

APPENDIX H



14 Unit Development

177 – 179 FRANCIS STREET, WEST END QLD 4810

ENGINEERING REPORT

KAENETTO INVESTMENTS

STP25-1272

DOCUMENT STATUS

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1. Introduction

Kaenetto Investments has engaged STP Consultants to prepare a Development Application (DA) Engineering Report, for submission to the Townsville City Council.

The purpose of this report is to address several key areas critical to the successful planning and execution of the project, including.

- Earthworks
- Flood Impact
- Stormwater Management
- Water Supply
- Sewerage Connection

1.1 Limitations

This report provides a desktop investigation from the information obtained from the following sources.

- Architectural plans prepared by Concepts Building Design.
- Survey Plan prepared by Atkinson Surveys.
- LiDAR data obtained from Department of Natural Resources and Mines (via ELVIS – Elevation Foundation Spatial Data).
- Townsville City Council Infrastructure Mapping Information.
- Townsville City Council Overlays.
- Townsville City Council Planning Scheme.
- Rainfall and Meteorological Data by the Australia Bureau of Meteorology.
- Before You Dig Australia.
- Queensland Globe.
- Google Maps and Street View.

2. Site Characteristics

The site is situated at 177 – 179 Francis Street, West End Queensland 4810, and encompasses four lots specifically identified as Lot 1 - 4 on RP711746, with a total land area of 4,436 m² (hereafter described as “the site”). The site falls within the Low-Density Residential zone under the authority of the Townsville City Council (TCC) local government area.

The site is positioned on the corner of Francis Street and Percy Street with the site being on the northern side of Francis Street. At present, the site is unoccupied with low density vegetation. The site's immediate surroundings are residential dwellings in the north, south, and east directions, while to the west across the road, is parkland.



Figure 2.1 - Zoning and Locality Plan Extract (TCC Mapping)

2.1 Easements and Resumptions

There are currently no easements registered over the lot.



Figure 2.2 - Cadastral Boundaries and Easements (Qld Globe)

2.3 Flood Study

In accordance with the Townsville City Council Floor Hazard Overlay Mapping, the 1% AEP (Annual Exceedance Probability) flood event does not affect the site.

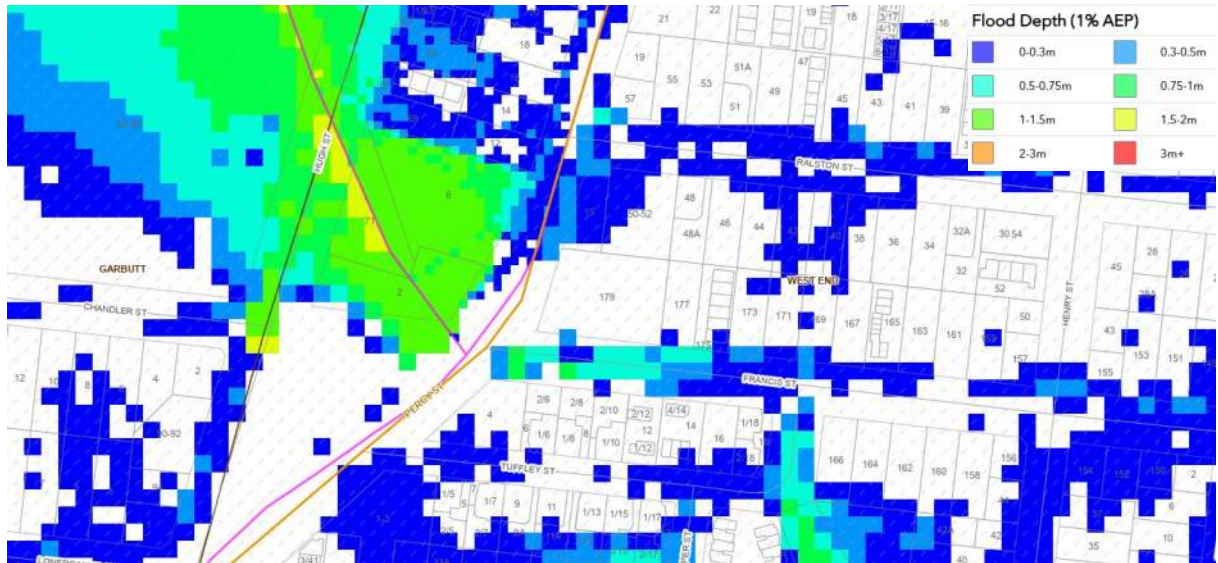


Figure 2.4 - 1% AEP Flood Map Extract (TCC Mapping)

The site is partly affected by the Storm Tide hazard Overlay which requires a minimum Habitable Floor levels to be set at RL3.9m AHD.

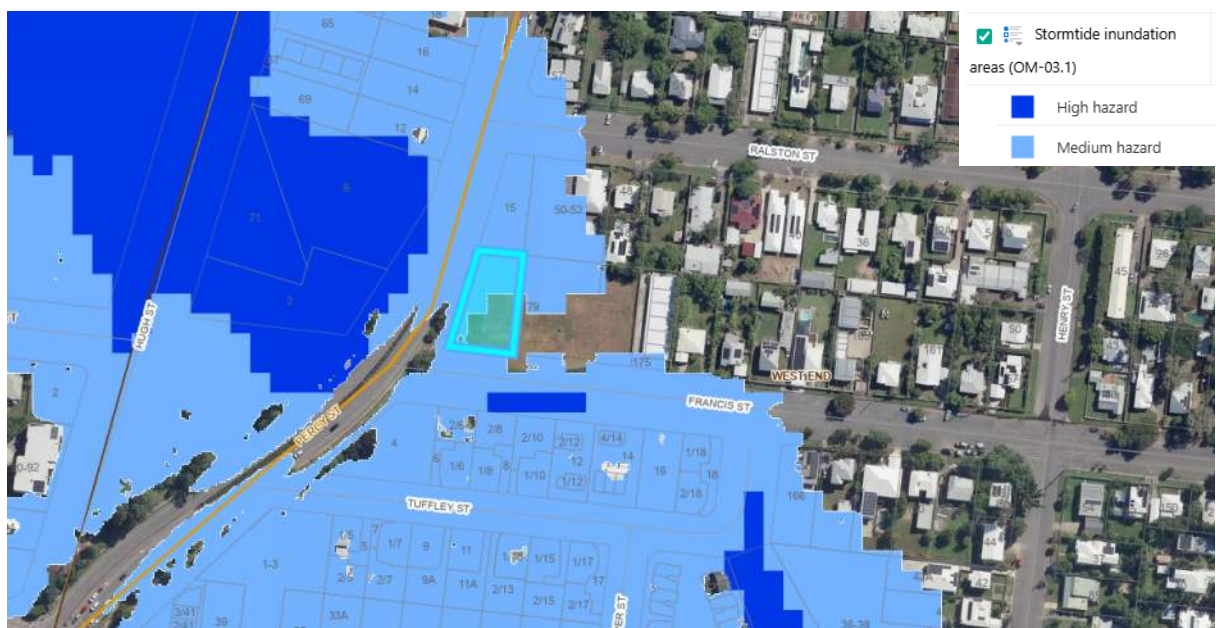


Figure 2.5 - Coastal Hazard Storm Tide Map Extract (TCC Mapping)

3. Proposed Development

3.1 Site Plan

A copy of the architectural site plan for the proposed development is provided in Appendix B.

The proposed development consists of the following.

- Clearing out the existing vegetation
- Potholing the unknown stormwater and 750mm dia water main.
- Minor earthworks for the new building paths, landscape areas, driveway, and car parks including retaining walls.
- Construction of the 14 units
- Construction of the site's stormwater drainage system including stormwater quality improvement device
- Extension of Francis Street with a cul-de-sac head.



Figure 3.1 - Site Plan (Building Concept Design)

3.2 Site Earthworks

A copy of the concept earthworks drawing for the proposed development is provided in Appendix C.

A Geotechnical Report was not available at the time of preparing this document.

Concept earthworks are based on the existing levels surveyed and the preliminary finished surface levels shown on the Concept Civil Works drawing. The proposed levels shown on the drawing, when compared to the surveyed levels, indicate that generally there will be minimal cut or fill on site for the proposed development thereby negating the need for significant site earthworks.

Geotechnical testing for CBR values for pavement design can be undertaken prior to construction commencing to confirm the pavement design.

Surface heights in the northeast corner of the site are to match existing ground levels to accept and cater for the external catchment on the site.





4. Traffic & Waste

A Traffic Engineering Report will be provided under a separate cover for this application.

An Operational Waste Management Plan will be provided under a separate cover for this application.

5. Stormwater Quantity Management

5.1 Existing Stormwater Infrastructure

Currently the site stormwater discharges runoff via overland flow towards the southern and western boundaries, into the existing open drains. There is no underground stormwater drainage according to Before You Dig Australia plans and Townsville City Council asset mapping.

It is proposed to maintain the existing catchments and therefore the Legal Point of Discharge (LPOD) is the open drains in Francis Street and Percy Street road reserves.



Figure 5.1 - Existing Council Infrastructure (TCC Mapping)

During a visit it was noted there is an existing stormwater pipe that potentially runs parallel to the rear boundary from east to west. The size is 300mm pipe and the material of the pipe is unknown. Additional detailed survey or potholing is required to determine the length of the pipe, existing depths, and the stormwater catchment it caters for.



Figure 5.2 - Street View From Percy Street (Google)

5.2 External Catchment

The site possibly takes the northern neighbour's yard as part of an external catchment. The size of this area is approximately 912.5m² and only affects the north east corner of the site. The development's internal stormwater infrastructure must allow and cater for this external catchment during the design process.

The unknown stormwater pipe at the rear of the site will also contribute to the external stormwater catchment, but further investigations are required to be able to determine the extent and size



Figure 5.3 - External Catchment Extract (TCC Mapping)

5.3 Stormwater Runoff & Detention

The Townsville City Council Planning Scheme Policy in section 6.4.9.3 – Stormwater Quantity, prescribes the design AEP for both Major and Minor systems. The Major drainage system is to be designed for the 1% AEP event while the Minor system is to be designed for the 39% AEP event, in accordance with Table 5.1 below of the planning scheme.

Development Category	ARI (yrs)	AEP
Residential	2	39%
Commercial - Lower order (district centre and below)	2	39%
Commercial - Other (excluding Lower order commercial and Principal centre)	5	18%
Industrial	5	18%
Principal Centre (CBD)	10	10%
Rural Residential	20	5%
Parks and recreation areas (excluding community facilities)	1	1EY

Table 5.1 - Recommended Design for Minor Systems (TCC Planning Scheme)

Stormwater Detention in Townsville requires to be designed in accordance with the principles of QUDM. Detention storage must be installed if any of the following conditions are met.

- Insufficient capacity in the downstream drainage system to provide a no worsening situation.
- Limit any increase in discharge rate for all storm events up to and including the define flood event.

- The site must not discharge more than the discharge calculated for the pre-development flows.

In this case, pre-development and post-development runoff calculations will be based on the current permissible fraction of Impervious for the zone, and time of concentration will be based kerb inlet times of 10 minutes, as per QUDM clause 4.6.4.

The Townsville City Plan, *Schedule 6.4 Development Manual Planning Scheme Policy, Table SC6.4.9.2 – Fraction impervious for Land Use Zones*, prescribes the fraction impervious for the existing Low Density Residential zoning of 0.65 and for a fraction impervious of 0.70 for the proposed Medium Density Residential zoning.

With reference to the Architectural drawings 'Gross Area Schedule the grassed areas and garden beds make up 41% of the land area, giving a fraction impervious for the subject site 59% which is less than assigned 70% for a Medium Density Residential zoned site, in accordance with the Townsville City Council Planning Scheme and less than the 65% for Low Density Residential. As the fraction of impervious for the proposed development falls under the current permissible fraction of impervious for Low Density Residential zoning, no on-site detention will be required.

Development Category	Land use	Fraction impervious (fi)
Residential zones category	Low density residential	0.65
	Medium density residential	0.7
	High density residential	0.9
	Rural residential	0.6
Centre zones category	Character residential	0.55
	Neighbourhood centre	0.9
	Local centre	0.9
	District centre	0.9
	Major centre	1.0
	Principal centre (CBD)	1.0
	Specialised centre	0.9
Community facilities and Open space zone category	Mixed use	0.9
	Sport & recreation	0.2
	Open space	0.2
	Community facilities	0.95
	Environmental management & conservation	0.4
Industry zones category	Low impact industry	0.9
	Medium impact industry	0.9
	High impact industry	0.8
Rural zones category	Rural	0.1
Other zones category	Emerging community	-
	Special purpose	-

Table 5.2 - Fraction of Impervious for Land Use Zones (TCC Planning Scheme)

6. Stormwater Quality Management

In accordance with the State Planning Policy (SPP), the reconfigured development does meet the threshold criteria and therefore stormwater quality treatment is required. The size of the development is 4,436m².

Assessment benchmarks – water quality These performance outcomes apply to the following development applications, to the extent the SPP has not been identified in a local planning instrument as being appropriately integrated.		
For receiving waters, a development application for: (1) a material change of use for an urban purpose that involves premises 2500 metres ² or greater in size and; (a) will result in six or more dwellings; or (b) will result in an impervious area greater than 25 per cent of the net developable area; or (2) reconfiguring a lot for an urban purpose that involves premises 2500 metres ² or greater in size and will result in six or more lots; or (3) operational works for an urban purpose that involves disturbing a land area 2500 metres ² or greater in size.	For water supply buffer areas, a development application: (4) located wholly outside an urban area and relating to premises that is within, or partly within, a water supply buffer area, that involves: (a) a material change of use for the intensive animal industry, medium and high-impact industry, noxious and hazardous industry, extractive industry, utility installation that involves sewerage services, drainage or stormwater services, waste management facilities, or motor sport facility; or (b) reconfiguring a lot to create five or more additional lots if any resultant lot is less than 16 hectares in size, and any of the lots created will rely on on-site wastewater treatment.	The following requirements are assessment benchmarks for the development: (1) Development is located, designed, constructed and operated to avoid or minimise adverse impacts on environmental values arising from: (a) altered stormwater quality and hydrology (b) waste water (c) the creation or expansion of non-tidal artificial waterways (d) the release and mobilisation of nutrients and sediments. (2) Development achieves the applicable stormwater management design objectives outlined in tables A and B (appendix 2) (3) Development in a water supply buffer area avoids adverse impacts on drinking water supply environmental values. Further information in relation to these requirements is detailed in the water quality guidance material.

Figure 6.1 - Assessment Benchmark for Stormwater Quality (State Planning Policy)

6.1 Pollutant Concern

Queensland Healthy Water Guidelines provide guidance of the types of pollutants likely to be generated from different developments. These pollutants are indicators that need to be address and treated prior to discharge. The pollutants most likely to be of concern for developments are identified in Table 6.1 below.

Pollutant	Development Phase	
	Construction	Operation
Litter	✓	✓
Sediment	✓	unlikely
Hydrocarbons (including oil and grease)	✓	✓
Toxic materials (e.g. cement slurry, asphalt primer, solvents)	✓	unlikely
pH altering substances (e.g. cement slurry and wash waters)	✓	unlikely
Oxygen demanding substances (organic and chemical matter)	possibly	unlikely
Nutrients (nitrogen and phosphorus)	✓	✓
Pathogens / Faecal coliforms (bacteria and viruses)	possibly	unlikely
Heavy metals (often associated with fine sediment)	unlikely	unlikely
Surfactants (e.g. detergents from car washing)	unlikely	possibly
Thermal pollution (heat)	unlikely	unlikely

Table 6.1 - Pollutants Likely to be of Most Concern

6.2 Design Objectives for Water Management

Load based reduction targets focus on performance of a stormwater quality management system within the urban footprint, concentration-based water quality objectives are concerned with median flow concentrations as they enter downstream receiving water. Table 6.2 shows the minimum water quality objectives for Townsville.

Parameter	Statistic	Load Based Reduction	Water Quality Objectives
Total Suspended Solids (TSS)	Mean Range	80%	Less than 5mg/L
Total Phosphorous (TP)	Mean Range	65%	Less than 0.01 to 0.05mg/L
Total Nitrogen (TN)	Mean Range	40%	Less than 0.2 to 0.5mg/L
Gross Pollutants	-	90%	Retention of litter greater than 3mm for flows up to the 3-month ARI peak flow

Table 6.2 - Water Quality Objectives (TCC Planning Scheme)

6.3 Proposed Stormwater Treatment Train Analysis

The proposed development site has sufficient area available to dedicate the stormwater treatment devices. Roof water will discharge via downpipes to splash pads. The landscaped areas and pavements will discharge directly to field inlet pits or to overland flow. A minimum of 6 Atlan Stormsacks (3 in landscape and 3 in the driveway) are required to reduce pollutant loads. Once stormwater runoff is treated it will discharge to the LPOD. A single treatment chamber has been used for the site catchments. The Atlan Flow Filter (FLF.1500/6) has been used for modelling purposes but may be substituted by another proprietary product with similar performance characteristics. This initial model assumes that all the surface water will be capture but will need to be updated once the detail design has commenced to ensure the treatment matches what the design catchments.

6.4 MUSIC Modelling

6.4.1 Model Parameters

Input	Data Used
Rainfall Station	32040 TOWNSVILLE
Rainfall Period	03/03/1953 – 31/03/2010
Mean Annual Rainfall (mm)	1014mm
Mean Annual Evapotranspiration (mm)	1827mm
Model Timestep	6 minutes
Rainfall Runoff Parameters*	Urban Residential SEQ
Pollutant Parameters*	Residential (Split)

Table 6.3 - Basic MUSIC Model Parameters

6.4.2 Rainfall & Runoff Parameters

Parameter	Roof/Road/Ground Level
Rainfall Threshold (mm)	1
Soil Storage Capacity (mm)	400
Soil Initial Storage (% of Capacity)	10
Field Capacity (mm)	200
Infiltration Capacity – Coefficient A	211
Infiltration Capacity – Coefficient B	5.0
Initial Depth (mm)	50
Daily Recharge Rate (%)	28
Daily Baseflow Rate (%)	27
Daily Deep Seepage Rate (%)	0

Table 6.4 - Recommended MUSIC Rainfall-Runoff Parameters

6.4.3 Pollutant Generation

MUSIC, stormwater quality is characterized by event mean concentrations (EMC) for storm flows and base flows. In this study, the EMC adopted the Water by Design MUSIC Modelling Guidelines. The pollutants of concern that were assessed include total suspended solids (TSS), total phosphorous (TP), and total nitrogen (TN). The quality of stormwater runoff is characterised by inputting event mean concentrations (EMC) for storm flow and base flow conditions as well as the standard deviation of each EMC.

Pollutant concentrations are based on Urban Residential land use parameters.

Flow Type	Surface Type	TSS (log ₁₀ values)		TP (log ₁₀ values)		TN (log ₁₀ values)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Baseflow	Roof	0	0	0	0	0	0
	Roads	1	0.34	-0.97	0.31	0.20	0.20
	Ground level	1	0.34	-0.97	0.31	0.20	0.20
Stormflow	Roof	1.30	0.39	-0.89	0.31	0.26	0.23
	Roads	2.43	0.39	-0.30	0.31	0.26	0.23
	Ground level	2.18	0.39	-0.47	0.31	0.26	0.23

Table 6.5 - Water by Design MUSIC Modelling Parameters – Urban Residential Split Catchment

6.4.4 Results

The indicative layout of the MUSIC model are shown below in Figures 6.2 and the perspective treatment effectiveness in Tables 6.6.

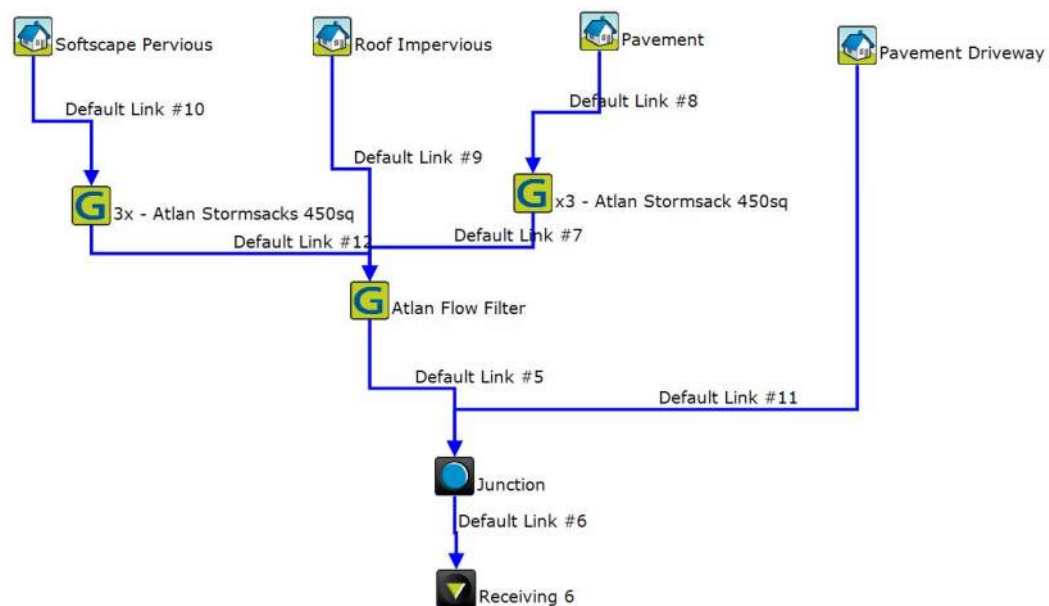


Figure 6.2 – MUSIC X Treatment Train

(1) Scenario 1 : Treatment Train Effectiveness : Receiving 6			
	Sources	Residual Load	% Reduction
Flow (ML/yr)	4.079	4.079	-2.177E-14
Total Suspended Solids (kg/yr)	534.1	69.88	86.92
Total Phosphorus (kg/yr)	1.223	0.2396	80.4
Total Nitrogen (kg/yr)	8.487	4.912	42.12
Gross Pollutants (kg/yr)	68.12	3.975	94.16

Table 6.6 – MUSIC X Modelling Results

7. Water Supply & Sewerage

7.1 Water Supply

In accordance with the information provided by Townsville Maps and Before You Dig Australia (BYDA), the subject site does not currently contain a water meter or a connection point to council main. A new connection will need to be installed of the 100mm AC main, with the size to be determined by the hydraulic consultant during the design phase based on actual water demands.

There is an existing fire hydrant on verge of Francis Street on the site frontage, located on the 100mm AC main. Further fire requirements for the site (boosters and hydrants) will be determined by the hydraulic consultant during the design phase.

The location of the existing water connection and fire hydrants is provided in the Figure below.

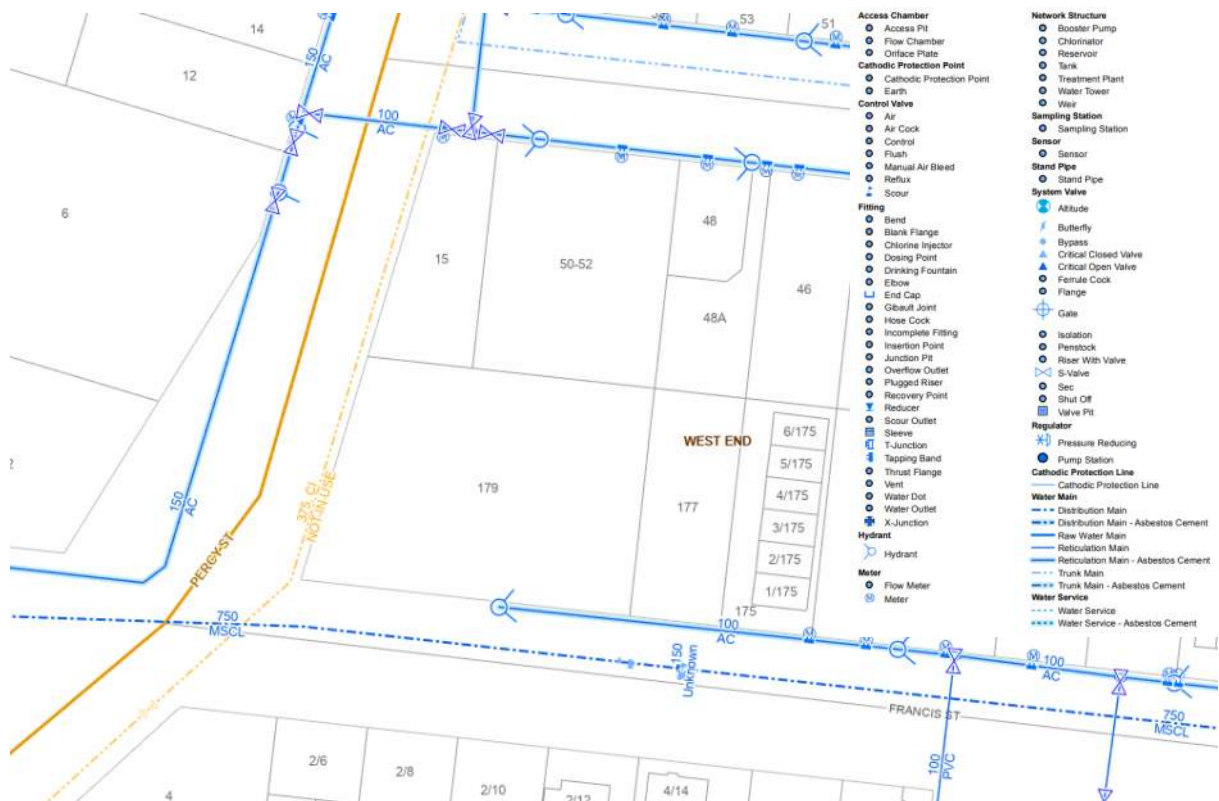


Figure 7.1 - Existing Water Layout (TCC Mapping)

A water network analysis has been undertaken for the proposed development in accordance with SC6.4.11 of the Townsville City Plan and the analysis demonstrates that the existing water network infrastructure has sufficient capacity to cope with the proposed development. The water network analysis is provided in Appendix F.

7.2 Sewer Connection

In accordance with the information provided by Townsville Maps and Before You Dig Australia (BYDA), the subject site does not currently contain a sewer property connection. The site currently is traversed by two sewers.

- A 150mm dia Glass Reinforce Polyester (GRP) which travels north to south from manhole 1/A6A8 to 24/A6A, with an approximate depth of 2.87m.
- A 225mm dia Polyvinyl Chloride Pipe (PVC) which travels from north west to south east. There is an existing manhole located on the southern side of the site where the 150mm and 225mm pipe join. This manhole is 24/A6A and has a depth of approximately 3m and an invert level of RL1.29m AHD.

The existing sewer manhole 24/A26A has a top of manhole level of RL4.29m AHD. The concept design proposes

to lower the lid level to approximately RL3.255m AHD, to sit flush with the driveway pavement. This may require a change to the existing sewer manhole lid to a Class D trafficable type.

A new 150mm dia stub connection will need to be installed on manhole 24/A6A at invert level RL1.59m AHD, to service the proposed development.

Given the lowest building floor level is RL3.9m AHD, there is sufficient depth to grade the internal sewers at 1 in 60 to the proposed new sewer connection.

A building over sewer application will be required as the proposed retaining walls traverse the sewer alignment.

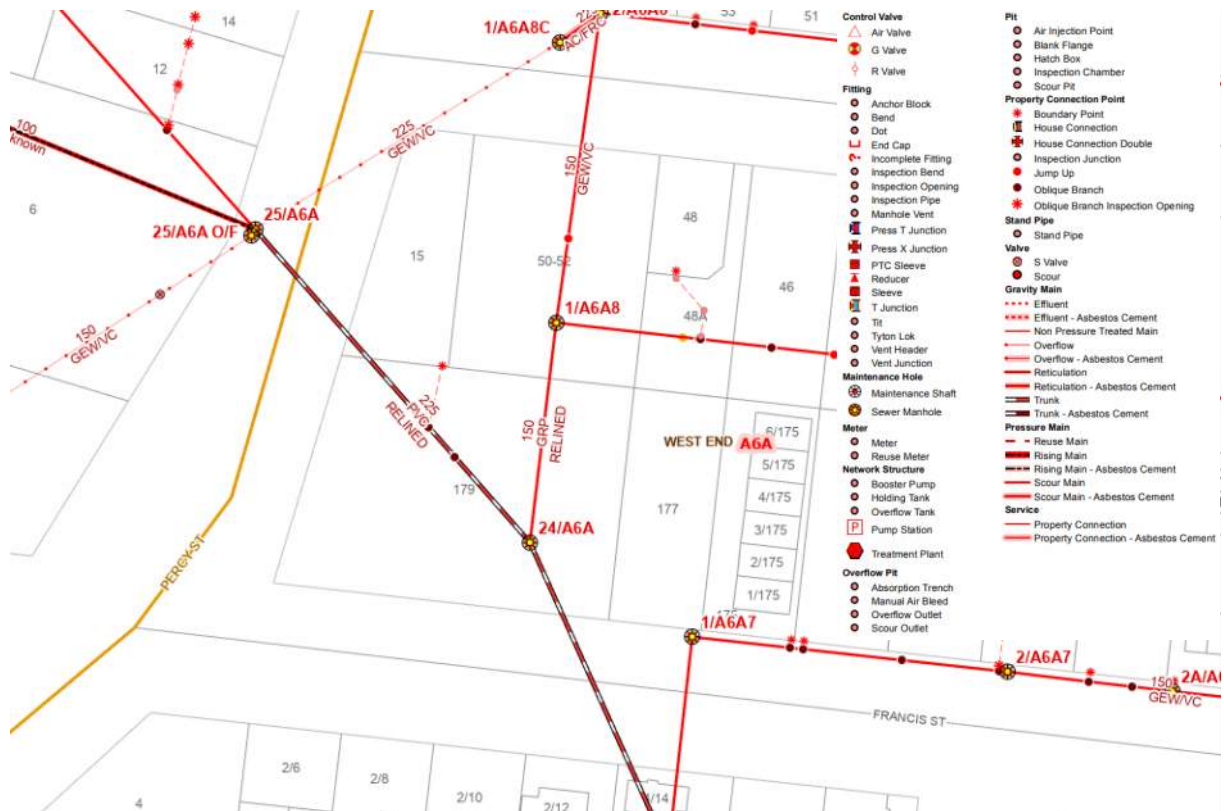


Figure 7.2 - Existing Sewer Layout (TCC Mapping)

A sewer network analysis has been undertaken for the proposed development in accordance with SC6.4.11 of the Townsville City Plan and the analysis demonstrates that the existing sewer network infrastructure has sufficient capacity to cope with the proposed development. The sewer network analysis is provided in Appendix F.

8. Electrical and Communication Services

The site will need to connect to Ergon for power requirements and will need to comply with the suppliers' standard drawings. Based on BYDA's provided drawings, a new power pole for overhead power or underground low voltage cables will need to be installed to power the site.

Similarly for telecommunications, the NBN or Telstra conduits will need to be extended to provide data to the development.

The Electrical Engineer will determine the supply demands for the site and coordinate with the local suppliers during the detailed design phase.

9. Conclusion

As demonstrated within the report, the proposed development can be undertaken, and a summary of the requirements are as follows: -

- The 1% AEP Design Storm does not affect the site.
- Storm Tide Coastal Hazard affects the site.
- The building floor levels should be set to minimum of RL3.9m AHD, to comply with the Coastal Hazard Overlay.
- Retaining walls are required for the development with a maximum height of 1.2m.
- The external catchment from the adjacent northern property is accommodated in the design.
- The Minor Design Event is 39% AEP.
- The Major Design Event is 1% AEP.
- No on-site detention is required.
- Stormwater Quality treatment is required under the State Planning Policy.
- The Legal Point of Discharge is the Open Drain on Fracis Street.
- The existing water and sewer networks have sufficient capacity to accommodate the proposed development.
- Power and telecommunications will need to extend, and new services installed in the verge to service the development.
- A Building Over Sewer Application will be required for the site.

Based on our investigative works, we consider that Council has no impediment to the approval of this development within the context of engineering issues. We therefore recommend that Council approves the application subject to reasonable, relevant, equitable and justifiable conditions.

Appendix A: Survey



Appendix B: Site Plan



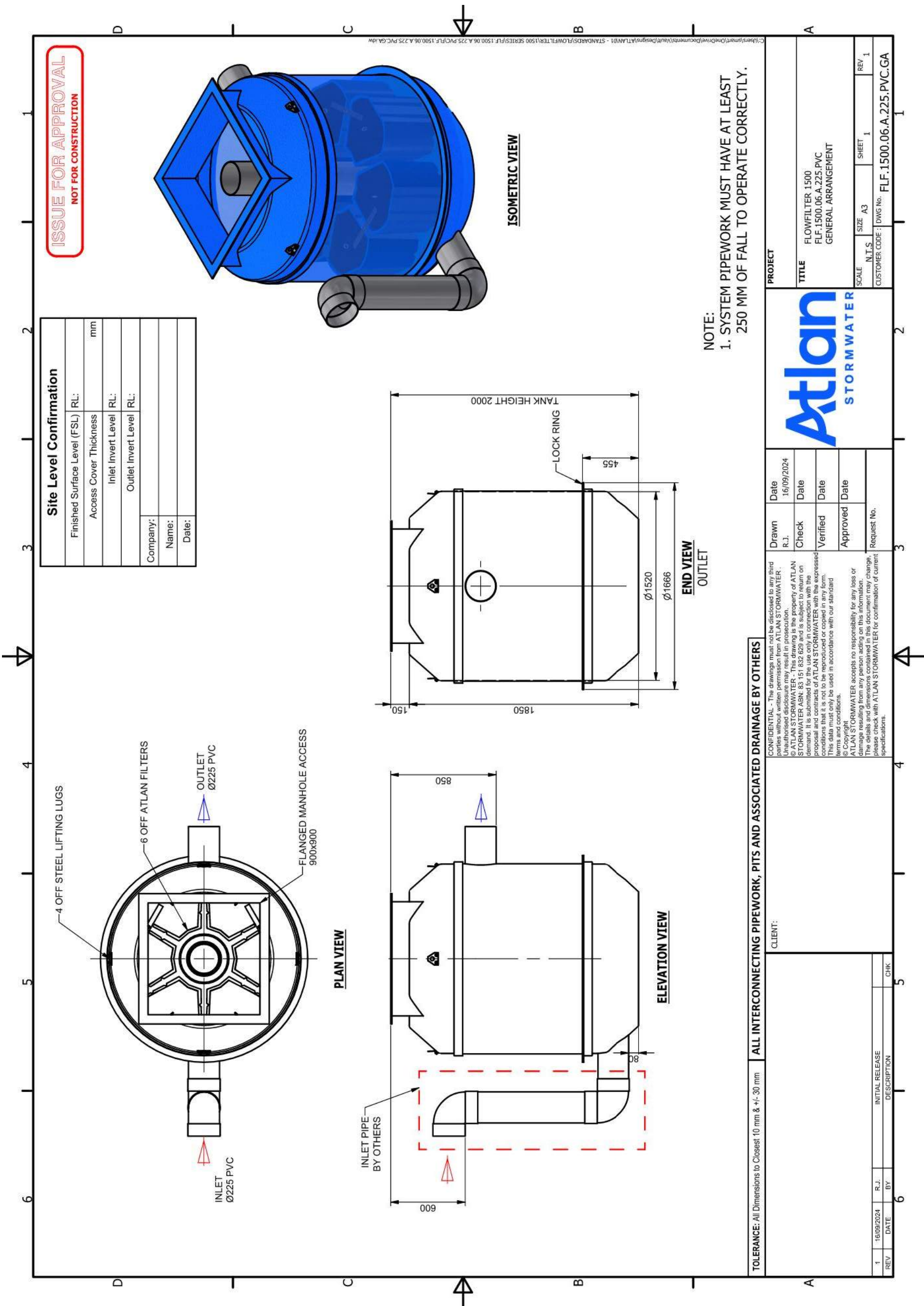
Appendix C: Concept Earthworks



Appendix D: Concept Civil Works



Appendix E: Atlan FlowFilter



Appendix F: Water and Sewer Planning Report



177-179 FRANCIS STREET, WEST END RESIDENTIAL UNITS

WATER SUPPLY & SEWERAGE PLANNING REPORT

**Date: 20 March 2026
(Revision A)**

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APPENDICES

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Appendix B	Water Network Modelling & Results
Appendix C	Sewer Network Modelling & Results

REPORT AUTHORISATION				
Revision	Revision Date	Details	Prepared by	Signature
A	20/03/2026	Original Report	Desmond Moseley (RPEQ 7565)	

1 INTRODUCTION

A development that will consist of 14 residential units is proposed for No 177 – 179 Francis St, West End. This site is located on the northern side of Francis St and at the intersection with Percy St. This site is currently undeveloped as per the Townsville Council GIS image below.



Figure 1.1 – Development Site Location

The site is proposed to be developed into a single-story residential unit complex with a total of 14 units. The development plans are included in Appendix A with the development layout plan extract provided below as Figure 1.2 below.

To ensure the residential unit development can be adequately serviced by with a potable water supply and sewage system in accordance with Council standards, an assessment of the system capacities have been undertaken. This report summarises the assessment of the existing water and sewerage network with this illustrating:

- The water network modelling shows the existing DN100 AC water main along the Francis St frontage is adequately sized to service the development to meet Townsville Council standards.
- The existing DN225 gravity sewer that runs through the development site has sufficient capacity to service the development.

The water network modelling and sewer system capacity assessment undertaken for this development is summarised in the following report sections.

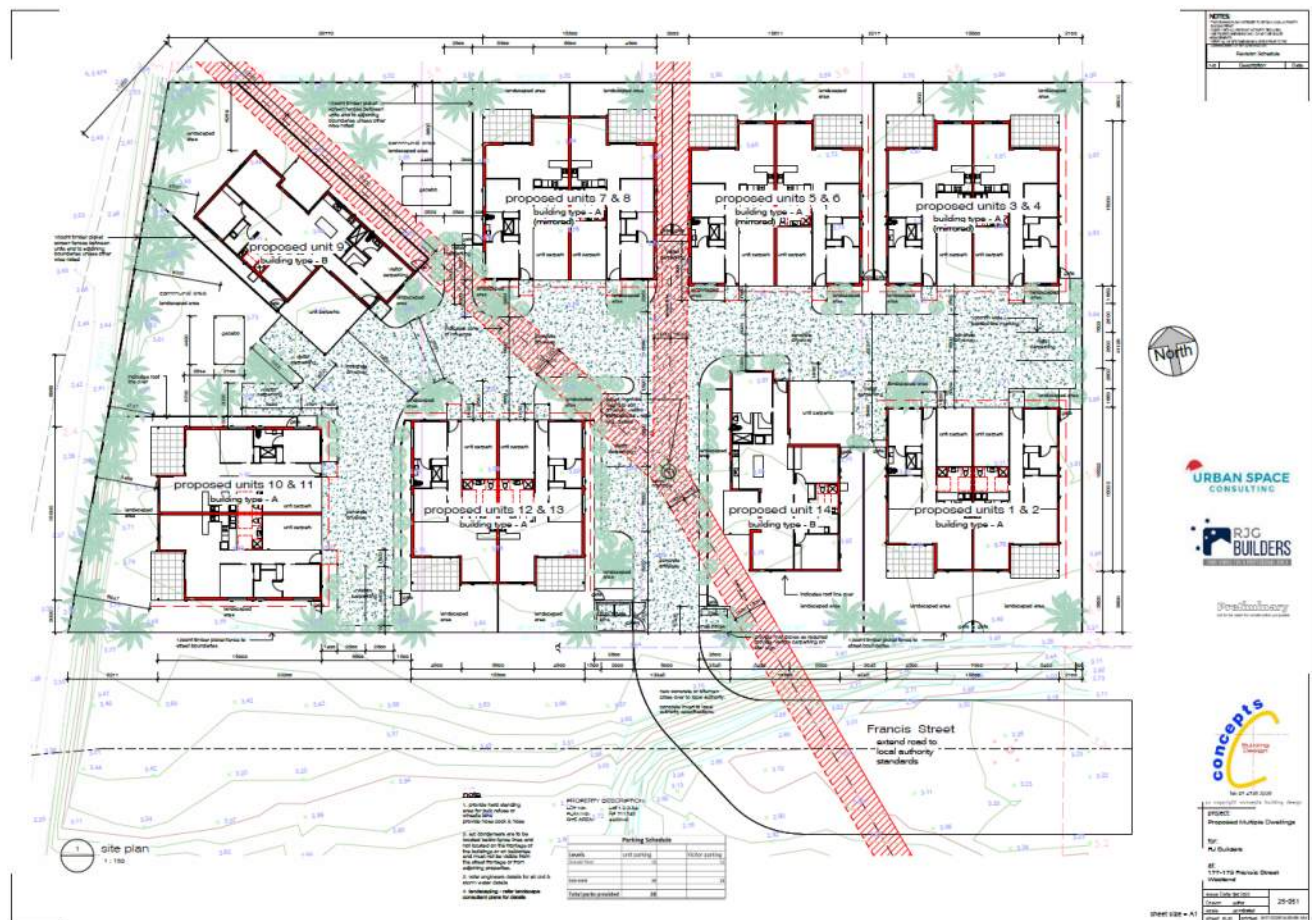


Figure 1.2 – Development Layout Plan Extract

2 POPULATION ASSESSMENT

The following Table 2.1 provides the equivalent population assessment for the proposed residential unit development on 177-179 Francis Street. The equivalent population for each residential unit is in accordance with the CTM Code.

Table 2.1 –Population Assessment

	Number	Rate	EP
Residential Units	14 units	1.8 EP/lot	25.2 EP

The above equivalent has been used in the water & sewer infrastructure capacity assessment.

3 WATER SUPPLY PLANNING

3.1 Water Demand

Water demands have been calculated in accordance with Townsville City Council planning scheme and CTM Code. The following table provides the “residential” water demand parameters from the CTM Code for each equivalent person (EP).

Table 3.1 - Water Supply Unit Demand Parameters

Parameter	Unit Demand	Peaking Factor
Average Day (AD)	600 L/day/EP	
Mean Day Max Month (MDMM)	900 L/day/EP	1.5 AD
Peak Day (PD)	1125 L/day/EP	1.25 MDMM
Peak Hour (PH)	0.033 L/s/EP	2.56 PD

The peak hour residential water demands have been applied to the proposed unit development, giving a peak water demand of $25.2 \text{ EP} \times 0.033 \text{ l/s/EP} = 0.84 \text{ l/s}$.

In addition to the above, as the development is residential, the 15 l/s residential fire flow is applicable in accordance with the CTM Code. This fire flow has been used to assess the theoretical performance of the water network.

3.2 Water Supply Assessment & Network Modelling

The site for the proposed 14 unit development is on the northern side of Francis St in West End. The existing water infrastructure that services the site includes:

- A DN100 Asbestos Cement (AC) water main along the northern side of Francis St. This is along the frontage of the proposed development. The existing DN100 water main extends to the east along Francis St where it links to the DN375 trunk water main at the intersection of Francis St & Leigh St. The DN100 AC main also connects into a number of other reticulation water mains on Tuffley St and Henry St.
- The DN375 DICL water main then immediately connects to a DN450 trunk main that runs to the west under Francis St to connect to the DN375 PVC trunk water main that is located on the eastern side of Henry Street.
- The DN375 PVC trunk water main extends to the south where it connects to a DN450 MSCL trunk water main that is fed from the Mount Louisa Reservoirs.
- It is noted that the DN375 DICL water main on Leigh St runs to the north east where it connects to the existing West End Reservoir which is not currently operational. The West End reservoir is planned to be renewed and put back into operation in the next year or two. This will further improve the water network operation and performance in the West End area.
- The development site and the West End area is generally well serviced with a network of reticulation and trunk water mains.

The following extract from the Council GIS illustrates the existing water infrastructure that services the development site.



Figure 3.1 – Council GIS Plot of Water Network

Theoretical water network modelling has been performed to assess the capacity of the existing reticulation network. The modelling was undertaken using the WaterGEMS network model of Townsville for both the peak hour demands and fire flows.

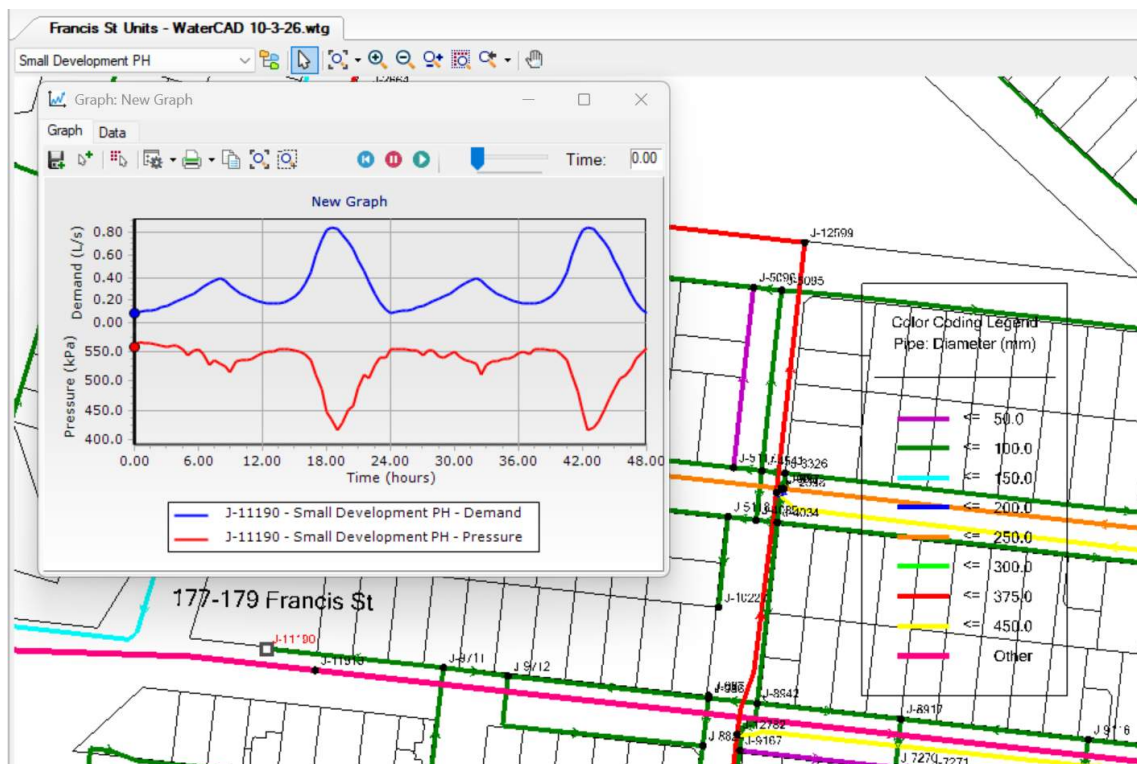
The WaterGems network modelling results with the inclusion of the water demands from the proposed development shows:

- The existing DN100 AC water main along Francis St frontage is shown to be adequately sized to service the development with peak hour and fire flows.
- The peak hour pressures at 7 pm (ie the peak residential demand period) are reduced to 410 kPa. This meets the minimum pressure requirement of 220 kPa.
- The existing DN100 AC water main along Francis St from Tuffley St to the development site had a velocity of 0.11 m/s and a headloss gradient of less than 0.001 m/m therefore meets TCC standards of 2.5 m/s and headloss gradient of less than 0.005 m/m.
- The existing DN100 AC water main further to the east along Francis St (under the Henry St intersection) was shown to have a velocity of 0.75 m/s and a headloss gradient of up to 0.012 m/m. The headloss gradient is higher than the recommended value of 0.005 m/m but the velocity is well under the maximum recommended value of 2.5 m/s. It is noted that the headloss gradient along the existing DN100 AC water main without the additional demands from the unit development was already up to 0.010 m/m so was already higher than TCC recommended values. The headloss gradient is only an indication of the efficiency of the water main so the existing water main is adequately sized to service the development.

- With the inclusion of the 15 l/s fire flow the water pressures are reduced to 277 kPa within the water main (not accounting for pressure losses through the hydrant tee and standpipe). This is the pressure at 7pm and is concurrent with the peak residential demand period and meets the minimum pressure requirement of 120 kPa.
- The velocity along the DN100 reticulation main on Francis St for the fire flow assessment is 2.02 m/s and meets the Council design standards of being less than 4.0 m/s for fire flows.
- The WaterGems figure and results table are provided in Appendix B.

The above water network modelling shows that the proposed residential unit development is able to be serviced with a reticulated water supply that meets Council's standards with no upgrades required.

The following figure illustrates the peak hour demands and residual water pressure at the proposed residential unit site.



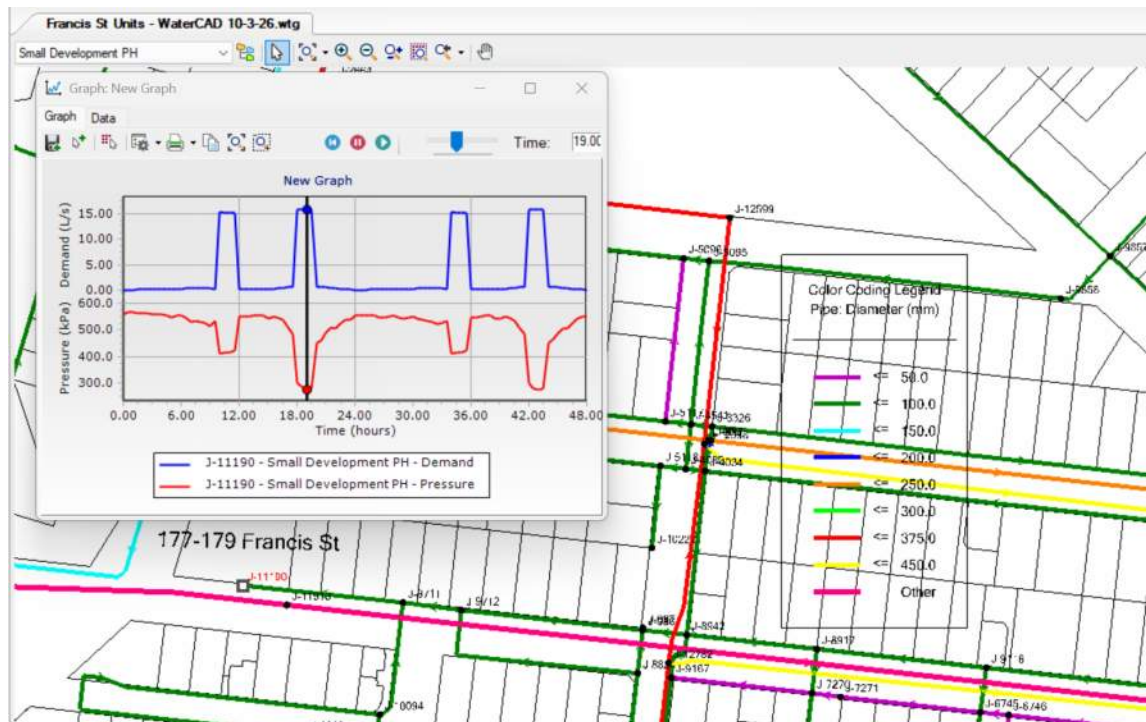


Figure 3.3 – 15 l/s Fire Flow Water Demand & Pressures

It is noted that the fire flow WaterGEMS network modelling is to assess the proposed developments performance against Townsville Council planning standards. Based on the type/classification of the residential unit development, the Building Code may require different fire flow and pressure standards. This assessment has not specifically assessed the performance against the building code requirements.

4 SEWAGE SYSTEM PLANNING

The existing site for the proposed residential unit development is currently serviced with a reticulated gravity sewer system. The existing gravity sewer system consists of:

- A DN225 PVC relined sewer from MH 25/A6A which extends under Percy St and into the development site to existing MH 24/A6A. MH 24/A6A is located within the development site on 177-179 Francis St. The DN225 sewer continues to the south east under Francis St to MH 18/A6A.
- The sewer increases to a DN300 sewer at MH 18/A6A and continues to the south west and through to PS A6A that is located on the southern side of Ingham Rd and western side of Kings Rd. PS A6A pumps sewage along a common pressure main through to the Cleveland Bay STP.
- A DN150 sewer runs through the development site from MH 1/A6A8 to MH 26/A6A.
- There is also a DN225 environmental overflows from this sewer system. The environmental overflow is from existing MH 25/A6A that is located on the western side of Percy St and is into an open stormwater drainage system.

The DN225 sewer that services the development site used to have capacity issues, however in 2016 a new PS A8C (Harold St) was constructed. Much of the sewage flows along the DN225 sewer were diverted to the new pump station at MH B32/A6A on Harold St. If there are any ongoing capacity constraints in this sewer system, they would be related to excessive infiltration and inflow issues into the aging sewer infrastructure.

Figure 4.1 below is a plot from the Council GIS that illustrates the existing DN225 reticulation sewer system that services the development site. The capacity of the existing sewer system is provided in the following report sections.

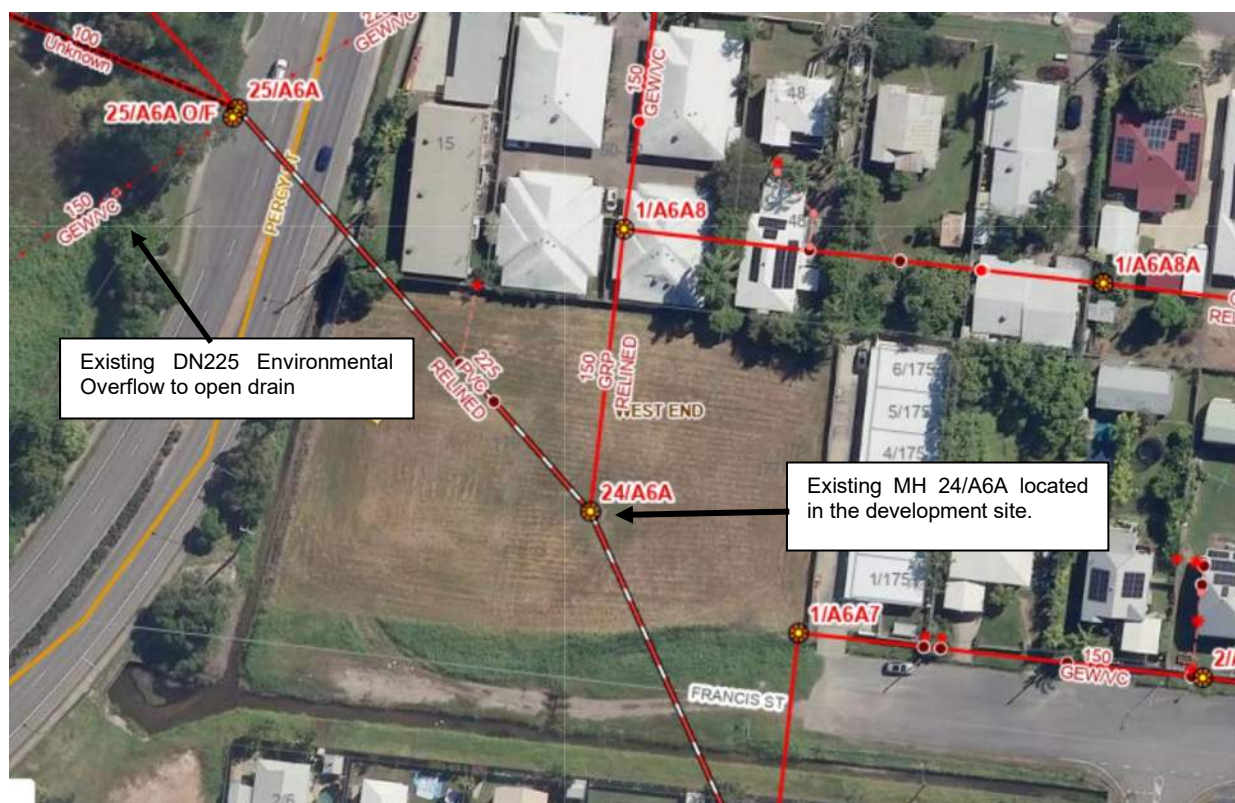


Figure 4.1 – GIS Plot of Existing Sewer System

It is noted that the layout for the 14 unit development has the buildings aligned so that the existing gravity sewers that traverse the site are not located under any of the proposed building.

4.1 Sewage Infrastructure Capacity

The capacity of the existing gravity sewer system to cater for the proposed residential unit development was assessed using the SewerGEMS model developed for the Eastern & Western suburbs of Townsville.

The SewerGEMS model includes the existing reticulation and trunk gravity sewer system from the development site through to PS A6 (Kings Rd). The additional residential equivalent population loading on MH 24/A6A is illustrated in the extract from the SewerGEMS model on Figure 4.2 below.

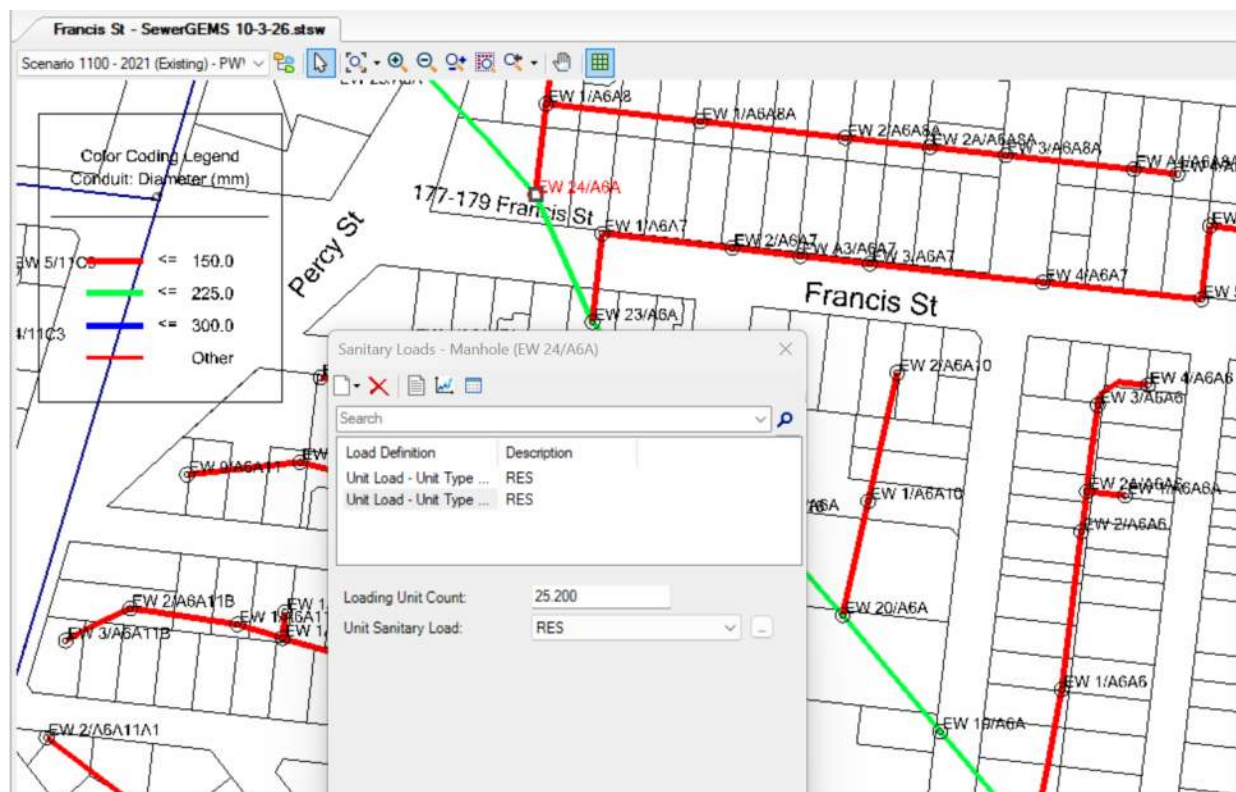


Figure 4.2 – Additional Residential Loading on MH 24/A6A

With the inclusion of the additional equivalent population loading on the existing gravity sewer system, the SewerGEMS model has illustrated:

- The existing DN225 sewer from MH 25/A6A to MH 18/A6A (being the sewer line crossing of Percy St and gravity sewer that runs through the proposed unit development site) flow up to 59% full for the peak wet weather flows. This is the reticulation sewer that will service the development site.
- The existing DN300 trunk sewer from MH 18/A6A to PS A6 (being the trunk sewer that runs to the south west through West End) flows up to 51% full for the peak wet weather flows.
- All the existing sewers flow less than 75% full which is the maximum value allowable in the CTM code.

The following Figure 4.3 provides the flows and performance of the existing gravity sewer system with the inclusion of the additional loading from the proposed development. A larger version of the modelling results is provided in Appendix D.

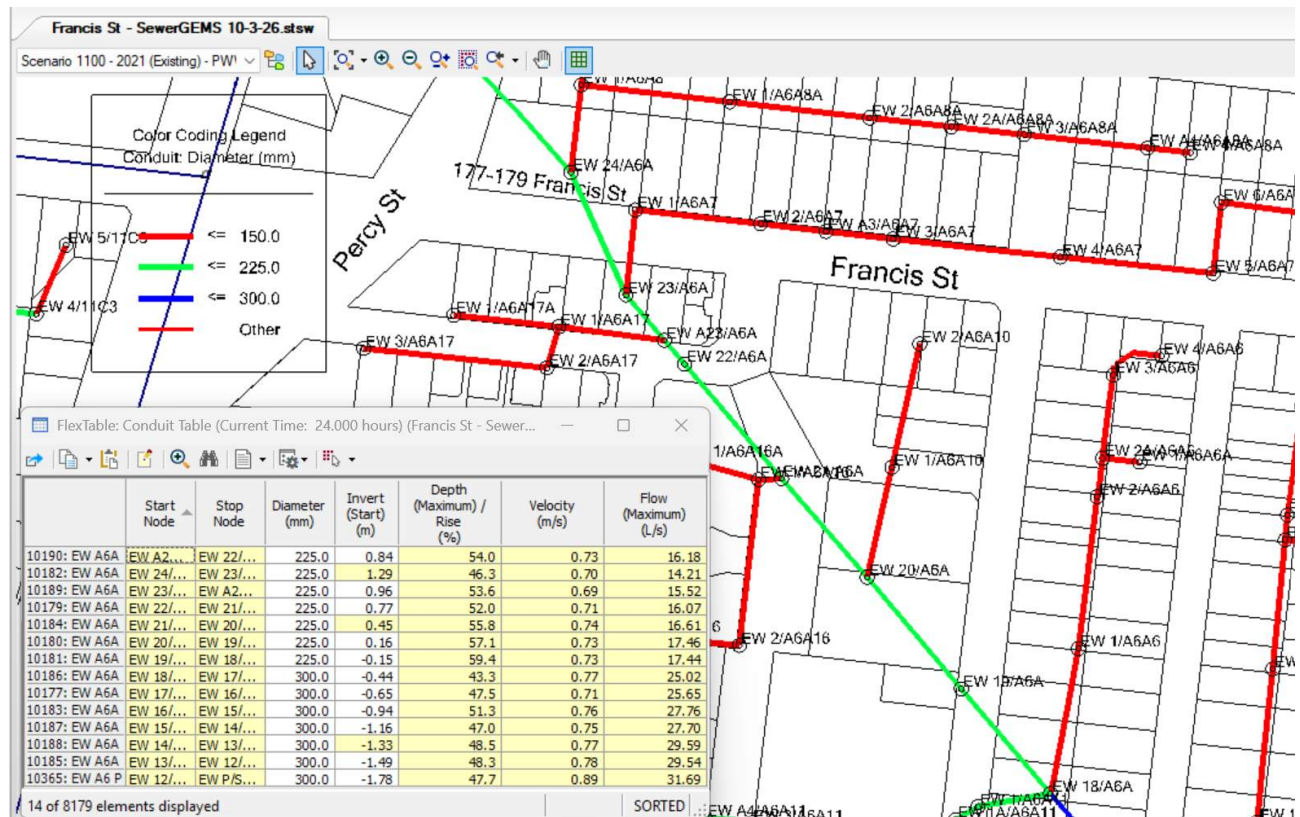


Figure 4.3 – SewerGEMS Modelling Results

The above assessment illustrates the existing gravity sewer system has sufficient capacity to cater for the proposed residential unit development at 177-179 Francis St, West End.

APPENDIX A
177-179 FRANCIS STREET SITE DEVELOPMENT
PLANS

NOTES: * THIS DRAWING IS ONLY INTENDED TO OBTAIN A LOCAL AUTHORITY BUILDING PERMIT. * COMPLY WITH ALL RELEVANT AUTHORITY REG. & BSA. * USE FIGURED DIMENSIONS ONLY. DO NOT USE SCALED MEASUREMENTS. * VERIFY ALL ON SITE DIMENSIONS & LEVELS PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION.		
Revision Schedule		
No	Description	Date
1		



1 francis street - view 1



3 francis street - view 3

Sheet List		
Count	Sheet Number	Sheet Name
1	sk_01	title page
1	sk_02	site plan
1	sk_03	site area breakdown
1	sk_04	services & detail survey plan
1	sk_05	Building - A
1	sk_06	Building - B

Grand total: 6



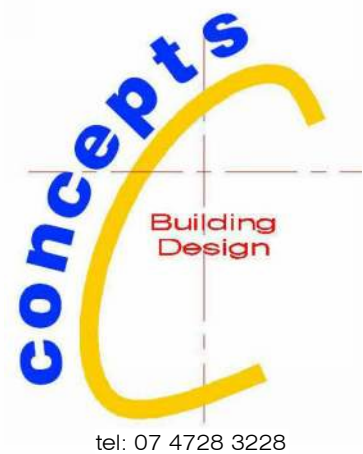
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5 francis street - view aerial



4 percy street - view -1



project:
Proposed Multiple Dwellings

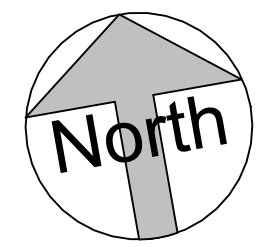
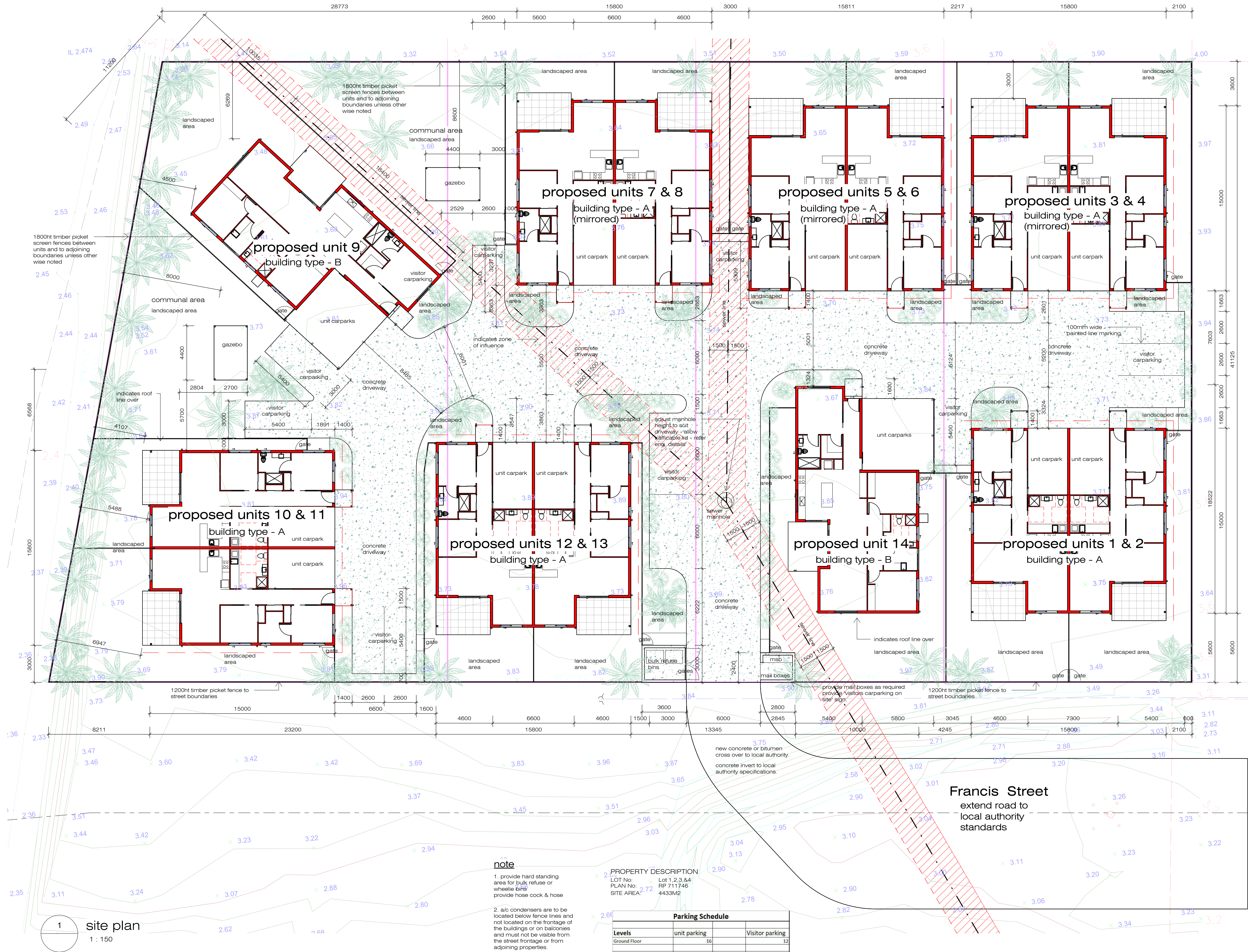
for:
RJ Builders

at:
177-179 Francis Street
Westend

Issue Date	dec 2026	25-051
Drawn	Author	
scale		
sheet	sk_01	printed 9/01/2026 9:35:57 AM

sheet size = A1

NOTES:		
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Revision Schedule		
No	Description	Date



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Design
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project:
Proposed Multiple Dwellings

for:
RJ Builders

at:
177-179 Francis Street
Westend

Issue Date	dec 2025	25-051
Drawn	Author	
scale	As indicated	
sheet	sk 02	printed 9/01/2026 9:35:58 AM

sheet size = A1

note

1. provide hard standing area for bulk refuse or wheeler bins provide hose cock & hose
2. a/c condensers are to be located below fence lines and not located on the frontage of the buildings or on balconies and must not be visible from the street frontage or from adjoining properties.
3. refer engineers details for all civil & storm water details
4. landscaping - refer landscape consultant plans for details

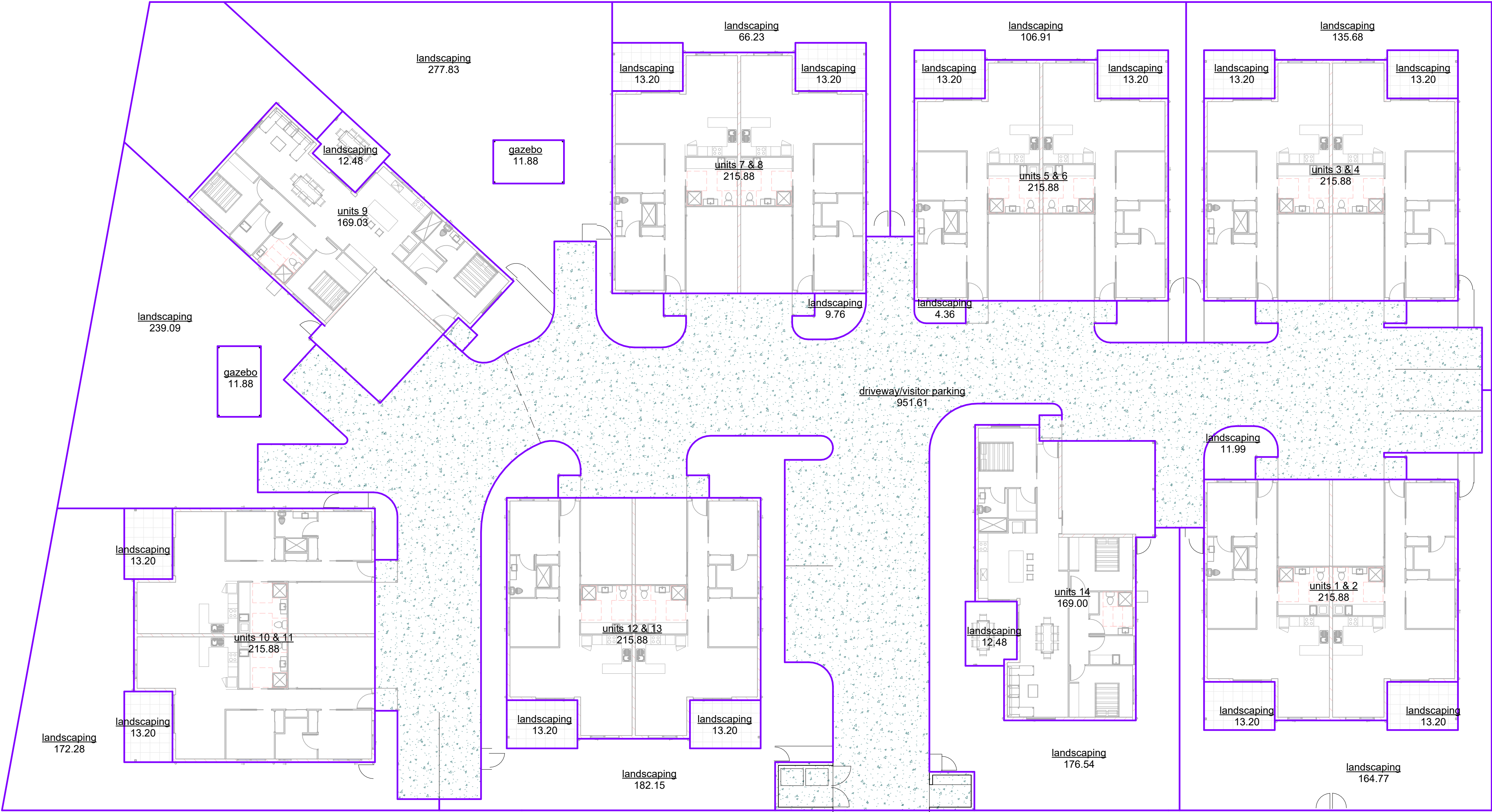
PROPERTY DESCRIPTION

LOT No: Lot 1, 2, 3, 4
PLAN No: RP 711746
SITE AREA: 4433M2

Parking Schedule		
Levels	unit parking	Visitor parking
Ground Floor	16	12
Sub-total	16	12
Total parks provided	28	

Gross Area Schedule				
number	Count	Name	Area	percentage
building				
1	1	units 1 & 2	215.88 m²	5%
2	1	units 3 & 4	215.88 m²	5%
3	1	units 5 & 6	215.88 m²	5%
4	1	units 7 & 8	215.88 m²	5%
5	1	units 9	169.03 m²	4%
6	1	units 10 & 11	215.88 m²	5%
46	1	units 12 & 13	215.88 m²	5%
47	1	units 14	169.00 m²	4%
building: 8	8		1633.31 m²	38%
driveway/parking				
7	1	driveway/visitor parking	951.61 m²	22%
driveway/parking: 1	1		951.61 m²	22%
landscape				
48	1	gazebo	11.88 m²	0%
49	1	gazebo	11.88 m²	0%
13	1	landscaping	13.20 m²	0%
16	1	landscaping	11.99 m²	0%
17	1	landscaping	176.54 m²	4%
24	1	landscaping	164.77 m²	4%
25	1	landscaping	135.68 m²	3%

Gross Area Schedule				
number	Count	Name	Area	percentage
26	1	landscaping	106.91 m²	2%
27	1	landscaping	66.23 m²	2%
28	1	landscaping	277.83 m²	6%
29	1	landscaping	182.15 m²	4%
30	1	landscaping	172.28 m²	4%
31	1	landscaping	9.76 m²	0%
32	1	landscaping	4.36 m²	0%
33	1	landscaping	13.20 m²	0%
34	1	landscaping	12.48 m²	0%
35	1	landscaping	13.20 m²	0%
36	1	landscaping	13.20 m²	0%
37	1	landscaping	13.20 m²	0%
38	1	landscaping	13.20 m²	0%
39	1	landscaping	12.48 m²	0%
40	1	landscaping	13.20 m²	0%
41	1	landscaping	13.20 m²	0%
42	1	landscaping	13.20 m²	0%
43	1	landscaping	13.20 m²	0%
44	1	landscaping	13.20 m²	0%
45	1	landscaping	13.20 m²	0%
50	1	landscaping	239.09 m²	6%
landscape: 28	28		1754.73 m²	40%
Grand total: 37	37		4339.65 m²	100%



1 site area break down
1 : 150

NOTES:		
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Revision Schedule		
No	Description	Date
1		



Preliminary
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tel: 07 4728 3228

project:
Proposed Multiple Dwellings

for:
RJ Builders

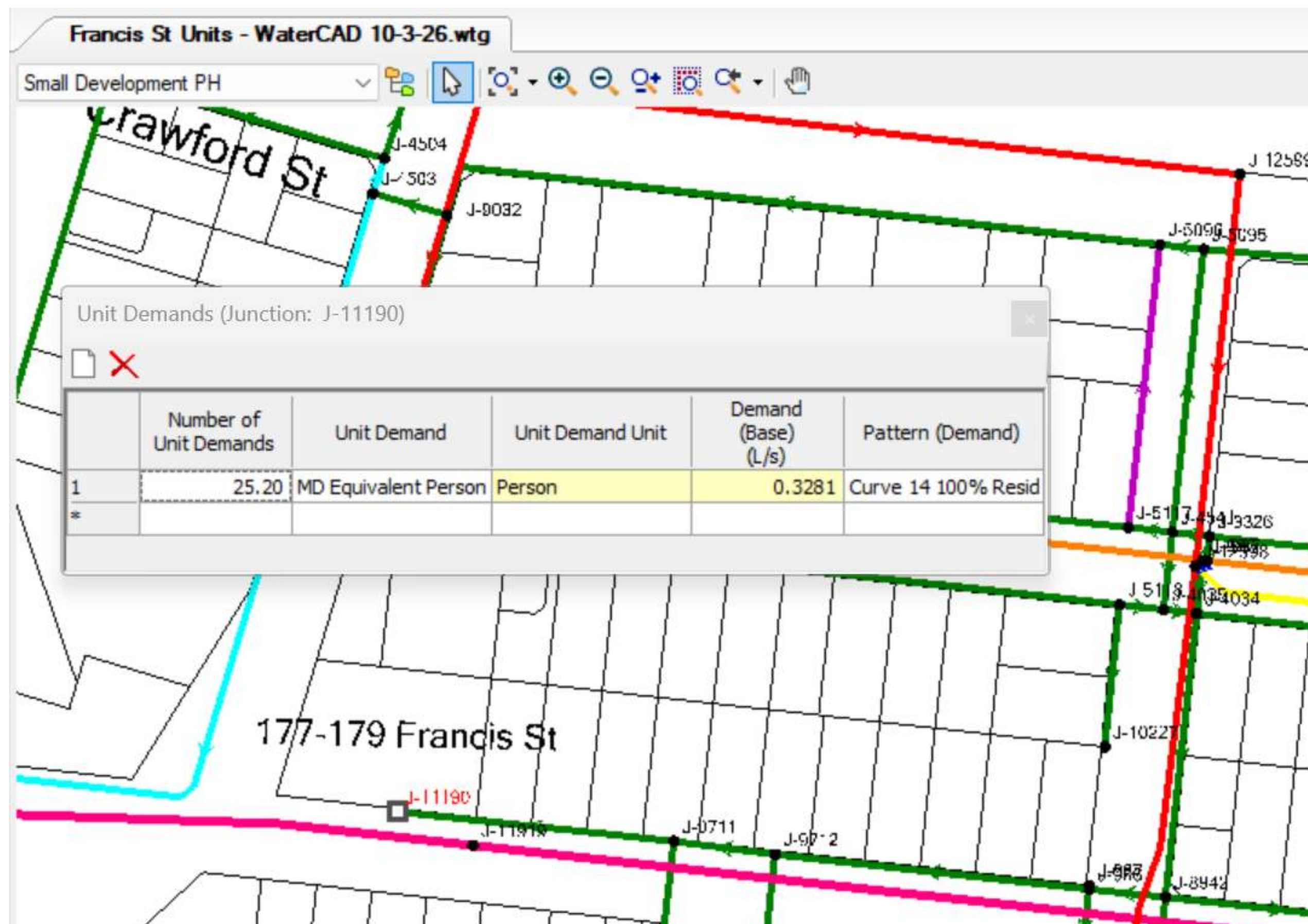
at:
177-179 Francis Street
Westend

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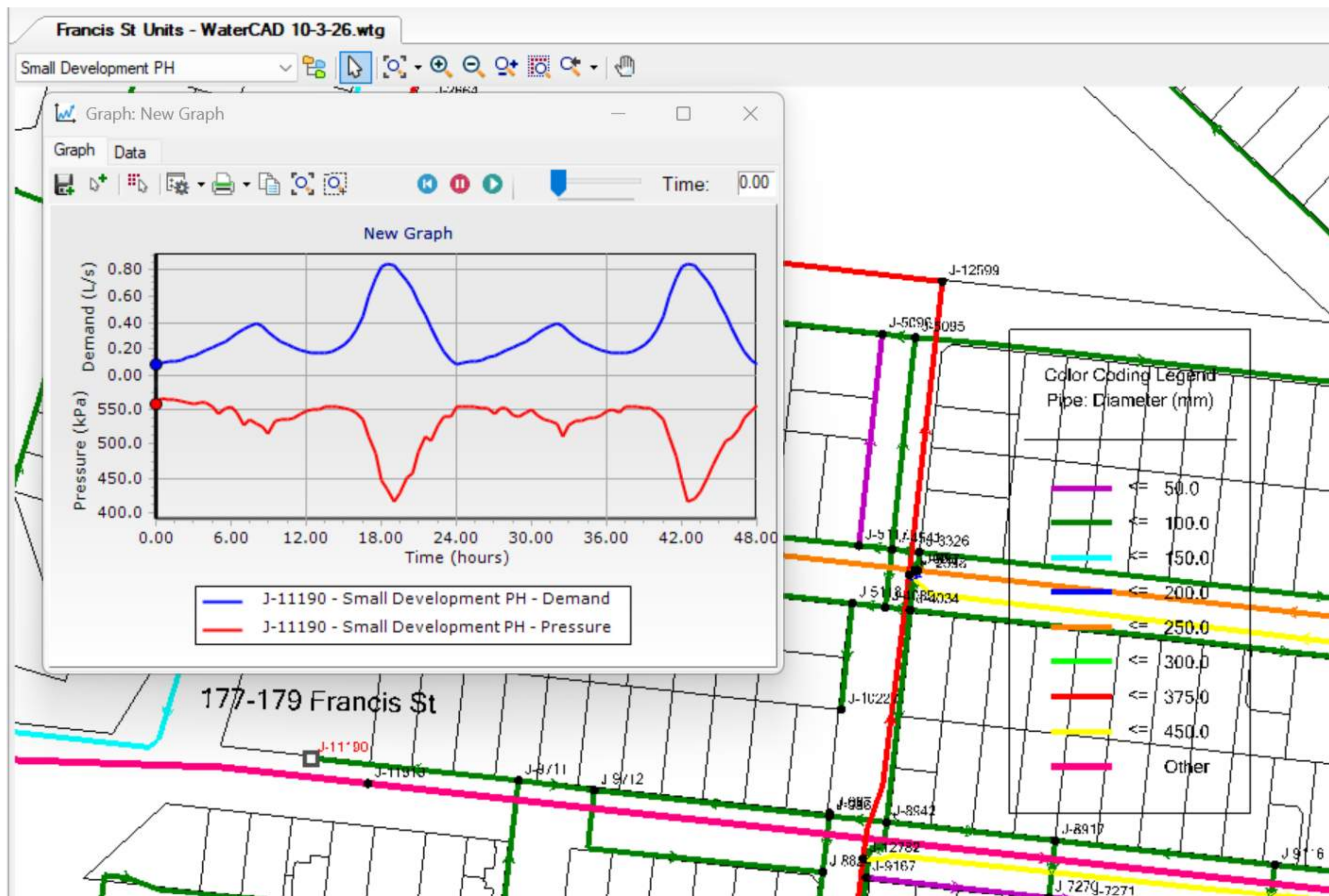
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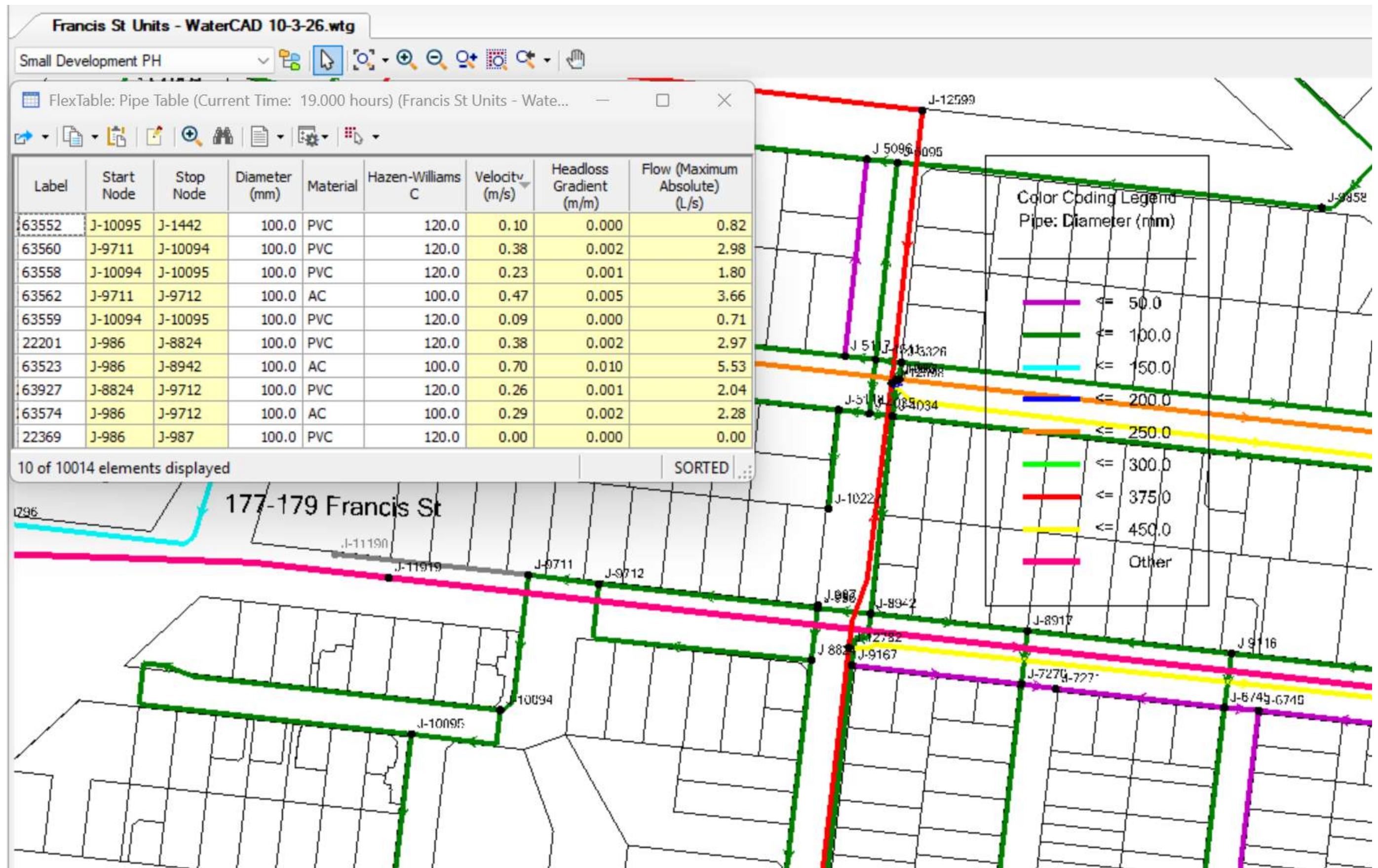
APPENDIX B

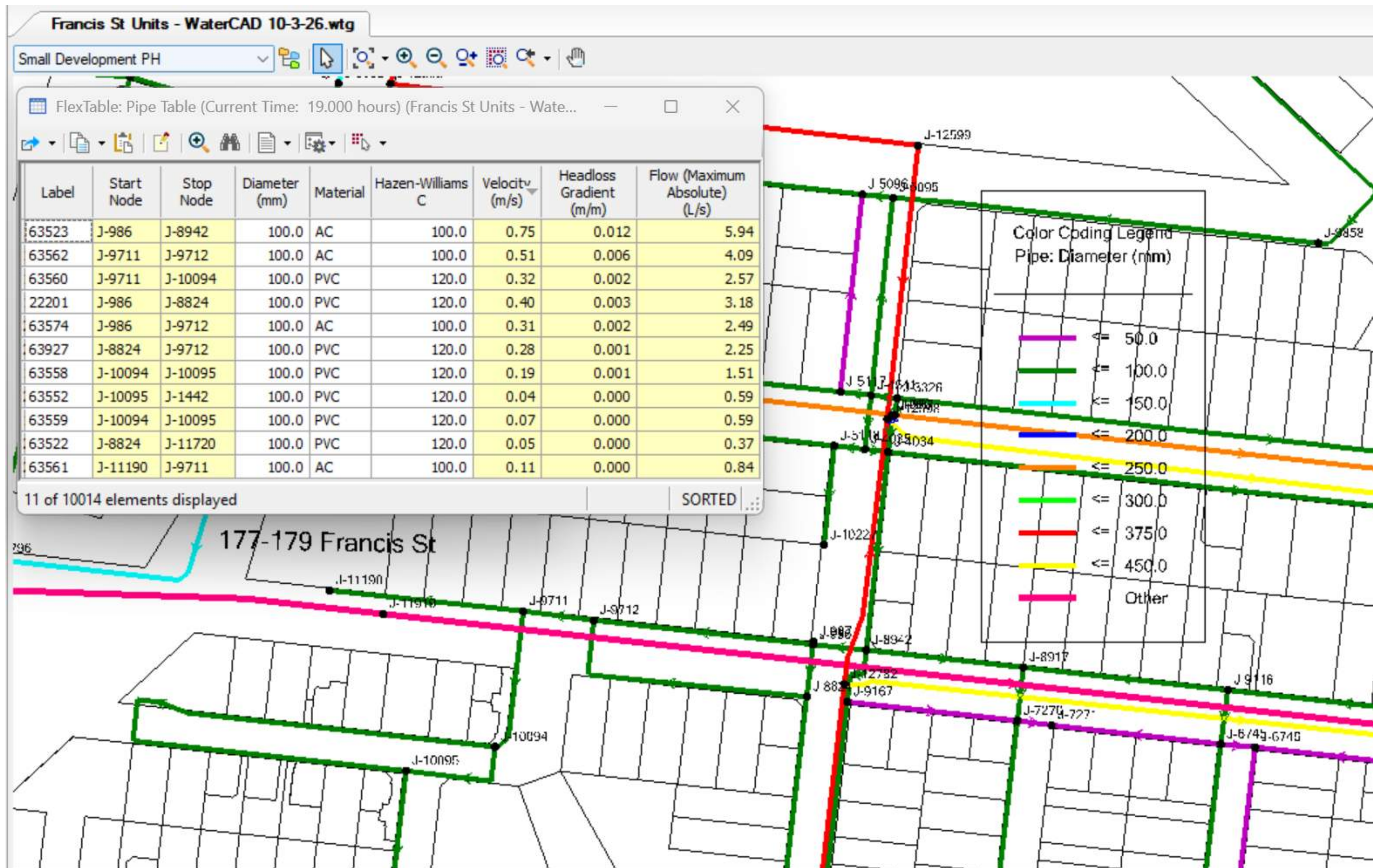
WATERGEMS MODELLING RESULTS



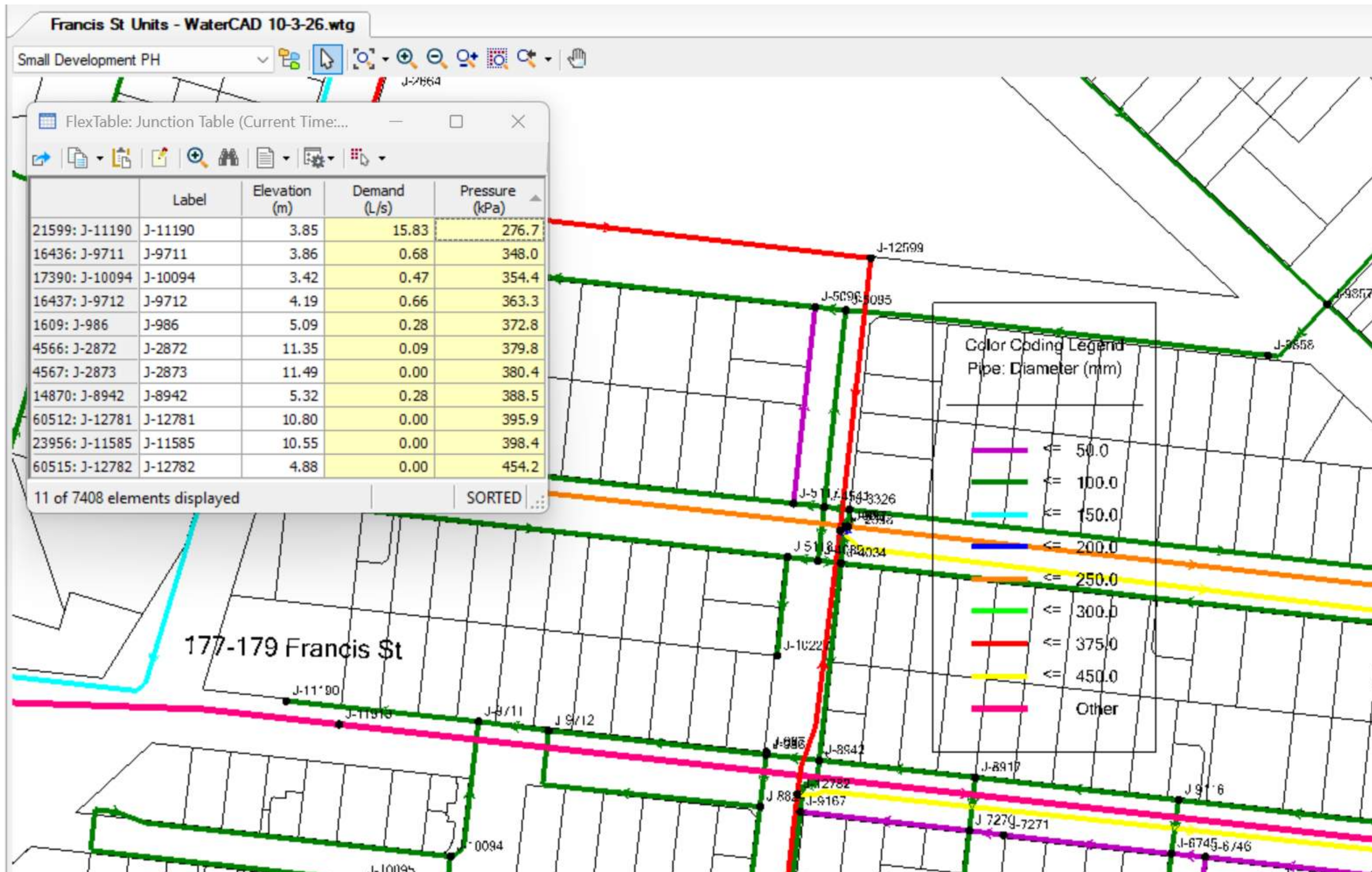
WATERGEMS Model With 28 Residential Units - Water Demand Added



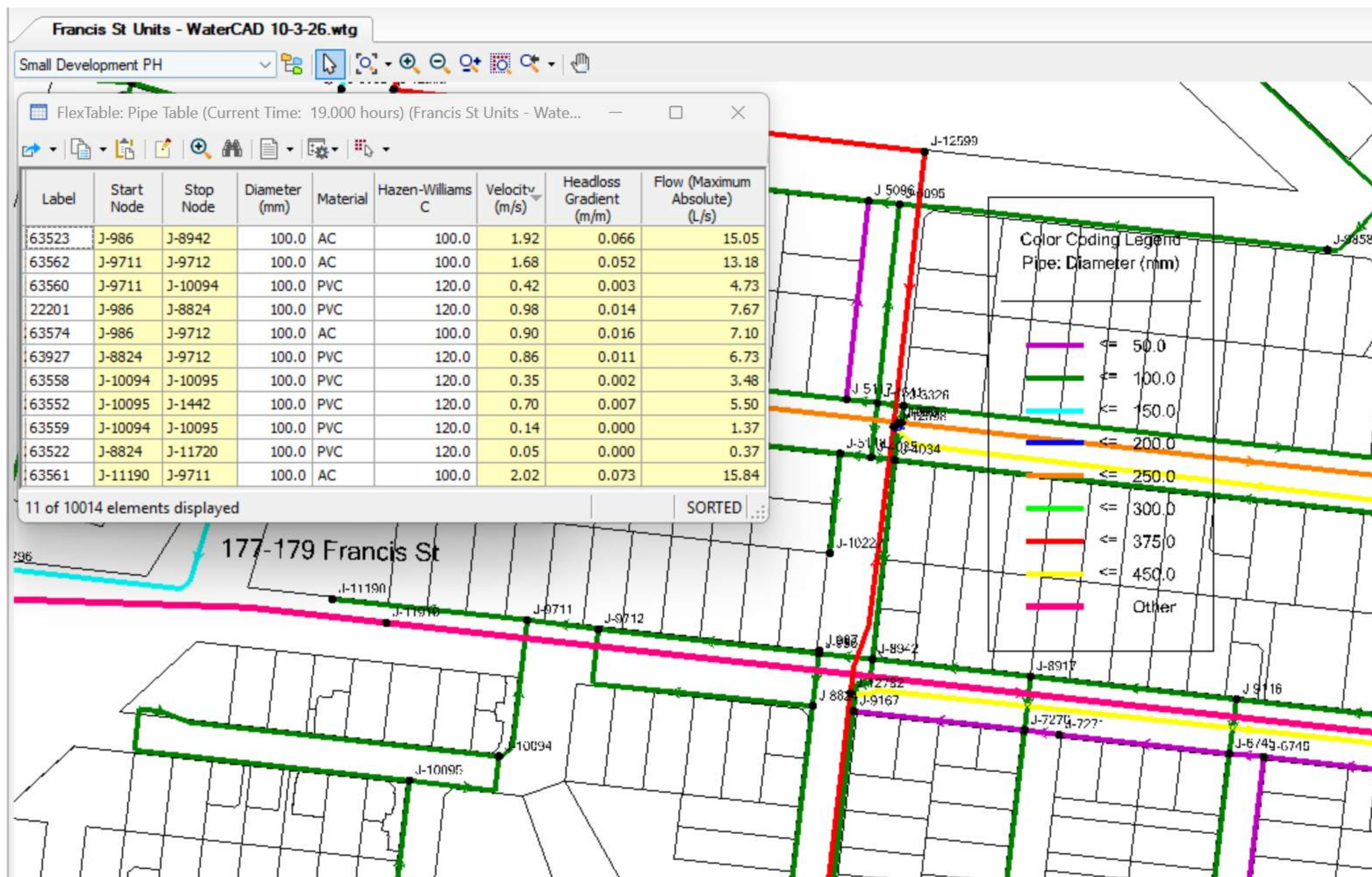




Peak Hour Pipes Modelling Results – 7 pm

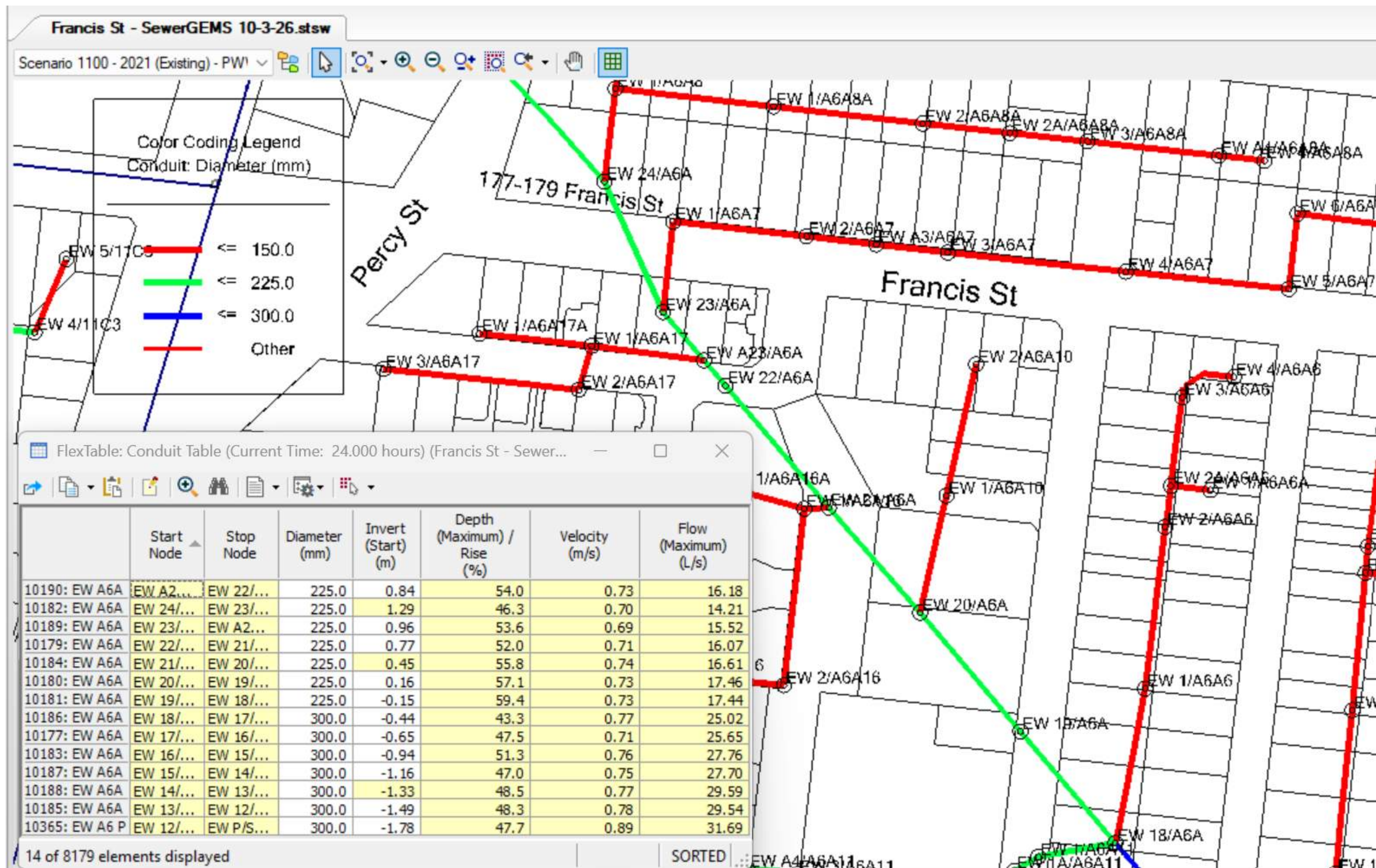


Peak Hour Node + 15 l/s Fire Flow Results – 7 pm



APPENDIX C

SEWERGEMS MODELLING RESULTS & FIGURES



PWWF Sewer Capacity Assessment Results

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