WATERSHED

TECHNICAL MEMO

Neil Construction Kauri Road Project

Water Supply – Hydraulic Modelling and Design Support

Prepared for Neil Construction Limited
Prepared by: Watershed Engineering Limited

05 October 2022

1 INTRODUCTION

Cato Bolam Limited has approached Watershed Engineering Ltd, on behalf of Neil Construction Limited, to provide modelling services and design support for a mixed use (273-lot residential, 2.03ha Industrial) development located on the corner of Brigham Creek and Kauri Roads.

The scope of works includes the develop of a conceptual water distribution network layout and hydraulic model for the proposed development set out in the plan provided by Cato Bolam – see Figure 1. The model is to include a representation of the future demands associated with additional growth to the north of the proposed development - supplied through the network to be constructed along Road 1 (see Figure 1).

The development will connect to the existing 315mm main running along Brigham Creek Road.

Modelling has been undertaken to Watercare Services' (Watercare) current modelling specification. Boundary conditions set at the Brigham Creek Road have been provided by Watercare.

The assessment and resulting layout is based on the full development being supplied from the Brigham Creek Road Watermain. There is currently no reliance on the 150mm AC main running along Kauri Road. However, it is noted that this 150mm main will require relocation as part of the development.

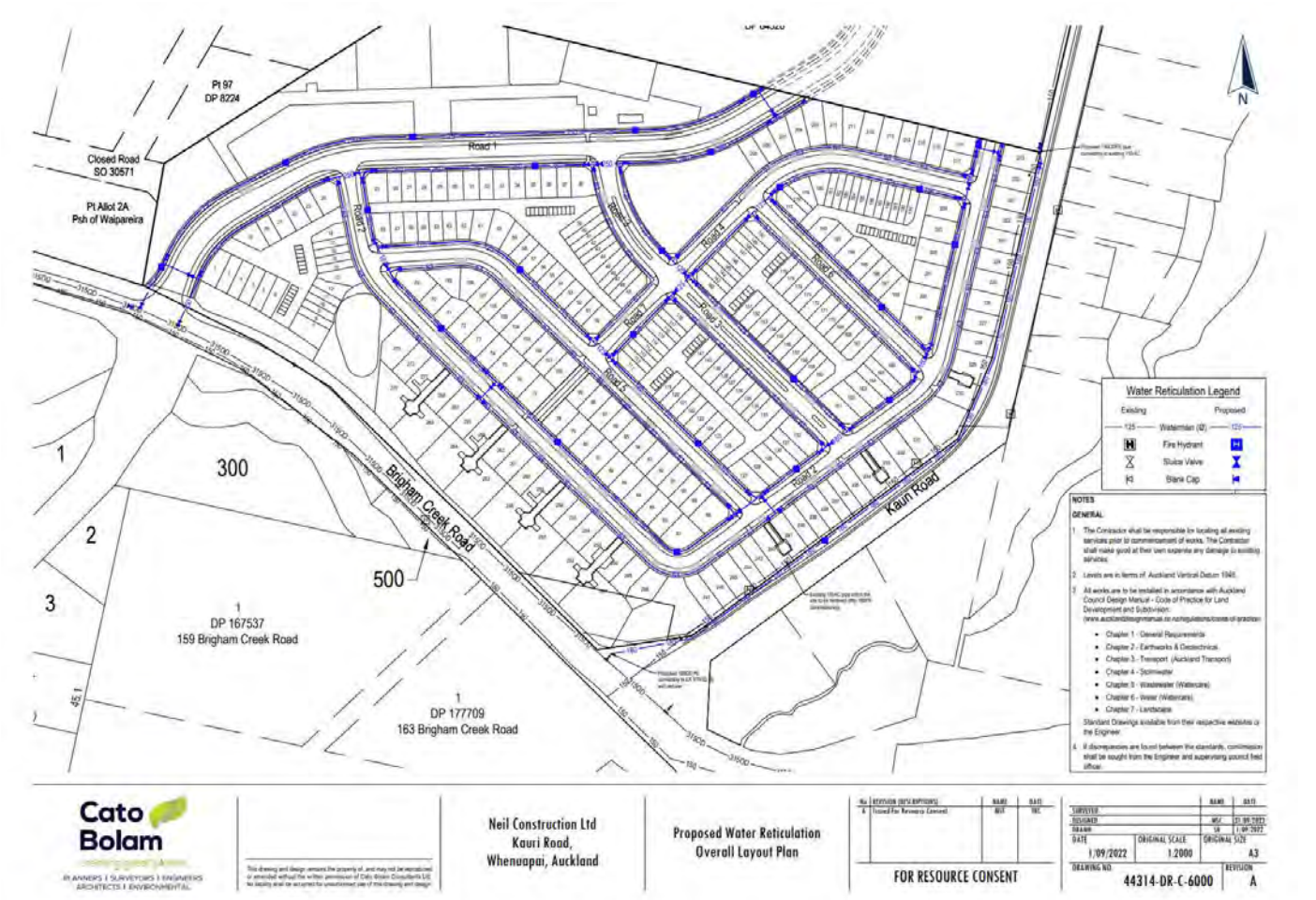


Figure 1 Water Supply Layout for Proposed Development

2 SCOPE

This section sets out the scope of works for the modelling assessment.

2.1 NETWORK LAYOUT

- Provide Cato Bolam Network layout for review – Layout will be based on Chapter 6 of The Auckland Code of Practice for Land Development and Subdivision (Water and Wastewater Code of Practice for Land Development and Subdivision)

2.2 GROWTH DEMAND FOR DEVELOPMENTS NORTH OF ROAD 1

- Develop demands based on Watercare CoP for Water Supply for best understanding of future development for properties 2, 12, 20 – 26, 34 Kauri Road. Anticipated Land Use to be agreed with Cato Bolam and Watercare.

2.3 MODEL DEVELOPMENT

- Import network data into model.
- Update with supporting data (elevations, pipe roughness, valve losses etc.).
- Develop demands.
- Confirm boundary conditions for normal operation assessment, and for fire flow assessment.
- Run system performance assessment (normal operation and fire flow).
- Produce plans of system performance assessment, and discuss with Cato Bolam.
- Make any revisions to model design; finalise and produce short supporting memo.

3 HYDRANT LOGGING SUPPORT

Hydrant flow testing was undertaken by Nova Flowtech at 7:30am on 10th November 2021. The test locations are set out in Figure 2. A number of hydrants were visited, with the intention of testing; however, the majority were either unable to be located or had unsuitable/unsafe discharge areas. The hydrant located at 153 Brigham Creek Road was selected and flowed in stages until maximum flow (hydrant valve fully open) was achieved. Pressure was logged during the test at 159 Brigham Creek Road. The results of the flow test are set out in Table 1; the full data sheet from the test is attached as Appendix A.

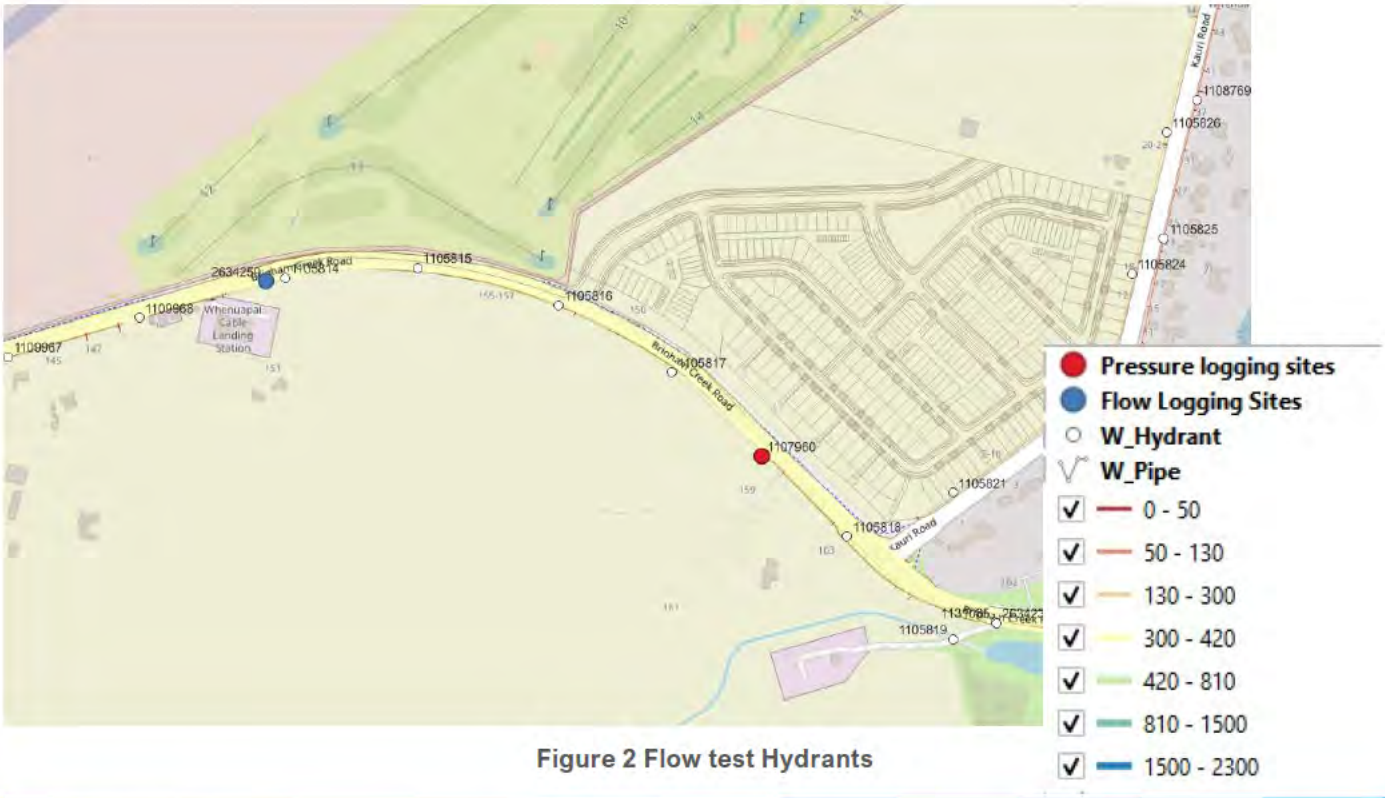


Figure 2 Flow test Hydrants

Table 1 Nova Flowtech Hydrant flow test results

Flow (L/s) HYD ID: 2634259	Pressure (m) HYD ID: 1107960
0	53.0
10	48.9
15	46.9
20	45.9
25	43.8
36.5	41.8

A provisional review of the flow test indicates that there is sufficient pressure and capacity in the network to provide for the development. The demand assessment of the development results in peak flows of 11.1 L/s, which relates to a peak pressure drop of approximately 4m in the public network.

It is noted that there is further development projected for the properties north of the Kauri Road development site. It is assumed that the demand associated with this further development would be drawn through the Kauri Road development site, and from the connection point at Brigham Creak Road. The demand associated with these further developments has been calculated at 4.1L/s, bringing the total predicted pressure drop in the public network to approximately 6m.

4 MODEL DEVELOPMENT

A fully dynamic model has been developed of the proposed infrastructure within the site. The model has been developed in Infoworks WS Pro version 2023.0.2 (WS Pro).

4.1 DATA IMPORT AND REFINEMENT

A basic network layout has been developed in GIS and imported into the modelling software. Layout for the network is based on standard requirements set out in Watercare CoP for Water Supply.

4.1.1 Pipe Diameters

Pipe diameters are to be reviewed, and sizes confirmed, as part of this project; however, all pipes will be represented as PE with nominal diameters modelled.

4.1.2 Pipe Roughness

All proposed pipework is PE and has been allocated a roughness value of 0.06mm, as consistent with the Watercare Water Network Modelling Standard.

4.1.3 Elevations

A ground model has been created in WS Pro, using the Auckland Council 2016 LiDAR. Elevations for the model have been extracted from the ground model at all nodal points.

4.2 MODEL BOUNDARY CONDITIONS

Boundary conditions have been applied at the connection points to the public network. The proposed connection point is located at approximately 157 Brigham Creek Road. Connection is into existing 315mm PE pipe, located on the south side of the road.

Table 2 lists the boundary conditions provided by Watercare Services Ltd.

Table 2 Model Boundary Conditions Connecting to the 315mm PE Main at 151 Brigham Creek Road (Whenuapai Zone)

Operational Condition	Hydraulic Grade (mAD)
Normal Operation	60
Fire flow 25 L/s	56
Fire flow 50 L/s	49

4.3 DEMAND

Demand has been represented in the model, using the standards set out in the sections below. Figure 3 sets out the land use assumptions adopted in the model development.

4.3.1 Residential Demand

The development proposes 273 Residential lots, each containing a single dwelling.

Residential Demand has been calculated based on Chapter 6 of The Auckland Code of Practice for Land Development and Subdivision (Water and Wastewater Code of Practice for Land Development and Subdivision) as follows:

- Average Demand per lot (220 L/p/d * 3 p/lot)
- Peak Day Factor 2
- Peak Hour of 2.5 (applied in the model profile)

This results in a residential peak day average flow rate of 4.1 L/s and peak day peak hour flow rate of 10.25 L/s.

4.3.2 Commercial/Industrial Demand

For design purposes, it has been assumed that the non-residential areas will be developed as light industrial/commercial. Each non-residential area has been assumed to have 60% of the total land area developed as Industrial, with the following assumptions:

- That industrial land use, (assuming 20% warehouse as light water users, 80% medium water users).
  - Warehouse (Light Water Use) (4.5L/m^2/day) Represented in the model using a 16hr Profile
  - Warehouse (Medium Water Use) (6L/m^2/day) Represented in the model using a 16hr Profile

These demand calculations result in an average Commercial/Industrial flow of 0.6 L/s and a peak flow of 0.79 L/s

4.3.3 Commercial/Industrial Demand Outside Kauri Road Development Area

Future development areas have been identified to the North of the Kauri Road Development Area. It is likely that some supply for these areas will be provided via the infrastructure constructed for the Kauri Road Development. The full demand for this area has been included in the model, and is accounted for in the pipe sizing. It is understood that this area is to be developed as Industrial Land use, so the following assumptions have been adopted in the development of demand for this area:

- That industrial land use, (assuming 20% warehouse as light water users, 80% medium water users).
  - Warehouse (Light Water Use) (4.5L/m^2/day) Represented in the model using a 16hr Profile
  - Warehouse (Medium Water Use) (6L/m^2/day) Represented in the model using a 16hr Profile

The area is 12.3ha, and so has resulted in an estimated average demand of 3.2 L/s and a peak demand of 4.1L/s.

4.3.4 Demand Summary

Table 3 sets out the peak day demand, as calculated from the Watercare CoP.

Table 3 Demand Summary

Connection Point/Zone	Average			Instantaneous Peak		
	Residential (L/s)	Industrial (L/s)	Total (lLs)	Residential (L/s)	Industrial Ll/s)	Total (L/s)
Kauri Road Development	4.2	0.6	4.80	10.43	0.79	11.21
Future Industrial Area (North)	0	3.3	3.28	0	4.10	4.10
Totals (L/s)	4.17	3.91	8.08	10.43	4.89	15.32

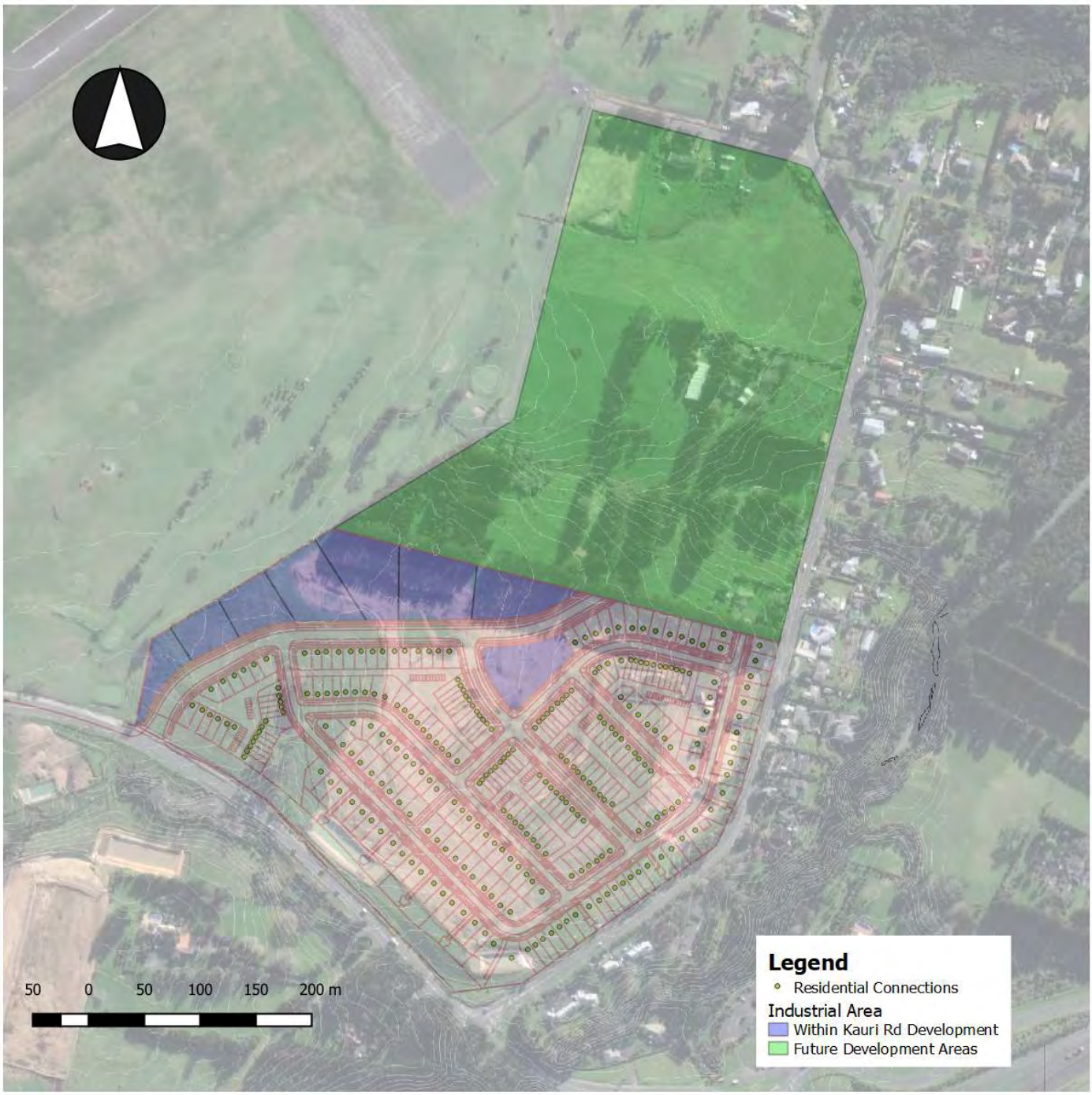


Figure 3 Land Use Adopted for the Development of Modelled Demand.

4.3.5 Consumption Profile

Figure 4 shows the consumption profiles adopted in the model.

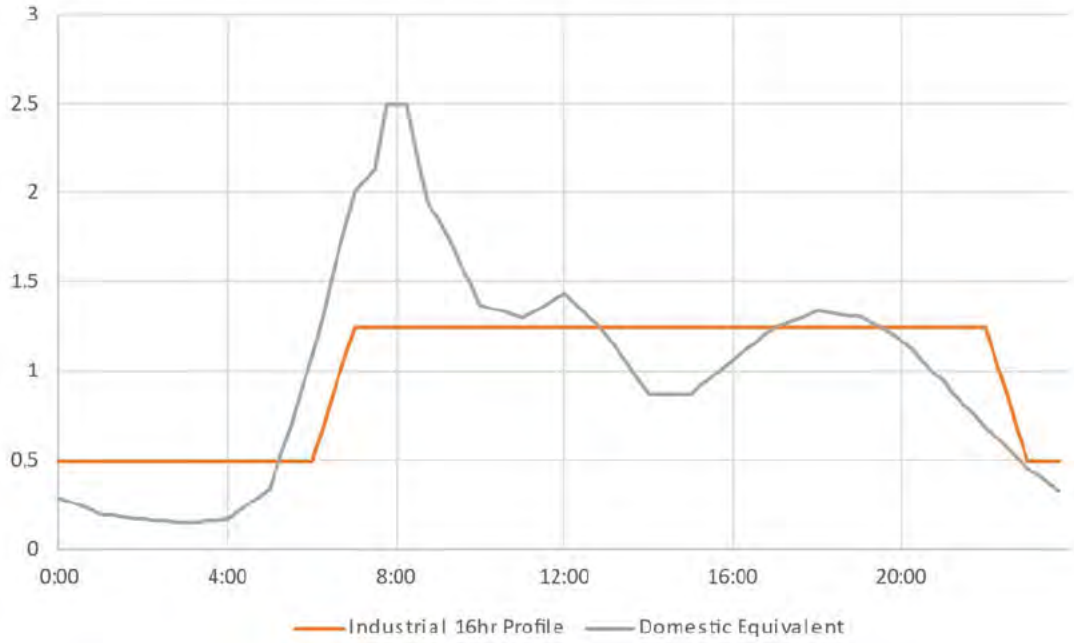


Figure 4 Consumption Profiles Adopted in the Model

5 NETWORK SIZING AND SYSTEM PERFORMANCE

The model has been used to confirm network sizing, based on the following criteria:

5.1 LEVELS OF SERVICE

5.1.1 Normal Operation with peak day demand

- Minimum pressure under normal operating conditions – 25m
- Maximum pressure under normal operating conditions – 90m
- Maximum pressure fluctuation (30m)
- Maximum pipe headloss – 10 m/km
- Maximum pipe velocity – 1m/s
- Maximum pipe headloss, – 5 m/km for DN ≤150; and 3 m/km for DN >150.

5.1.2 Firefighting conditions

It is appreciated that specific design for individual buildings will likely result in the application of sprinklers. In the absence of the specific land use preferences, the network has been assessed against the New Zealand Fire

Service specification SNZ PAS 4509:2008, as shown in Table 4. This is assessed in the model at 60% of peak day demand, and with a residual pressure of 10m.

Table 4 SNZ PAS 4509:2008

Water Supply Classification SNZ PAS 4509:2008	Water flow required within a radial distance of 135m (L/s)	Additional water flow required within a radial distance of 270m (L/s)	Maximum number of fire hydrants to provide flow
FW1	7.5	-	1
FW2	12.5	12.5	2
FW3	25	25	3
FW4	50	50	4
FW5	75	75	6
FW6	100	100	8
FW7	As calculated (See note 7 SNZ PAS 4509:2008)		

Watercare has advised that the existing public network is not able to provide firefighting flows greater than 50 L/s. For this reason, FW3 (50 L/s) has been used as the basis for design. However, the proposed network has been tested for higher flows to ensure the internal network is not the limiting factor in firefighting. This has been undertaken by assuming the public network can provide Normal Operation HGLs during firefighting conditions.

5.2 SIZING APPROACH

The development along Road 1 is zoned Industrial land; as a result, firefighting requirements will dominate the network sizing. Watercare has provided boundary conditions to supply 50 L/s FW3 firefighting flows.

5.2.1 Firefighting Capacity

The model has been used to size the network to provide 50 L/s. This process resulted in the following internal diameters:

- Pipes along Road 1 supplying commercial area and flows to northern development areas - ND 200 (mm) on both sides of the road.
- Road 2, ND 150mm main with 50mm rider
- Remaining residential roads, ND 100mm main with 50mm rider.

These diameters are shown in Figure 5.

5.2.2 Normal Operation

Network along Roads 2 to 7 provides water to residential properties. Figure 6 shows the network performance under peak demand conditions, confirming sufficient pipe sizing for the residential areas. As shown in Table 5, the network operates well, and within Watercare CoP levels of service. Minimum pressures of 35m are achieved, with maximum pressures reaching 42m. Maximum pipe headloss is under 2 m/km, which is well within the Watercare CoP standard of 5 m/km for pipes less than a DN 150mm.

Table 5 Peak Day Network Performance Characteristics.

Level of Service Parameter	Residential Area, Roads 2 - 7	
	Value	Location
Minimum pressure	35.45 (m)	Corner of Road 1 and Road 3. Low pressure results from high elevation point in network.
Maximum pressure	41.77 (m)	Corner of Road 3 and 2 High pressure results from low elevation point in network.
Pressure fluctuation	0.31 (m)	Corner of Road 3 2
Max Pipe Headloss	1.9 (m/km)	Corner of Road 1 and Road 2 (in 50mm rider main)
Max Velocity	0.52 (m/s)	Road Crossing at connection to 315mm main in Brigham Creek Road

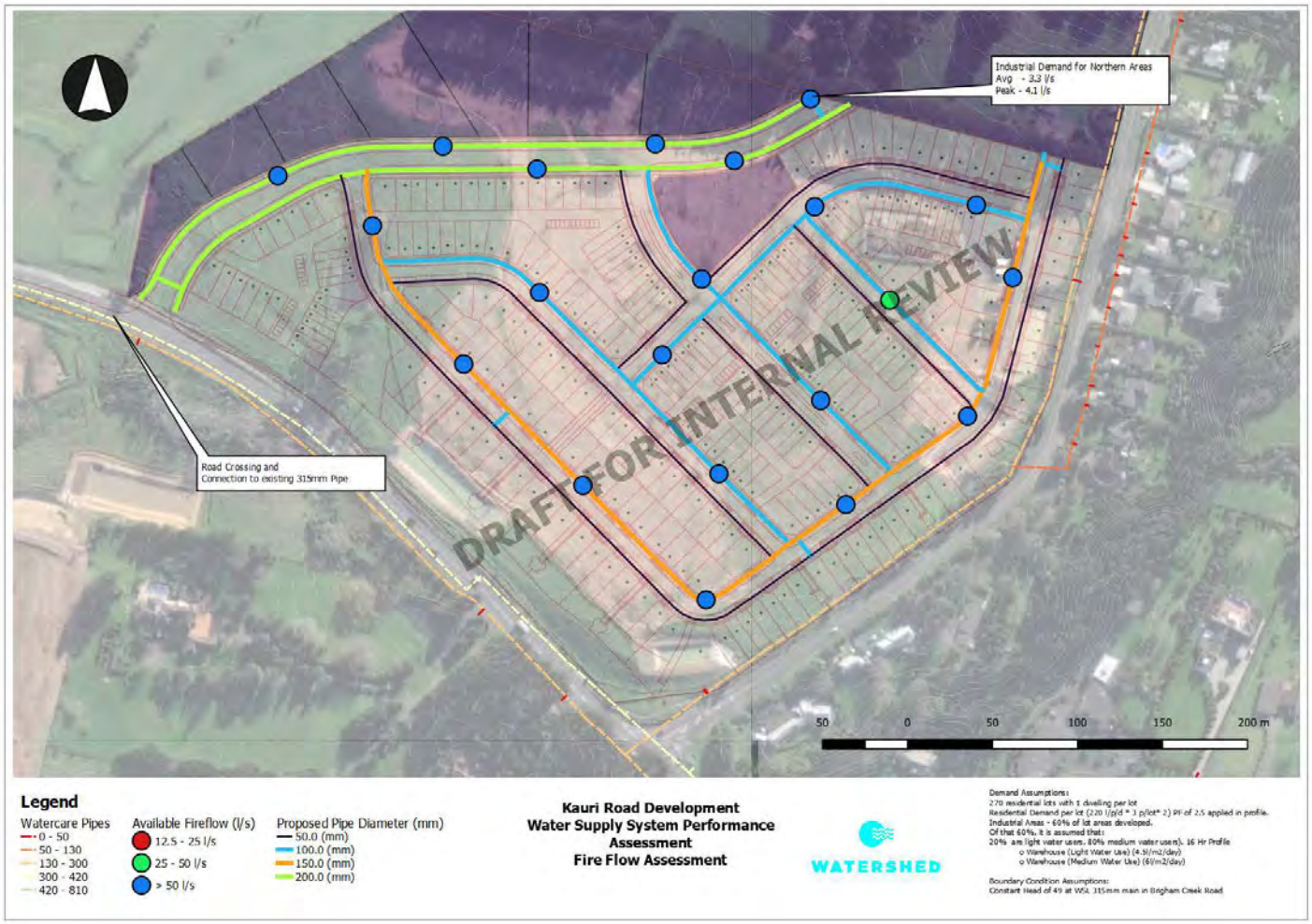


Figure 5 Network Pipe Sizes (Internal Diameters)

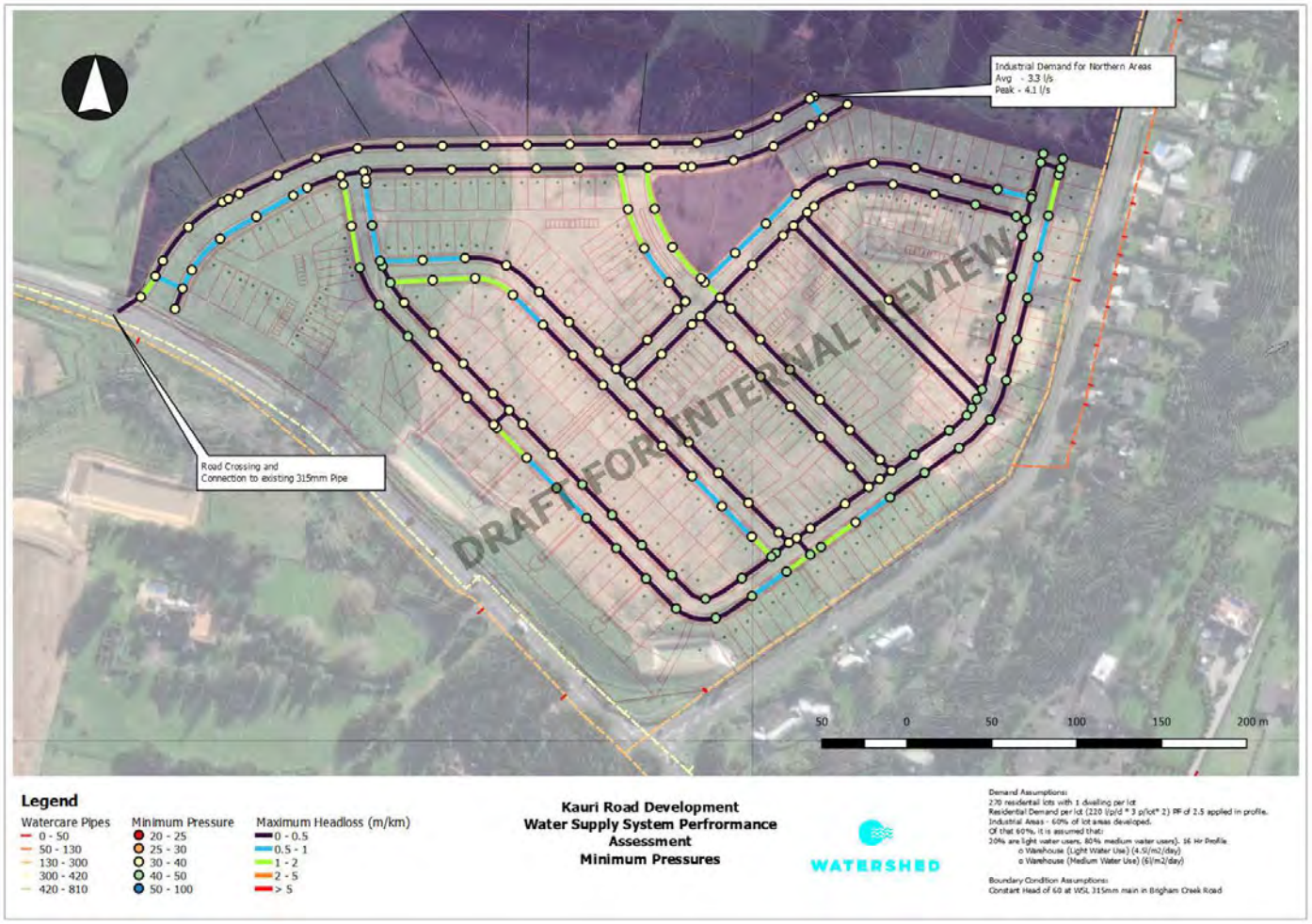


Figure 6 Peak Day: Minimum Pressures and Pipe Headloss

5.3 RECOMMENDATIONS

- Supply from Brigham Creek Road should be at least a DN 200mm pipe. Two connections may be required for security of supply.
- FW3 (50 L/s firefighting can be achieved throughout the proposed network with pipe Nominal Diameters of 200mm (along Road 1), 150mm (along Roads 2) and 100mm within the remaining residential area. Additional 50mm rider mains are proposed to provide supply on both sides of street.
- The site is to be connected to the 315 mm PE pipe located in Brigham Creek Road.
- Hydrant Spacing is recommended at 100m intervals. Actual hydrant spacing should be specified based on the locations of buildings. This information is not available; however, the recommended spacing will provide reasonable flexibility and redundancy.

Revision	Name	Signed	Date
A	Tristan Jamieson		27 September2022
B	Tristan Jamieson		05 October 2022

APPENDIX A – HYDRANT FLOW TEST

NOVA FLOWTEC SERVICES LTD
HYDRANT TESTING SPECIALISTS

E: info@novaflowtec.co.nz
T: 09 444 8375
PO Box 241, Albany Village, Auckland 0755
www.novaflowtec.co.nz

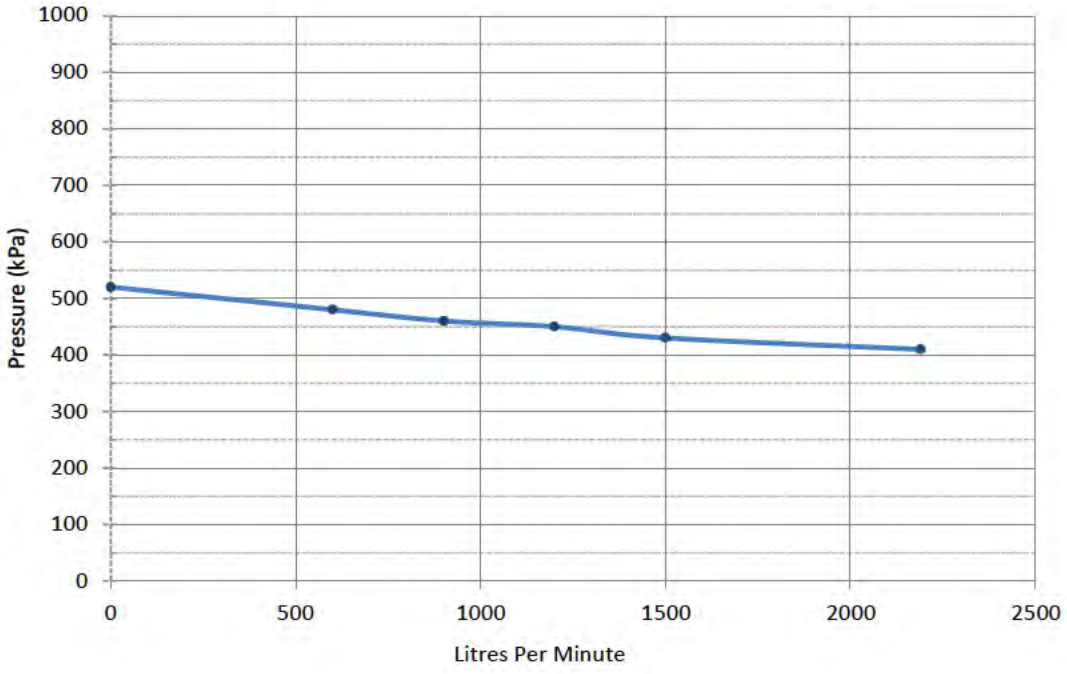
Mains Flow and Pressure Report

Hydrant locations: Brigham Creek Road
Date: 10th November 2021
Time: 7.20am
Flow: Hydrant 5
Residual pressure: Hydrant 6
Maximum flow result: 2190Lpm at 410kPa
Test Supervisor: Anthony Blewman

Data:

Flow (Lpm)	Pressure (kPa)
0	520
600	480
900	460
1200	450
1500	430
2190	410

Graph:



Notes: The hydrant was flowed to full capacity at the time of testing.

Disclaimer: These results indicate the water networks performance on this given date and time. The networks performance is subject to fluctuations.

Hydrant Map: See page 2

Hydrant Map