034
33	14.015	18.490	23.650	36.622	26.449	35.904	42.928	50.302	60.841	69.563
34	13.776	18.164	23.219	35.936	25.964	35.231	42.112	49.333	59.635	68.157
35	13.547	17.851	22.808	35.279	25.499	34.588	41.331	48.405	58.481	66.812
36	13.328	17.551	22.413	34.651	25.055	33.971	40.582	47.516	57.377	65.523
37	13.118	17.264	22.035	34.047	24.628	33.380	39.865	46.663	56.317	64.289
38	12.915	16.988	21.673	33.469	24.219	32.812	39.176	45.845	55.301	63.104
39	12.721	16.723	21.324	32.913	23.826	32.267	38.514	45.059	54.325	61.967
40	12.534	16.468	20.990	32.378	23.448	31.743	37.878	44.303	53.387	60.874
41	12.354	16.223	20.667	31.863	23.085	31.239	37.266	43.576	52.484	59.823
42	12.180	15.987	20.357	31.368	22.735	30.753	36.676	42.876	51.616	58.812
43	12.012	15.759	20.058	30.890	22.397	30.285	36.108	42.201	50.779	57.837
44	11.850	15.539	19.770	30.430	22.072	29.833	35.559	41.550	49.972	56.899
45	11.694	15.327	19.491	29.985	21.758	29.397	35.030	40.921	49.194	55.993
46	11.542	15.121	19.222	29.556	21.455	28.976	34.519	40.315	48.442	55.120
47	11.396	14.923	18.962	29.140	21.161	28.569	34.026	39.728	47.716	54.276
48	11.254	14.731	18.711	28.739	20.878	28.175	33.548	39.161	47.015	53.461
49	11.117	14.545	18.468	28.350	20.603	27.795	33.086	38.612	46.336	52.673
50	10.983	14.365	18.232	27.974	20.338	27.426	32.638	38.081	45.680	51.911
55	10.373	13.542	17.157	26.258	19.125	25.743	30.598	35.660	42.692	48.444
60	9.843	12.828	16.226	24.774	18.076	24.288	28.835	33.570	40.118	45.464
65	9.376	12.202	15.412	23.477	17.158	23.017	27.296	31.745	37.877	42.874
70	8.962	11.648	14.692	22.333	16.348	21.895	25.938	30.138	35.908	40.602
75	8.591	11.153	14.051	21.315	15.626	20.897	24.732	28.711	34.164	38.593
80	8.257	10.709	13.475	20.402	14.978	20.002	23.652	27.434	32.607	36.802
85	7.954	10.306	12.956	19.580	14.394	19.196	22.679	26.285	31.208	35.196
90	7.678	9.940	12.483	18.834	13.863	18.464	21.798	25.245	29.944	33.747

ARR16 IFD MAP CHECK



CONSTANTS

Council	C'10
CARDINIA	0.11508008
CASEY	0.11508008
HUME	0.16031382
MELTON	0.15445632
WHITTLESEA	0.16031382
WYNDHAM	0.15445632
OTHER	0.15100884

Zone	Frac. Impervious
Lot <450sq.m	0.8
Lot 450-600sq.m	0.7
Lot 600-1000sq.m	0.6
Lot 1000-4000sq.m	0.3
Major Roads	0.8
Local Roads	0.7
Drainage Reserve	0.25
Open Space	0.1
Schools	0.7
Mixed Use Zone	0.7
Industrial	0.9
Medium Density	0.9
Health/Community	0.7
Impervious	1

Pit Type	
SEP	
GEP	

Co-Ordinate Type	
Easting	Latitude
Northing	Longitude

	Frequency Factor
4EY	0.80
2EY	0.80
1EY	0.80
0.2EY	0.95
50% AEP	0.85
20% AEP	0.95
10% AEP	1.00
5% AEP	1.05
2% AEP	1.15
1% AEP	1.20

Surface	FR
Smooth Concrete	0.013
Asphalt	0.015
Road Reserve	0.02
Earth Channel	0.025
Grass Channel	0.035
OTHER	

Pipe Type	Mannings
PE	0.01
PP	0.01
PVC	0.01
RC	0.013
VC	0.015

Y or N?
Y
N

1or 2?
1
2

Pipe Sizes	No. of Pipes
225	1
300	2
375	3
450	4
525	5
600	
675	
750	
825	
900	
1050	
1200	
1350	
1500	
1650	
1800	

Storm
Minor 1
Minor 2
Major
Overland

18140 - Frequency Factor Ratio, F(AEP)

DALTON CONSULTING ENGINEERS

PEAK FLOW CALCULATION SHEET
RATIONAL METHOD, ARR16

Job Name: Axxess Corporate Park, Mount Waverley
Job Number: 22058
Compiled by: S Khaji
Date: 9/09/2022

ARI (1 in x years)	AEP (%)	FREQUENCY FACTOR, F_{AEP}
100	1	1.20
50	2	1.15
20	5	1.05
10	10	1.00
5	18.13	0.95
4.48	20	0.94
2	50	0.85
1	63.21	0.80

Job Name: ɔrporate Park, Mount Waverley
Job Number: 22058
Compiled by: S Khaji
Date: 9/09/2022

IFD DATA - FREQUENT AND INFREQUENT EVENTS

IFD Design Rainfall Intensity (mm/h)
Issued: 9-Sep-22
Location
Requested coordinat Latitude -37.8973 Longitude 145.12982
Nearest grid cell: Latitude 37.8875 (S) Longitude 145.1375 (E)

Annual Exceedance Probability (AEP)								
Duration	Duration in min	63.20%	50%	20%	10%	5%	2%	1%
1 min	1	96.2	108	146	174	204	247	282
2 min	2	82.1	91.4	123	145	167	195	218
3 min	3	73.7	82	110	130	151	178	199
4 min	4	67.3	75	101	120	139	165	187
5 min	5	62.1	69.3	93.6	111	130	155	176
10 min	10	46.1	51.6	70.2	84.1	98.7	120	138
15 min	15	37.4	41.9	57.1	68.6	80.6	98.3	113
20 min	20	31.9	35.7	48.7	58.4	68.6	83.5	96
25 min	25	28	31.3	42.6	51.1	60	72.9	83.6
30 min	30	25.1	28	38.1	45.6	53.5	64.8	74.2
45 min	45	19.5	21.8	29.4	35	40.9	49.2	56
1 hour	60	16.2	18.1	24.3	28.8	33.6	40.1	45.5
1.5 hour	90	12.5	13.9	18.5	21.8	25.2	29.9	33.7
2 hour	120	10.4	11.5	15.2	17.9	20.6	24.3	27.3
3 hour	180	7.95	8.79	11.5	13.5	15.5	18.3	20.5
4.5 hour	270	6.1	6.74	8.8	10.3	11.8	13.9	15.5
6 hour	360	5.06	5.59	7.29	8.5	9.73	11.5	12.9
9 hour	540	3.88	4.29	5.62	6.56	7.5	8.89	10
12 hour	720	3.21	3.56	4.68	5.47	6.28	7.47	8.42
18 hour	1080	2.45	2.72	3.62	4.26	4.9	5.86	6.63
24 hour	1440	2.01	2.24	3.01	3.56	4.11	4.93	5.59
30 hour	1800	1.71	1.92	2.61	3.09	3.59	4.3	4.88
36 hour	2160	1.5	1.69	2.31	2.75	3.2	3.84	4.35
48 hour	2880	1.22	1.38	1.9	2.27	2.65	3.18	3.59
72 hour	4320	0.894	1.01	1.41	1.7	1.99	2.38	2.68
96 hour	5760	0.713	0.808	1.12	1.35	1.59	1.89	2.12
120 hour	7200	0.597	0.674	0.927	1.11	1.31	1.56	1.75
144 hour	8640	0.516	0.579	0.785	0.941	1.11	1.31	1.47
168 hour	10080	0.455	0.508	0.677	0.808	0.949	1.13	1.27

IFD DATA - FREQUENT AND INFREQUENT EVENTS

Very Frequent Design Rainfall Intensity (mm/h)
Issued: 9-Sep-22
Location
Requested coordina Latitude -37.8973 Longitude 145.12982
Nearest grid cell: Latitude 37.8875 (S) Longitude 145.1375 (E)

Exceedance per Year (EY)									
Duration	Duration in min	12EY	6EY	4EY	3EY	2EY	1EY	0.5EY	0.2EY
1 min	1	37.1	42.5	52.5	60.3	72.3	96.2	119	149
2 min	2	33.1	37.8	46.3	52.9	62.9	82.1	101	125
3 min	3	29.8	34	41.7	47.6	56.5	73.7	91.1	112
4 min	4	27.2	31	38.1	43.5	51.6	67.3	83.2	103
5 min	5	25.1	28.7	35.2	40.1	47.7	62.1	77	95.5
10 min	10	18.9	21.5	26.3	29.9	35.4	46.1	57.2	71.6
15 min	15	15.7	17.7	21.6	24.5	28.9	37.4	46.5	58.3
20 min	20	13.6	15.3	18.5	21	24.7	31.9	39.6	49.6
25 min	25	12.1	13.6	16.4	18.5	21.8	28	34.8	43.5
30 min	30	11	12.3	14.8	16.7	19.6	25.1	31.1	38.9
45 min	45	8.74	9.78	11.7	13.1	15.3	19.5	24.2	30
1 hour	60	7.4	8.27	9.84	11	12.8	16.2	20.1	24.8
1.5 hour	90	5.81	6.47	7.68	8.59	9.94	12.5	15.4	18.8
2 hour	120	4.86	5.41	6.42	7.17	8.28	10.4	12.7	15.5
3 hour	180	3.76	4.19	4.96	5.54	6.39	7.95	9.75	11.8
4.5 hour	270	2.88	3.22	3.82	4.26	4.92	6.1	7.48	8.98
6 hour	360	2.38	2.66	3.16	3.53	4.08	5.06	6.2	7.44
9 hour	540	1.8	2.02	2.41	2.7	3.12	3.88	4.77	5.73
12 hour	720	1.48	1.66	1.98	2.22	2.57	3.21	3.95	4.77
18 hour	1080	1.11	1.25	1.5	1.68	1.95	2.45	3.02	3.69
24 hour	1440	0.901	1.01	1.22	1.37	1.59	2.01	2.49	3.08
30 hour	1800	0.765	0.861	1.03	1.16	1.36	1.71	2.14	2.66
36 hour	2160	0.669	0.752	0.903	1.02	1.19	1.5	1.88	2.36
48 hour	2880	0.539	0.606	0.728	0.82	0.957	1.22	1.53	1.94
72 hour	4320	0.395	0.444	0.533	0.601	0.702	0.894	1.12	1.44
96 hour	5760	0.316	0.355	0.427	0.481	0.562	0.713	0.897	1.14
120 hour	7200	0.265	0.299	0.359	0.405	0.472	0.597	0.748	0.945
144 hour	8640	0.229	0.259	0.313	0.352	0.41	0.516	0.643	0.801
168 hour	10080	0.202	0.229	0.278	0.314	0.365	0.455	0.564	0.69

Job Name: Axxess Corporate Park, Mount Waverley
Job Number: 22058
Compiled by: S Khaji
Date: 9/09/2022

IFD DATA - RARE EVENTS

IFD Design Rainfall Intensity (mm/h)
Issued: 9-Sep-22
Location
Requested coordinat Latitude -37.8973 Longitude 145.12982
Nearest grid cell: Latitude 37.8875 (S) Longitude 145.1375 (E)

		Annual Exceedance Probability (AEP)						
Duration	Duration in min	63.20%	50%	20%	10%	5%	2%	1%
1 min	1	96.2	108.0	146.0	174.0	204.0	247.0	282.0
2 min	2	82.1	91.4	123.0	145.0	167.0	195.0	218.0
3 min	3	73.7	82.0	110.0	130.0	151.0	178.0	199.0
4 min	4	67.3	75.0	101.0	120.0	139.0	165.0	187.0
5 min	5	62.1	69.3	93.6	111.0	130.0	155.0	176.0
10 min	10	46.1	51.6	70.2	84.1	98.7	120.0	138.0
15 min	15	37.4	41.9	57.1	68.6	80.6	98.3	113.0
20 min	20	31.9	35.7	48.7	58.4	68.6	83.5	96.0
25 min	25	28.0	31.3	42.6	51.1	60.0	72.9	83.6
30 min	30	25.1	28.0	38.1	45.6	53.5	64.8	74.2
45 min	45	19.5	21.8	29.4	35.0	40.9	49.2	56.0
1 hour	60	16.2	18.1	24.3	28.8	33.6	40.1	45.5
1.5 hour	90	12.5	13.9	18.5	21.8	25.2	29.9	33.7
2 hour	120	10.4	11.5	15.2	17.9	20.6	24.3	27.3
3 hour	180	8.0	8.8	11.5	13.5	15.5	18.3	20.5
4.5 hour	270	6.1	6.7	8.8	10.3	11.8	13.9	15.5
6 hour	360	5.1	5.6	7.3	8.5	9.7	11.5	12.9
9 hour	540	3.9	4.3	5.6	6.6	7.5	8.9	10.0
12 hour	720	3.2	3.6	4.7	5.5	6.3	7.5	8.4
18 hour	1080	2.5	2.7	3.6	4.3	4.9	5.9	6.6
24 hour	1440	2.01	2.24	3.01	3.56	4.11	4.93	5.59
30 hour	1800	1.71	1.92	2.61	3.09	3.59	4.3	4.88
36 hour	2160	1.5	1.69	2.31	2.75	3.2	3.84	4.35
48 hour	2880	1.22	1.38	1.9	2.27	2.65	3.18	3.59
72 hour	4320	0.894	1.01	1.41	1.7	1.99	2.38	2.68
96 hour	5760	0.713	0.808	1.12	1.35	1.59	1.89	2.12
120 hour	7200	0.597	0.674	0.927	1.11	1.31	1.56	1.75
144 hour	8640	0.516	0.579	0.785	0.941	1.11	1.31	1.47
168 hour	10080	0.455	0.508	0.677	0.808	0.949	1.13	1.27

IFD DATA - FREQUENT AND INFREQUENT EVENTS

Rare Design Rainfall Intensity (mm/h)
Issued: 9-Sep-22
Location
Requested c Latitude -37.8973 Longitude 145.12982
Nearest grid Latitude 37.8875 (S) Longitude 145.1375 (E)

		Exceedance per Year (EY)				
Duration	Duration in min	1 in 100	1 in 200	1 in 500	1 in 1000	1 in 2000
1 min	1	282.0	328.0	384.0	430.0	480.0
2 min	2	218.0	248.0	287.0	319.0	353.0
3 min	3	199.0	228.0	265.0	295.0	327.0
4 min	4	187.0	215.0	250.0	280.0	311.0
5 min	5	176.0	204.0	238.0	266.0	296.0
10 min	10	138.0	160.0	188.0	211.0	236.0
15 min	15	113.0	132.0	155.0	173.0	194.0
20 min	20	96.0	112.0	131.0	147.0	164.0
25 min	25	83.6	97.1	114.0	127.0	142.0
30 min	30	74.2	86.0	101.0	113.0	126.0
45 min	45	56.0	64.8	75.7	84.7	94.3
1 hour	60	45.5	52.5	61.3	68.6	76.3
1.5 hour	90	33.7	39.0	45.5	50.9	56.6
2 hour	120	27.3	31.6	37.0	41.3	46.0
3 hour	180	20.5	23.8	27.8	31.2	34.8
4.5 hour	270	15.5	18.1	21.2	23.8	26.6
6 hour	360	12.9	15.0	17.7	19.9	22.3
9 hour	540	10.0	11.7	13.8	15.5	17.4
12 hour	720	8.4	9.9	11.6	13.1	14.7
18 hour	1080	6.6	7.7	9.1	10.2	11.4
24 hour	1440	5.59	6.48	7.59	8.5	9.49
30 hour	1800	4.88	5.64	6.58	7.35	8.17
36 hour	2160	4.35	5	5.81	6.46	7.16
48 hour	2880	3.59	4.08	4.7	5.2	5.72
72 hour	4320	2.68	2.98	3.4	3.72	4.06
96 hour	5760	2.12	2.34	2.65	2.89	3.14
120 hour	7200	1.75	1.92	2.17	2.37	2.57
144 hour	8640	1.47	1.62	1.84	2	2.17
168 hour	10080	1.27	1.4	1.59	1.74	1.89

18140 - EX 1 in 500 AEP -Site +External

DALTON CONSULTING ENGINEERS

Job Name: Axxess Corporate Park, Mount Waverley
Job Number: 22058
Compiled by: S Khaji
Date: 9/09/2022

Rational Method using ARR16 terminology

$Q_{AEP} = C_{AEP} \times {}^{AEP}I_{tc} \times A / 360$

Where Q_{AEP} = design discharge for annual exceedance probability (AEP) (m^3/s)
C = runoff coefficient for annual exceedance probability, AEP
${}^{AEP}I_{tc}$ = rainfall intensity for the event and duration required (mm/h)
A = catchment area (ha)

$C'_{10} = 0.1 + 0.0133 ({}^{10}I_1 - 25)$

Where C'_{10} is the pervious runoff coefficient
${}^{10}I_1$ is the 10 % AEP, 1 hour duration rainfall intensity (mm/h)

And,

$C_{10} = 0.9f + C'_{10}(1-f)$

Where C_{10} is the 10 % AEP runoff coefficient
f is the fraction impervious (0.0 to 1.0)

And,

$C_Y = F_Y C_{10}$

Where C_Y is an average recurrence interval
F_{AEP} is a frequency factor

Rational Method Calculation

Known catchment area, ha

A = 8.2 ha

Determination of C'_{10} value

${}^{10\%}I_{1h}$ = 28.80
C'_{10} = 0.151

Determination of C_{10} value

f = 0.900 Based on aerial imagery
C_{10} = 0.825

Calculation of runoff coefficient, C, for event, AEP

AEP = 0.2
F_{AEP} = 1.35
C_{AEP} = 1.114

Determination of Rainfall intensity at site based on BOM data

t_C = 20 min
${}^{AEP}I_{20}$ = 131 mm/h

Based on 5 min for initiation time, and 857 metres (est) of pipe flow at assumed 1 m/s velocity, rounded down to 20 mins

Calculation of design discharge from site (m^3/s)

Q_{AEP} = 2.984

18140 - DEV 1 in 500 AEP-Site+External

DALTON CONSULTING ENGINEERS

Job Name: Axxess Corporate Park, Mount Waverley
Job Number: 22058
Compiled by: S Khaji
Date: 9/09/2022

Rational Method using ARR16 terminology

$Q_{AEP} = C_{AEP} \times {}^{AEP}I_{tc} \times A / 360$

Where Q_{AEP} = design discharge for annual exceedance probability (AEP) (m^3/s)
C = runoff coefficient for annual exceedance probability, AEP
${}^{AEP}I_{tc}$ = rainfall intensity for the event and duration required (mm/h)
A = catchment area (ha)

$C'_{10} = 0.1 + 0.0133 ({}^{10}I_1 - 25)$

Where C'_{10} is the pervious runoff coefficient
${}^{10}I_1$ is the 10 % AEP, 1 hour duration rainfall intensity (mm/h)

And,

$C_{10} = 0.9f + C'_{10}(1-f)$

Where C_{10} is the 10 % AEP runoff coefficient
f is the fraction impervious (0.0 to 1.0)

And,

$C_Y = F_Y C_{10}$

Where C_Y is an average recurrence interval
F_{AEP} is a frequency factor

Rational Method Calculation

Known catchment area, ha

A = 6.1 ha

Determination of C'_{10} value

${}^{10\%}I_{1h}$ = 28.80
C'_{10} = 0.151

Determination of C_{10} value

f = 0.877 Based on layout plan
C_{10} = 0.808

Calculation of runoff coefficient, C, for event, AEP

AEP = 0.2
F_{AEP} = 1.35
C_{AEP} = 1.091

Runoff coefficient of > 1.0 is numerically possible, though conservative as not-physically possible (runoff volume > rainfall volume)

Determination of Rainfall intensity at site based on BOM data

t_C = 14 min
${}^{AEP}I_{14}$ = 160 mm/h

Based on 5 min for initiation time, and 580 metres (est) ofoverland flow at assumed 1 m/s velocity, rounded down to 14 mins

Calculation of design discharge from site (m^3/s)

Q_{AEP} = 2.711

18140 - EX 1 in 500 AEP-Lot 1 and 2

DALTON CONSULTING ENGINEERS

Job Name: Axxess Corporate Park, Mount Waverley
Job Number: 22058
Compiled by: S Khaji
Date: 9/09/2022

Rational Method using ARR16 terminology

$Q_{AEP} = C_{AEP} \times {}^{AEP}I_{tc} \times A / 360$

Where Q_{AEP} = design discharge for annual exceedance probability (AEP) (m^3/s)
C = runoff coefficient for annual exceedance probability, AEP
${}^{AEP}I_{tc}$ = rainfall intensity for the event and duration required (mm/h)
A = catchment area (ha)

$C'_{10} = 0.1 + 0.0133 ({}^{10}I_1 - 25)$

Where C'_{10} is the pervious runoff coefficient
${}^{10}I_1$ is the 10 % AEP, 1 hour duration rainfall intensity (mm/h)

And,

$C_{10} = 0.9f + C'_{10}(1-f)$

Where C_{10} is the 10 % AEP runoff coefficient
f is the fraction impervious (0.0 to 1.0)

And,

$C_Y = F_Y C_{10}$

Where C_Y is an average recurrence interval
F_{AEP} is a frequency factor

Rational Method Calculation

Known catchment area, ha

A = 6.1 ha

Determination of C'_{10} value

${}^{10\%}I_{1h}$ = 28.80
C'_{10} = 0.151

Determination of C_{10} value

f = 0.900 Based on aerial imagery
C_{10} = 0.825

Calculation of runoff coefficient, C, for event, AEP

AEP = 0.2
F_{AEP} = 1.35
C_{AEP} = 1.114

Determination of Rainfall intensity at site based on BOM data

t_C = 20 min
${}^{AEP}I_{20}$ = 131 mm/h

Based on 5 min for initiation time, and 857 metres (est) of pipe flow at assumed 1 m/s velocity, rounded down to 20 mins

Calculation of design discharge from site (m^3/s)

Q_{AEP} = 2.220

18140 - DEV 1 in 500 AEP-Lot 1 and 2

DALTON CONSULTING ENGINEERS

Job Name:	Axxess Corporate Park, Mount Waverley
Job Number:	22058
Compiled by:	S Khaji
Date:	9/09/2022

Rational Method using ARR16 terminology

$$Q_{AEP} = C_{AEP} \times {}^{AEP}I_{tc} \times A / 360$$

Where Q_{AEP} = design discharge for annual exceedance probability (AEP) (m^3/s)

C = runoff coefficient for annual exceedance probability, AEP

${}^{AEP}I_{tc}$ = rainfall intensity for the event and duration required (mm/h)

A = catchment area (ha)

$$C'_{10} = 0.1 + 0.0133 ({}^{10}I_1 - 25)$$

Where C'_{10} is the pervious runoff coefficient

${}^{10}I_1$ is the 10 % AEP, 1 hour duration rainfall intensity (mm/h)

And,

$$C_{10} = 0.9f + C'_{10}(1-f)$$

Where C_{10} is the 10 % AEP runoff coefficient

f is the fraction impervious (0.0 to 1.0)

And,

$$C_Y = F_Y C_{10}$$

Where C_Y is an average recurrence interval

F_{AEP} is a frequency factor

Rational Method Calculation

Known catchment area, ha

A = 6.1 ha

Determination of C'_{10} value

${}^{10\%}I_{1h}$ = 28.80

C'_{10} = 0.151

Determination of C_{10} value

f = 0.900 Based on layout plan

C_{10} = 0.825

Calculation of runoff coefficient, C, for event, AEP

AEP = 0.2

F_{AEP} = 1.35

C_{AEP} = 1.114

Runoff coefficient of > 1.0 is numerically possible, though conservative as not-physically possible (runoff volume > rainfall volume)

Determination of Rainfall intensity at site based on BOM data

t_C = 14 min

${}^{AEP}I_{14}$ = 160 mm/h

Based on 5 min for initiation time, and 580 metres (est) ofoverland flow at assumed 1 m/s velocity, rounded down to 14 mins

Calculation of design discharge from site (m^3/s)

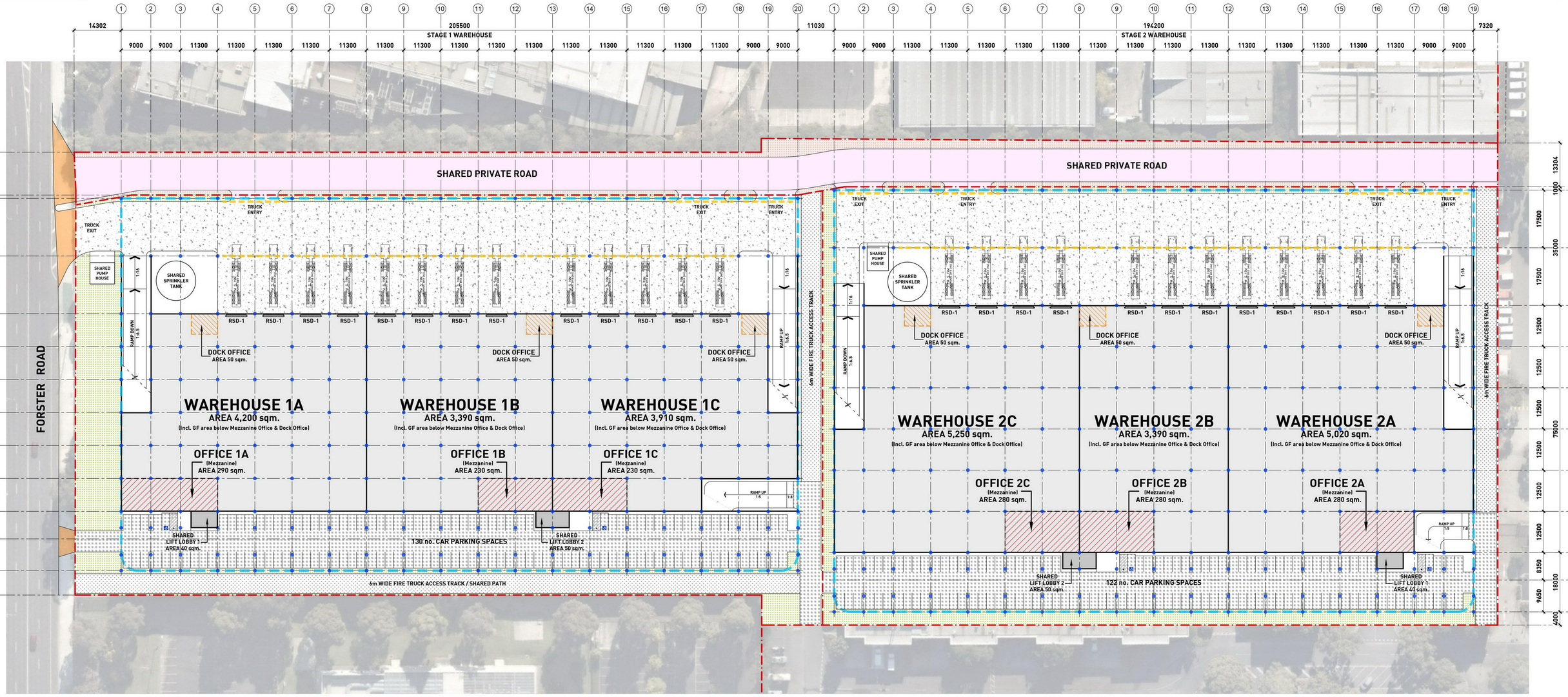
Q_{AEP} = 2.711

DALTON CONSULTING ENGINEERS

Appendix C: Development Plan

D22-412331

FOR INFORMATION ONLY
SUBJECT TO STATUTORY APPROVAL



TOTAL DEVELOPMENT SUMMARY

Proposed Stage 1 Site Area	27,696	sqm. approx.
Proposed Stage 2 Site Area	27,264	sqm. approx.
Shared Private Road Area	5,910	sqm. approx.
TOTAL SITE AREA	**60,870**	**sqm. approx.**
Total Stage 1 Building Area	37,620	sqm.
Total Stage 2 Building Area	43,070	sqm.
TOTAL BUILDING AREA	**80,690**	**sqm.**
Total Heavy Duty Paving Area (Excl. Circulation Ramp Areas)	48,120	sqm. approx.
Total Light Duty Paving Area (Excl. Circulation Ramp Areas)	18,600	sqm. approx.
Total Super Awning Area	9,890	sqm. approx.
Total Car Parking Provided	722	spaces

AREA SUMMARY - STAGE 1
(Ground Floor)

Warehouse 1A Area	4,200	sqm.
Office 1A Area (Mezzanine)	290	sqm.
Warehouse 1B Area	3,390	sqm.
Office 1B Area (Mezzanine)	230	sqm.
Warehouse 1C Area	3,910	sqm.
Office 1C Area (Mezzanine)	230	sqm.
Shared Lift Lobby 1 Area	40	sqm.
Shared Lift Lobby 2 Area	50	sqm.
TOTAL BUILDING AREA	**12,340**	**sqm.**
Total Heavy Duty Paving Area (Excl. Circulation Ramp Areas)	6,380	sqm. approx.
Total Light Duty Paving Area (Excl. Circulation Ramp Areas)	3,540	sqm. approx.
Total Car Parking Provided	130	spaces

AREA SUMMARY - STAGE 2
(Ground Floor)

Warehouse 2A Area	5,020	sqm.
Office 2A Area (Mezzanine)	280	sqm.
Warehouse 2B Area	3,390	sqm.
Office 2B Area (Mezzanine)	280	sqm.
Warehouse 2C Area	5,250	sqm.
Office 2C Area (Mezzanine)	280	sqm.
Shared Lift Lobby 1 Area	40	sqm.
Shared Lift Lobby 2 Area	50	sqm.
TOTAL BUILDING AREA	**14,590**	**sqm.**
Total Heavy Duty Paving Area (Excl. Circulation Ramp Areas)	5,920	sqm. approx.
Total Light Duty Paving Area (Excl. Circulation Ramp Areas)	3,220	sqm. approx.
Total Car Parking Provided	122	spaces

- EXTENT OF HEAVY DUTY PAVING AREA
- EXTENT OF LIGHT DUTY PAVING AREA
- EXTENT OF CRUSHED ROCK PAVING AREA
- EXTENT OF LANDSCAPE AREA
- OUTLINE OF FLOOR ABOVE
- EXTENT OF PROPOSED COLUMNS
- EXTENT OF PROPOSED TRANSFER BEAMS ABOVE
- RSD-1 ROLLER SHUTTER DOOR 6mW x 5mH
- PROPOSED NEW CROSSOVERS

NOTE:

- This concept plan is intended for feasibility purposes only. No planning advice has been sought from statutory authorities in the preparation of this plan. All setbacks, site coverage, car parking numbers, landscape areas and the like are subject to statutory approval.
- No assurance is given as to the features, attributes, feasibility or accuracy of anything shown on or disclosed in this plan.
- All existing & proposed features, dimensions, areas and boundaries are approximate only and subject to verification via detailed site survey by licensed surveyor.

CLIENT:

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PROPOSED DEVELOPMENT

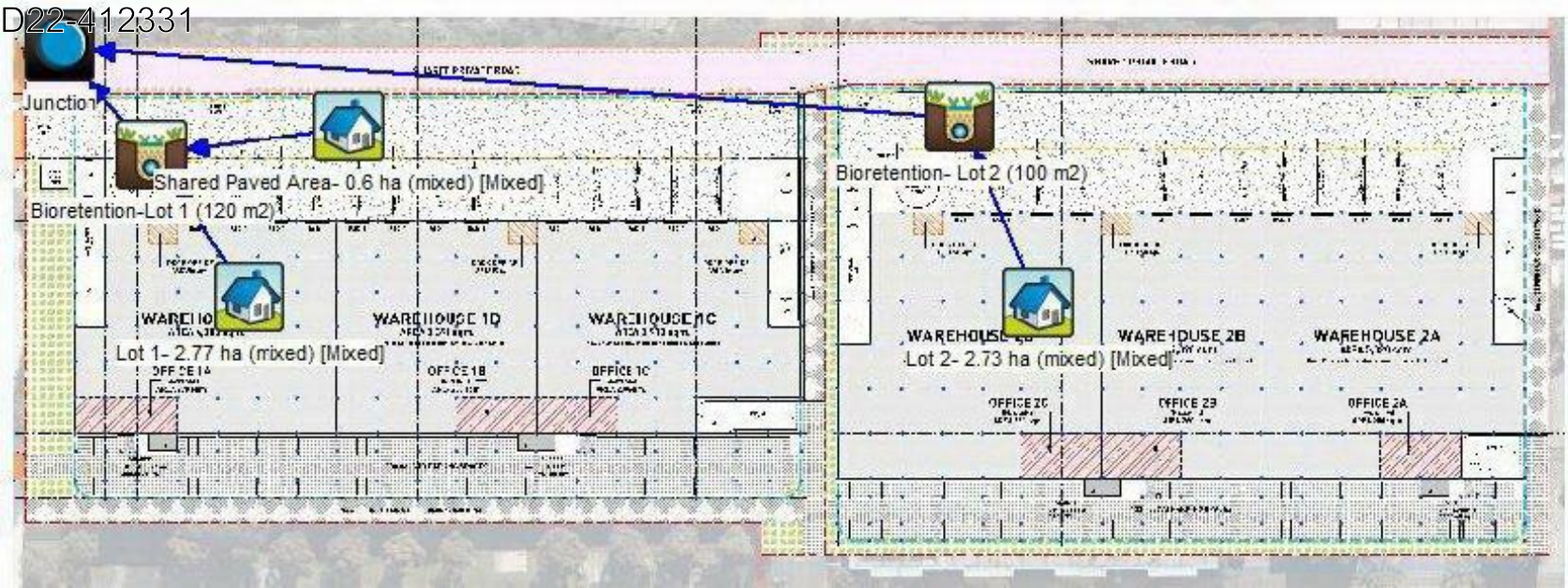
Axxess Corporate Park, 1-31 Gilby Road, Mount Waverley VIC

GROUND FLOOR PLAN

DRAWING TYPE: SKETCH DESIGN
DRAWING NUMBER: 2209-122-SK-011
REVISION: A
DATE: 27.08.2022
SCALE: 1:600 @ A1 / 1:1200 @ A3
0 30 60
SCALE BAR @ A1

DALTON CONSULTING ENGINEERS

Appendix D: MUSIC Model Inputs and Results


Junction1
Shared Paved Area- 0.6 ha (mixed) [Mixed]
Bioretention-Lot 1 (120 m2)
Lot 1- 2.77 ha (mixed) [Mixed]
Bioretention- Lot 2 (100 m2)
Lot 2- 2.73 ha (mixed) [Mixed]
WAREHOUSE 1D
WAREHOUSE 1C
WAREHOUSE 2B
WAREHOUSE 2A
OFFICE 1B
OFFICE 1C
OFFICE 2C
OFFICE 2B
OFFICE 2A

D22-412331

	Sources	Residual Load	% Reduction
Flow (ML/yr)	35.5	35	1.3
Total Suspended Solids (kg/yr)	7230	1350	81.3
Total Phosphorus (kg/yr)	14.6	5.75	60.6
Total Nitrogen (kg/yr)	102	51	50
Gross Pollutants (kg/yr)	1430	0	100

Source nodes
Location,Lot 1- 2.77 ha (mixed),Lot 2- 2.73 ha (mixed),Shared Paved Area- 0.6 ha (mixed)
ID,1,4,6
Node Type,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode
Zoning Surface Type,Mixed,Mixed,Mixed
Total Area (ha),2.77,2.73,0.59
Area Impervious (ha),2.49155298507463,2.45557388059702,0.530691791044776
Area Pervious (ha),0.278447014925372,0.274426119402984,0.0593082089552237
Field Capacity (mm),50,50,50
Pervious Area Infiltration Capacity coefficient - a,200,200,200
Pervious Area Infiltration Capacity exponent - b,1,1,1
Impervious Area Rainfall Threshold (mm/day),1,1,1
Pervious Area Soil Storage Capacity (mm),120,120,120
Pervious Area Soil Initial Storage (% of Capacity),25,25,25
Groundwater Initial Depth (mm),10,10,10
Groundwater Daily Recharge Rate (%),25,25,25
Groundwater Daily Baseflow Rate (%),5,5,5
Groundwater Daily Deep Seepage Rate (%),0,0,0
Stormflow Total Suspended Solids Mean (log mg/L),2.2,2.2,2.2
Stormflow Total Suspended Solids Standard Deviation (log mg/L),0.32,0.32,0.32
Stormflow Total Suspended Solids Estimation Method,Stochastic,Stochastic,Stochastic
Stormflow Total Suspended Solids Serial Correlation,0,0,0
Stormflow Total Phosphorus Mean (log mg/L),-0.45,-0.45,-0.45
Stormflow Total Phosphorus Standard Deviation (log mg/L),0.25,0.25,0.25
Stormflow Total Phosphorus Estimation Method,Stochastic,Stochastic,Stochastic
Stormflow Total Phosphorus Serial Correlation,0,0,0
Stormflow Total Nitrogen Mean (log mg/L),0.42,0.42,0.42
Stormflow Total Nitrogen Standard Deviation (log mg/L),0.19,0.19,0.19
Stormflow Total Nitrogen Estimation Method,Stochastic,Stochastic,Stochastic
Stormflow Total Nitrogen Serial Correlation,0,0,0
Baseflow Total Suspended Solids Mean (log mg/L),1.1,1.1,1.1
Baseflow Total Suspended Solids Stan