Appendix F

Infrastructure Report

Bell Road Limited Partnership

Wairakei South

Bell Road

Pāpāmoa

Infrastructure Report

PROJECT INFORMATION

CLIENT	Bell Road Limited Partnership
PROJECT	BOP 0749

DOCUMENT CONTROL

DATE OF ISSUE	8/05/26
REPORT TITLE	Infrastructure Report
REVISION	1
AUTHOR	Michael Brake and Dipa Pandey Engineer
REVIEWED BY	Rosa Charteris Principal
APPROVED BY	Carl Salmons Director

Maven Bay of Plenty Limited
116 Cameron Road
PO Box 13 185
Tauranga 3141
www.maven.co.nz

CONTENTS

1. EXECUTIVE SUMMARY

The Wairakei South Development (the Site) is a transformative, privately funded urban development project which will play a critical role in addressing the Western Bay of Plenty sub-region's growing housing and business land shortfalls. The site is approximately 350 hectares within the high-growth Eastern Corridor between Pāpāmoa, Te Tumu, and Te Puke, Wairakei South is positioned to become a vibrant, integrated and connected mixed-use community. The project will deliver approximately 2,750 new homes alongside 50 hectares of industrial, 4 hectares of commercial centres, and a 4 hectare primary school over the next 10–20 years.

The purpose of this report is to describe and assess the proposed infrastructure required to service the development, including earthworks, roading, stormwater, wastewater, water supply and utilities. This report will support the Fast-track Approvals Act ("FTA") substantive application.

This report is to be read in conjunction with the Engineering Drawings (Appendix D of the AEE), Flood Modelling Report (Appendix H of the AEE), Stormwater Management Plan (Appendix G of the AEE), Earthworks Management Plan (Appendix U of the AEE), and Construction Management Plan (Appendix AL of the AEE) prepared by Maven BOP Limited (Maven).

The key infrastructure conclusions and findings are summarised below.

Earthworks

The existing site presented significant flood engineering challenges requiring the site to be raised from existing ground levels of approximately 1.0–2.0mRL (NZVD 2016) to proposed finished levels of approximately 3.5–5.0mRL (NZVD 2016). This filling enables the provision of housing, employment land, and supporting infrastructure.

Ground improvement measures have been recommended by ENGEO Limited to address key geotechnical considerations, including consolidation and creep settlement, liquefaction, and embankment and channel edge stability. The earthworks design has incorporated these considerations and follows the recommendations outlined in ENGEO's geotechnical reporting.

Roading

The site will be accessed by road via a new connection to the Tauranga Eastern Link (TEL) via Pāpāmoa East Interchange (PEI) and the existing Bell Road. Internal roads are designed to comply with relevant Council standards and provide safe and efficient vehicle, pedestrian, and emergency access.

Refer to Boffa Miskell's Integrated Transport Assessment (ITA) for wider traffic network upgrade concepts resulting from regional traffic modelling (Appendix I of the AEE).

Stormwater

In raising the site, displacement of existing flood storage in the flood plain occurs. The proposed stormwater design seeks to manage this displacement with large stormwater conveyance swales and wetland areas supported by mechanical flood pumping, utilizing capacity within the adjoining Kopuaroa Canal and Kaituna Rivers. The design proposes conventional gravity stormwater pipe reticulation within the development areas, which drain into the swale systems which provide treatment.

Wastewater

Wastewater will be managed via a network of gravity pipes discharging to eleven (11) new pump stations. Wastewater from the proposed pump stations will be pumped to the Te Puke Wastewater Treatment Plant via a dedicated bulk rising main that follows the corridor of the Waiāri water supply trunk main.

Water Supply

Potable water supply will be obtained from the Waiāri Water Supply Scheme via connection to the existing trunk main located on the southern side of Kopuaroa Canal. The proposed reticulation is designed to meet peak demand and fire-fighting requirements.

Utilities

Electricity and telecommunications will be extended to service the development. Confirmation has been received by PowerCo and Tuatahi First Fibre.

This report confirms that the proposed development is able to be serviced in a manner that is practical, efficient and consistent with relevant local guidelines and industry standards.

2. INTRODUCTION

Maven have been engaged by Bell Road Limited Partnership (BRLP) to undertake the Infrastructure Design in support of the Fast-Track Approvals Act Application (FTA) for the Wairakei South FTA090 Development.

2.1. PURPOSE OF REPORT

The report outlines the proposed servicing strategy and identifies how infrastructure will be delivered to support the development. The engineering solutions presented have been developed in consultation with Bay of Plenty Regional Council (BOPRC) and Western Bay of Plenty District Council (WBOPDC), with detailed design to be progressed through a subsequent Engineering Plan Approval (EPA) process with WBOPDC following consent.

2.2. SITE DESCRIPTION

The site comprises 12 individual records of title, and a combined area of approximately 349ha (refer Table 1). The site is located immediately south of State Highway 2 (SH2) / the Tauranga Eastern Link, and south of the established Wairakei North and 'The Sands' developments. The site location is shown in Figure 1, below.

Legal and physical access to the site is directly via Bell Road, which traverses the property. A future transport link will become available via the Pāpāmoa East Interchange (PEI) to SH2, pending the completion of the PEI.

The land is zoned rural under the Western Bay of Plenty District Plan, and is situated within a predominantly rural environment. The site contains seven dwellings dispersed across various land parcels.

The site is bounded by State Highway 2 to the north and east of the site. The Kopuaroa Canal, a linear drainage canal, forms the southern boundary across the site extending from the west, eastward before connecting into the Kaituna River. Bell Road bisects the property, creating two distinct land parcels referred to in this application as:

- "The North Block" – land to the north of Bell Road; and
- "The South Block" – land to the south of Bell Road.

The site comprises flat, heavily modified alluvial plains with drained peat soils, rectilinear paddock patterns, channelised drainage networks and limited areas of native vegetation. The land is currently utilised for rural production activities, being predominantly in pasture and grazed by stock, with seasonal maize cropping.

Existing features within the site include farm drainage infrastructure, mature trees and hedgerows, residential dwellings, and associated farm buildings.

Culturally, the site is located within the rohe of Waitaha and Tapuika and forms part of a wider cultural landscape connected to Te Rae o Pāpāmoa, historic wetland systems, and the Kaituna River.

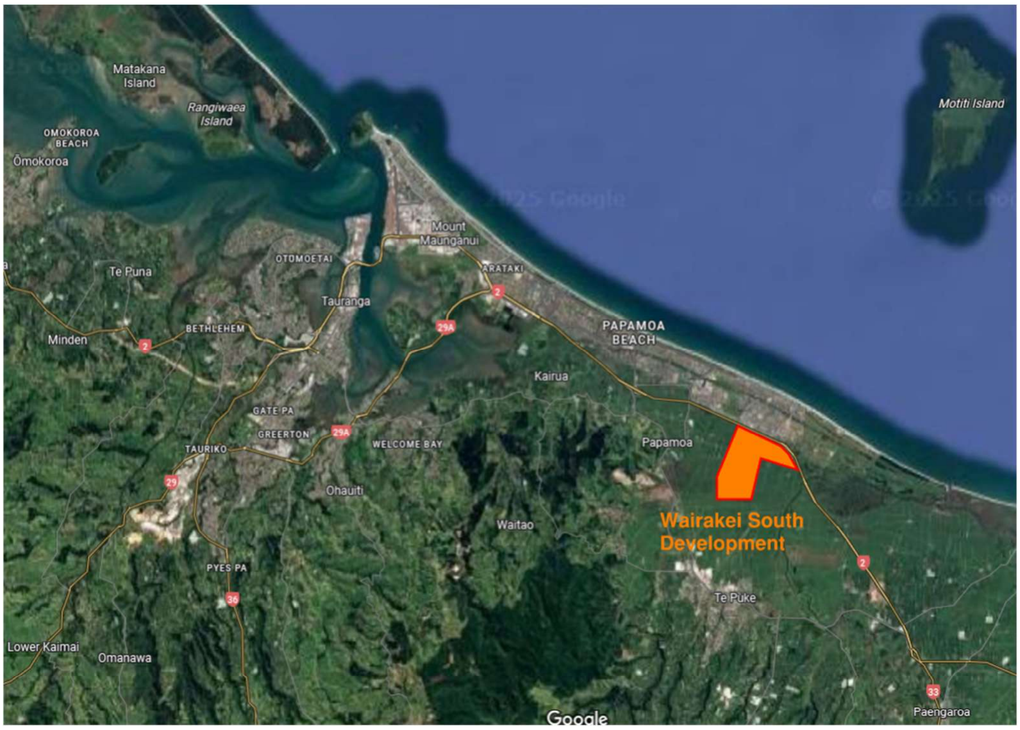


Figure 1 - Wairakei South Development Location (Source: Google Maps)

The site is legally described in Table 1 below and comprises a total area of 349.12 ha.

Table 1: Legal Descriptions of the site

Address	Record of Title	Appellation	Area (Ha)
	SA64B/396	Lot 2 DPS 81677 & Lot 1 DPS 54113	24.323
285 Bell Road, Pāpāmoa	SA64B/395	Lot 1 DPS 81677	2.694
	624307	Lot 1 DPS 69524 & Section 26 SO 427562	21.459
285A Bell Road, Pāpāmoa	SA55D/202	Lot 2 DPS 69524	0.981
311 Bell Road, Pāpāmoa	893643	Lot 1 DP 537375	15.290
	893644	Lot 2 DP 537375	3.527
339 Bell Road, Pāpāmoa	687138	Section 1 SO 457222	4.179
	606872	Section 13 SO 458365	59.941
	605743	Section 12 SO 458365	1.788
250, 252 Bell Road, Pāpāmoa	SA7A/206	Part Lot 1 DP 29530	113.762
314D Bell Road, Pāpāmoa	960662	Lot 2 DP 553506	99.109
314 Bell Road, Pāpāmoa	960661	Lot 1 DP 553506	2.062
Total			349.1196

2.3. THE PROPOSAL

The proposed development of Wairakei South by BRLP is a large-scale master-planned community, consisting of approximately 2,750 new homes alongside 50 hectares of industrial, 4 hectares of commercial centres, and a 4 hectare primary school over the next 10–20 years. In addition, recreational area to support a new community of this size are proposed such as parks/open space, stormwater reserves, and green connections/shared pathways. Figure 2, below, depicts the proposed Masterplan.

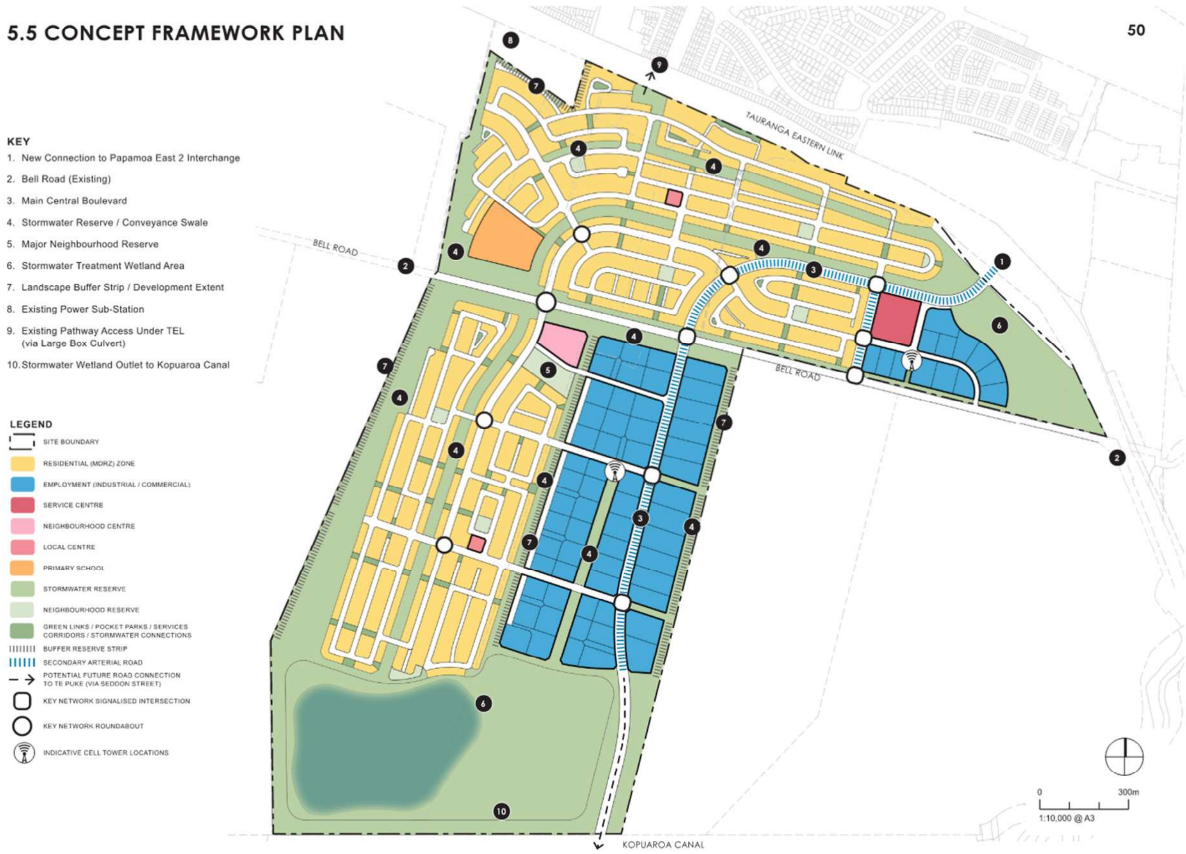


Figure 2 - Proposed Wairakei South Masterplan (Appendix C of the AEE)

2.4. CODES AND STANDARDS

The design and construction of all infrastructure associated with the development will be undertaken in accordance with applicable statutory requirements, codes, standards and guidelines. This includes, but is not limited to:

- Western Bay of Plenty Development Code
- Tauranga City Infrastructure Development Code
- NZS 4404:2010 – Land Development and Subdivision Infrastructure
- Bay of Plenty Regional Council Stormwater Management Guidelines

Compliance with these requirements will be demonstrated through the detailed design and approval processes.

3. EARTHWORKS

3.1. EXISTING SITE GEOLOGY

The existing site geology is described in full in ENGEO Limited's geotechnical reports (Appendixes O, P, Q, R, and S of the AEE).

ENGEO's Geotechnical Factual Report (Appendix O of the AEE) identifies that topsoil depths typically vary between 300-400mm. Beneath this lies a significant deposit of soft, fibrous peat containing organic clays and wood, which reaches a maximum thickness of 4 metres towards the southeast and pinches out to the north. Underlying the peat and topsoil is a 5 to 8 metres thick layer of fine to medium dune sand. Groundwater at the site is very shallow, typically recorded between 0.4 m and 1.5 m below the ground surface. The groundwater level generally follows the landform, being higher in the west and dropping towards the east.

3.2. GEOTECHNICAL RECOMMENDATIONS

In reference to the Geotechnical Interpretive Report prepared by ENGEO (Appendix P of the AEE), maximum cut/fill batter gradients of 1V:2H have been adopted relating to the earthwork design.

Ground improvement measures have also been recommended by ENGEO to address key geotechnical considerations, including consolidation and creep settlement, liquefaction, and embankment and channel edge stability. The earthworks design has incorporated these considerations and follows ENGEO's recommendations.

3.3. PROPOSED EARTHWORKS

Significant fill, peat excavation and preload earthworks are required to enable the development of the site. Earthworks are proposed over the entire site (350 ha) and entail stripping of peat in some areas, importation of fill from offsite and preload construction in stages.

The proposed landform follows a traditional longitudinal 'row' and 'valley' philosophy where housing and infrastructure is built on the filled 'rows', and the stormwater is directed laterally into the 'valleys' which convey it away from the site. This landform design allows for a simple drainage design and dictates the overall form of the developed masterplan.

3.3.1. EARTHWORKS OVERVIEW

The Engineering Drawings (C200s Appendix D of the AEE) detail the extent of the earthworks and erosion and sediment control measures to be implemented during construction. All earthworks will be undertaken in accordance with the recommendations contained in the ENGEO geotechnical reports.

Table 2, below, provides a summary of the proposed works based on the earthwork modelling completed by Maven (Appendix U of the AEE).

Table 2: Bulk Earthworks Volume Estimates

Item	Measure
Total area of ground disturbance	350 ha
Total volume of cut	591,200m^3
Total volume of fill	6,362,300m^3
Total volume of cut/fill (surplus)	6,362,300m^3
Total Settlement Fill	2,751,800
Total Volume (cut to fill + imported fill)	9,114,100m^3

3.3.2. EARTHWORKS STAGING

It is proposed that the bulk earthworks operation will be carried out in eighteen (18) separate stages, with each stage completed independently, as shown on the Engineering Drawings (C150s - Appendix D of the AEE).

Earthworks will commence at the Pāpāmoa East Interchange (PEI) intersection in the North Block and will progress generally from east to west through Stages 1 to 8. Once the North Block is developed, earthworks will progress in the South Block, starting in the northern section and moving south through Stage 9 to 16. Stage 17 & 18 in the North Block will be developed as final stages.

3.3.3. GROUND CONDITIONS AND TREATMENT

Where the underlying peat is <1m in depth in the initial northern stages, this peat layer is proposed to be excavated out and replaced with fill. No preload will be required in these areas, allowing the early stages of development to progress more rapidly.

Preload works are proposed over areas underlain by peat soils to improve ground performance prior to bulk earthworks and construction. A temporary surcharge fill is placed to induce consolidation of the peat, expel excess pore water, and achieve the majority of settlement in advance of permanent works. For further details refer to ENGEO's Geotechnical Interpretive Report (Appendix P of the AEE) and Maven's Earthworks Management Plan (Appendix U of the AEE). Topsoil across the site typically ranges from 300–400 mm and will be stripped, stockpiled, and managed in accordance with Maven's Earthworks Management Plan. It is expected that silty peats excavated from the initial stages and stormwater management areas will be mixed with silts and sands that are won on site or imported to form an appropriate reinstatement growing medium. This material will then be respread to lots and berms as topsoil where required.

3.3.4. SUPERVISION AND CERTIFICATION

During construction earthworks supervision will be undertaken by a suitably qualified professional to confirm the developed landform is compliant with expected standards. A Geotechnical Completion Report (GCR) will be provided at the completion of each stage of earthworks. The GCR will set out the earthworks specification that was achieved and have a record of the management and monitoring of the works as they progressed, including preload survey monitoring.

A suitably qualified engineer will issue a statement confirming the standard of any fill placed and any constraints associated with areas of natural ground or slope stability with respect to building foundation design.

3.4. RETAINING WALLS

In general, the earthworks and landform have been designed to avoid the need for retaining walls, with a few minor exceptions around existing boundaries and road corridors as shown on the earthwork's drawings (C200s – Appendix D of the AEE). Any retaining walls will be subject to a future detailed design and building consent process.

3.5. SEDIMENT & EROSION CONTROL

The Engineering Drawings (C230/240s – Appendix D of the AEE) detail the proposed sediment and erosion control measures. Also included within the application documents is an Earthworks Management Plan (Appendix U of the AEE) prepared by Maven which outlines the methodology associated with the proposed sediment and erosion control for the project.

Key sediment and erosion control measures include temporary sediment basins positioned within each earthworks stage, perimeter bunding to contain runoff within the active works area, and temporary diversion channels to intercept and redirect clean water away from disturbed ground. These measures are designed to prevent sediment-laden runoff from escaping the staging area and affecting the surrounding environment.

4. TRANSPORTATION

Transportation matters are addressed in detail in the Integrated Transportation Assessment by Boffa Miskell (Appendix I of the AEE) and should be read in conjunction with this Infrastructure Report.

4.1. EXISTING ROADING/ACCESS

The site is located directly south of Tauranga Eastern Link (TEL) State Highway 2 Corridor and is divided into North and South Block by Bell Road, a local, sealed public road that runs through the middle of the site. Numerous farm roads and tracks convey farming traffic through the site.

4.2. PROPOSED ROADING/ACCESS

4.2.1. PUBLIC ROADS

The Pāpāmoa East Interchange (PEI) currently links The Sands Avenue and Pāpāmoa East to State Highway 2. Proposed upgrades have been designed to provide an on/off connection directly into the site. Bell Road currently runs directly through the site between the proposed North and South blocks and will be upgraded to meet the development demands.

A new network of public roads connecting to the PEI and Bell Road has been proposed to service the site. A future connection south to Te Puke is also provisioned for, subject to being progressed by WBOPDC's Te Puke Spatial Planning.

The roads within the development provide for connectivity through the site between Pāpāmoa and Te Puke (Arterial), primary access roads through residential, commercial and industrial areas (Collector) and local roads. The Engineering Drawings (Appendix D of the AEE) identify the roading hierarchy and their cross-sections as well as longitudinal design and intersection details. The layout provides a clear and legible network that facilitates intuitive, safe and convenient movement through the development.

All public roads have been designed in accordance with WBOPDC standards, with both vertical and horizontal geometry complying with the required design parameters.

The treatment of intersections within the site includes give way, traffic signals and roundabouts as identified in the Engineering Drawings.

Regional traffic modelling completed by Boffa Miskell has identified broader traffic network upgrade concepts. Refer to Boffa Miskell's ITA (Appendix I of the AEE) and Maven's Engineering Drawings (Appendix D of the AEE) for more information.

4.2.2. PRIVATE ROADS

Common Access Lots (CAL) are proposed to provide access to selected properties as shown in the Engineering Drawings. Legal widths of CAL's are proposed to be 6.0m – 9.0m depending on the number of lots serviced.

4.2.3. PAVEMENT DESIGN

Pavement design will follow standard Council guidelines and be further detailed at the Engineering Plan Approval stage. The pavement has been designed to accommodate the anticipated local traffic and loading expected for the development over a design life of 25 years. Design traffic includes regular light vehicles with allowance for occasional service and maintenance vehicles as per the Western Bay of Plenty Development Code Section 4.

4.2.4. SURFACE DRAINAGE

Surface drainage within the road reserve and public spaces is achieved through appropriate grading of pavements and verge areas to direct overland runoff toward catchpits, swales, and the reticulated stormwater pipe network.

5. STORMWATER

A Stormwater Management Plan (SMP) (Appendix G of the AEE) and Flood Modelling Report (Appendix H of the AEE) have been prepared by Maven. These documents address the overarching stormwater strategy for the site and technical modelling results. Both reports should be read in conjunction with this Infrastructure Report. Stormwater Calculations are attached as Appendix A.

5.1. EXISTING STORMWATER NETWORK

5.1.1. KAITUNA RIVER

The Kaituna River is a major river in the Bay of Plenty, extending approximately 45 km. It drains Lake Rotorua via the Ohau Channel into Lake Rotoiti, before flowing east and discharging into the Bay of Plenty at Maketu.

The Kaituna is very significant to Iwi in the region and the general population of the area. It is the present receiving environment for the entire catchment of this site, via an existing Stormwater Pump Station scheme fed by an existing culvert under Bell Road.

Figure 3: Kaituna River (Source: Maven)

5.1.2. OPEN DRAINS

Kopuaroa Canal

The site is bounded to the south by the Kopuarua Canal, which is an artificial canal constructed in the early to mid-20th century to channelize a stream through the area, enabling the pastoral farming of the site and surrounding area. Crest to crest, the canal is broad at approximately 55m – 60m wide.

The Canal is administered by BOPRC and flows to the east directly to the Kaituna River.

Figure 4: Kopuaroa Canal (Source: Maven)

Bell Road Drain

The Bell Road Drain runs through the centre of the development site, and flows gradually east to the Bell Road/State Highway 2 culvert which conveys flows under the TEL. The base of the Bell Road Drain during normal flows is approximately 5-6m wide. The normal flow is very shallow and very slow. The drain fills up and overtops its banks during heavy rain events. It is crossed in several places by farm access bridges, and flap gates are used to restrict backflows into the surrounding farm drains.

To align with the proposed development, existing farm drains across the site are to be filled or modified as part of the earthworks.

Figure 5: Bell Road Drain (Source: Maven)

5.1.3. PIPED RETICULATION AND STRUCTURES

Bell Road Culvert

When the TEL was constructed, a new box culvert was placed to convey flows from the Bell Road catchment under the TEL, connecting to a BOPRC owned and maintained stormwater pump station which pumps stormwater during rainfall events into the Kaituna River. The box culvert was inadequately sized, and the catchment regularly floods as the box culvert is the key constraint to the Bell Road Drain's capacity. For more information see Maven's Flood Modelling Report (Appendix H of the AEE).


Figure 6: TEL Box Culvert (Source: Maven)

Bell Road C Pump Station

Located at the downstream end of the Bell Road Drain where it meets the Kaituna River, this large pump station lifts up to 3.00m³/s from the drain and discharges it into the river. It operates during significant rainfall events when river levels can be too high for gravity drainage and continues operating afterward to draw down water levels across the Bell Road Catchment. It is the catchment's primary mitigation against widespread flooding.

Pump Station A

There is an existing pump station on a neighbouring property in the southeast corner of the catchment. The pump captures stormwater south of Bell Road by a series of farm drains, and discharges directly to the Kaituna River. The capacity of the pump station is 2.37m³/s, which is a combination of permanent and temporary pumps. This is in line with Bay of Plenty Regional Council's current Hydraulic Modelling of Bell Road.

Bell Road B Pump Station

Located immediately north of the Bell Road C Pump Station, this pump is part of a separate drainage system and transfers 0.57³/s from the Bell Road B drain. The drain transfers stormwater from farm drains located between the TEL and the Kopuaroa Canal and supports drainage of the Bell Road catchment via a culvert beneath the TEL that connects to the farm drain network north of Bell Road.

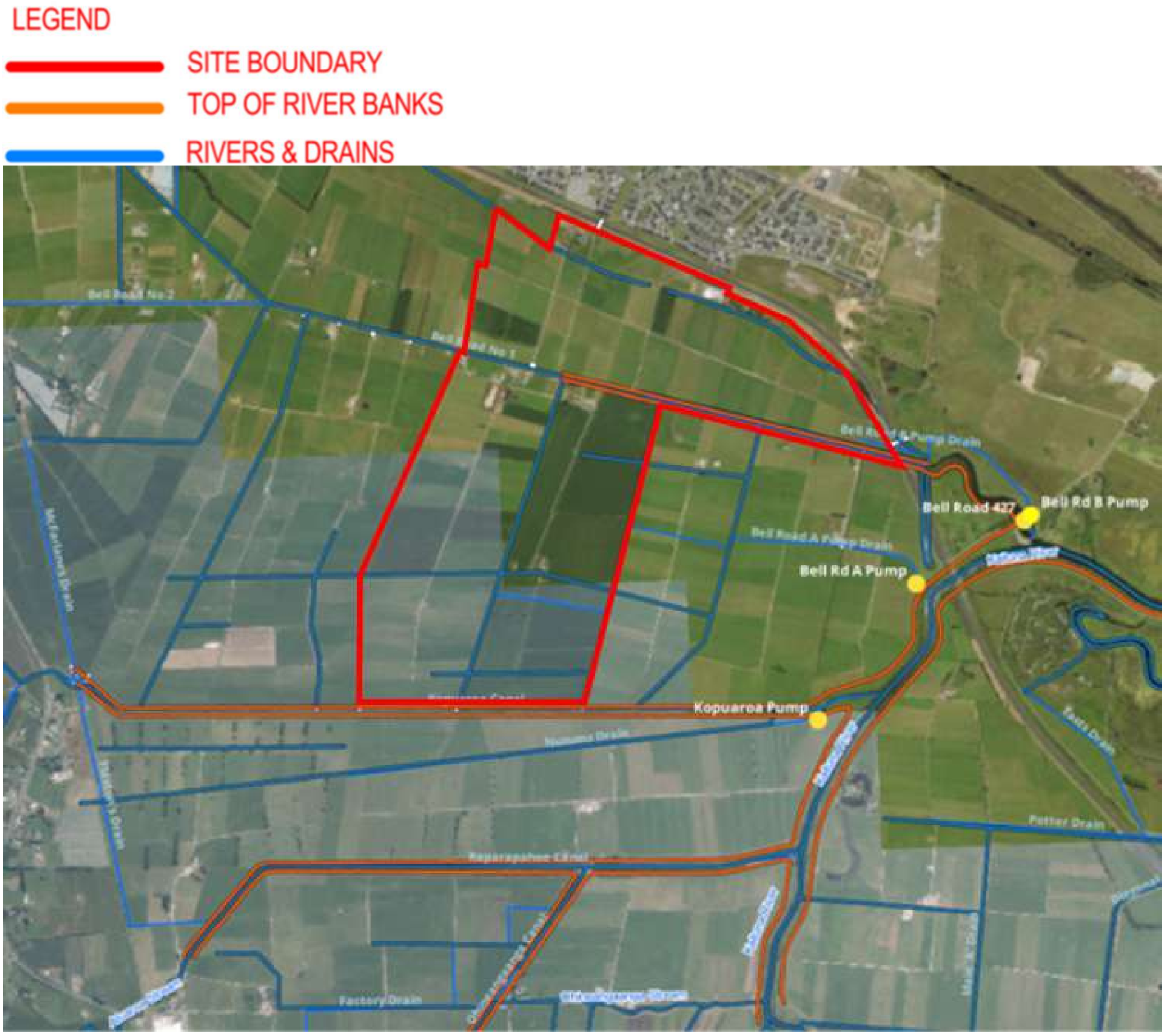


Figure 7: Existing Bell Road Drainage Scheme (Source: BOPRC MAPI)

5.1.4. NATURAL FEATURES

The site is located on a low-lying floodplain with a thin silty topsoil over soft fibrous peat (thickening to the southeast and thinning to the north), underlain by dune sands and deeper fluvial sand/gravel deposits. ENGEO's Hydrogeological Assessment Report (Appendix R of the AEE) has noted high groundwater levels and poor infiltration in the existing soils.

Topography across the development area is flat with limited natural relief, and ground levels across the site are between RL 0.55m and RL 2.20m. Existing land use in the wider catchment is primarily rural (horticulture and dairy farming on grassed drained flats with sparse tree coverage), with drainage provided by a network of land drains connected by culverts and controls. Riparian margins are generally grassed/weedy with limited buffer planting, and stop banks are a dominant feature within the floodplain drainage system.

5.1.5. FLOODING

Existing flooding at the site is driven by significant runoff from the upstream catchment, which frequently inundates the full site area and neighbouring rural land during major storms. Flood behaviour across the catchment is influenced by the flat topography and low-capacity open drains, resulting in diffuse overland flow rather than flow concentrating into defined channels in all areas. During storm events, the Kaituna River water surface can rise above flood levels in the Bell Road area, which limits gravity drainage.

Following storm events, drainage of floodwater is constrained by the capacity of the existing downstream conveyance and pump assets, with floodwater currently bottlenecked by the State Highway culvert and the existing Bell Road A Pump Station. Where flap gates are present, these close when the Kaituna River level is higher than the drain, further limiting outflow until river levels fall or pumping lowers water levels.

5.2. PROPOSED STORMWATER NETWORK

This section describes the proposed stormwater management strategy for the development master plan. The strategy comprises three integrated systems:

Primary System: A piped reticulation network designed to collect and convey runoff from residential and employment lots to downstream stormwater.

Secondary System: Defined overland flow paths, primarily within road corridors and service corridors, that convey excess runoff during major storm events when the capacity of the primary system is exceeded.

Stormwater Treatment and Attenuation: Constructed wetland swales, attenuation basins, and pump station infrastructure that provide water quality treatment, flood storage, and controlled discharge to the receiving environment.

Design Parameters

The proposed stormwater infrastructure has been designed in accordance with the requirements of *Western Bay of Plenty District Council Design Standard DS5, Stormwater*. Rainfall intensities adopted for the stormwater design are based on a time of concentration (Tc) of 10 minutes for the proposed sub-catchments, as landform has dictated small pipe network catchments (most are under 3ha). This Tc has been applied consistently for the full range of storm events, in accordance with the Stormwater Management Guidelines for the Bay of Plenty Region Section 7.1.6.

Design flows for the proposed stormwater network were determined using the Rational Method (Appendix A – Stormwater Calculations). Runoff enters the piped network by one of two routes: via catchpits collecting road and surface runoff, or via direct private connections from individual lots. These two routes operate differently for residential and industrial land uses due to the way runoff is generated and captured on each lot type. Design flows for each inflow to the reticulation network are summarised in Table 3, and the connection philosophy for each lot type is described in Section 5.2.1.

Table 3 - Design Flow Categories (Appendix A – Stormwater Calculations)

Inflow Type	C	I (mm/hr)	A (m^2)	Q (l/s)	Notes
Residential Lot Connections	0.90	139.0	1000	12.7	Q per $1000m^2$ *
Residential Runoff to Catchpits	0.68	139.0	1619	27.0	A per catchpit
Industrial Lot Connections	0.77	139.0	1000	29.8	Q per $1000m^2$
Industrial Runoff to Catchpits	0.72	139.0	975	27.0	A per catchpit

*For residential areas only roofs discharge to lot connections, with roofs comprising $364.5m^2$ per $1000m^2$

The weighted impervious coverage across each land use zone, accounting for the lot coverage assumptions and road reserve areas described above, is summarised in Table 4.

Table 4 - Impervious Coverage by Land Use Zone

Land Use Zone	Assumed Impervious Area (%)
Residential / Commercial	78.4%
Industrial	80%

The residential zone impervious coverage of 78.4% represents the weighted average across all contributing surfaces within the residential zone, including lot coverage and local road and reserve areas. The industrial zone coverage of 80% represents an assumed maximum probable development (MPD) for industrial lots.

The proposed stormwater network provides the basis for stormwater conveyance within the development and is intended to integrate with the new downstream stormwater infrastructure. Further detail on network layout, infrastructure components, and secondary overland flow paths is provided in the following sections.

5.2.1. PRIMARY SYSTEM

The primary stormwater system integrates roof drainage, surface runoff, kerb and channel flow, and underground reticulation to provide a continuous conveyance path to the downstream stormwater infrastructure.

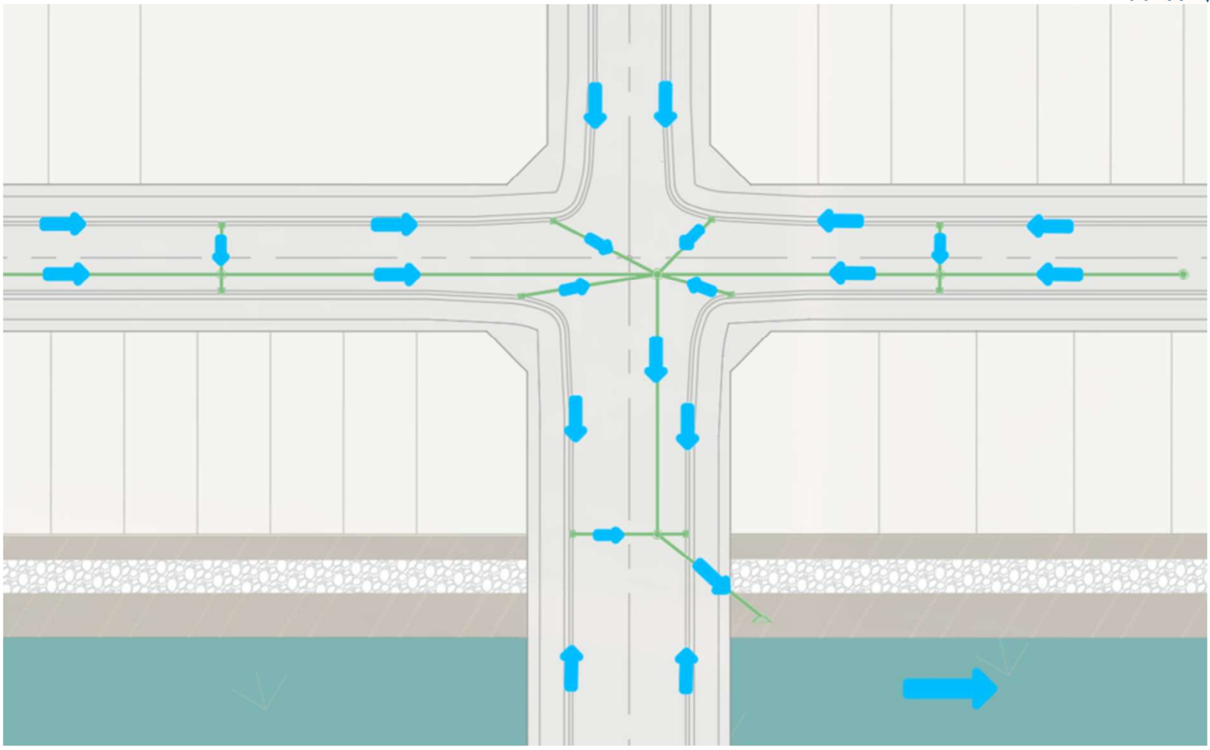


Figure 8: Surface Runoff, Kerb and Channel Flow, and Reticulation (Source: Maven)

The primary piped network has been sized to convey runoff generated by a 10-year ARI design event of 139mm/hr, based on a Tc of 10 minutes. Pipes have been sized using Manning's Formula with an 80% utilisation factor to provide an allowance for maintenance and partial blockage conditions. Minimum pipe grades have been set to achieve self-cleansing velocities of 0.7 m/s under the 2-year ARI event (84.7mm), in accordance with section 5.2.1 of the Western Bay of Plenty Development Code. No surcharge of the piped network is expected up to the 10-year ARI storm. Pipe sizing calculations are provided in Appendix A - Stormwater Calculations.

Residential Lot Connections

For residential lots, lot coverage has been assumed at 50% roof, 30% hardstand, and 20% pervious cover. These assumptions are consistent with the worst-case impervious coverage outlined in Boffa Miskell's Proposed Residential Area Design Guide (Appendix AF of the AEE).

Roof runoff is collected via individual downpipes and directed through private drainage to a single point of discharge for each lot. Discharge from each lot connects directly to the underground stormwater reticulation network.

Runoff generated from remaining open-to-sky areas within residential lots, including grassed surfaces and paved or concreted areas, is assumed to drain via sheet flow toward the adjoining road reserve. This runoff is combined with sheet flow from the road reserve and conveyed along the kerb and channel system to downstream stormwater catchpits.

Industrial Lot Connections

For industrial lots, a maximum probable development (MPD) coverage of 80% impervious has been adopted. All runoff generated within the lot boundary, including roof and hardstand areas, is captured internally and conveyed to a single point of discharge to the piped reticulation network. Sites that exceed this threshold are expected to provide on-site attenuation to mitigate runoff back to an 80% impervious coverage equivalent.

Runoff from industrial zone road corridors is collected separately via catchpits.

Catchpit Spacing and Design

Catchpit spacing and placement has been set to ensure full capture of the upstream contributing catchment during the 10-year ARI storm event. A maximum spacing of 80 m has been adopted between catchpits, with reduced spacing where required to ensure effective interception of runoff. Each catchpit has an assumed maximum intake capacity of 27 L/s. Contributing areas have been sized such that runoff during the 10-year ARI 10-minute event does not exceed this limit, with catchpit spacing determined accordingly. Due to the different runoff characteristics of residential and industrial land uses, the maximum contributing area and resulting spacing differs between zones.

Outlet Configuration

Piped reticulation discharges to internal wetland swales via wingwall outlets. Inverts for outlet pipes have been set at the 10-year ARI event water surface elevation, derived from Maven's flood modelling (Appendix H of the AEE) that has been independently reviewed by Awa Environmental, as requested by BOPRC. No surcharge is expected up to the 10-year ARI storm.

5.2.2. SECONDARY SYSTEM

The secondary stormwater system for the development is provided through defined overland flow paths, primarily utilising the road network, service corridors, and downstream open drainage features.

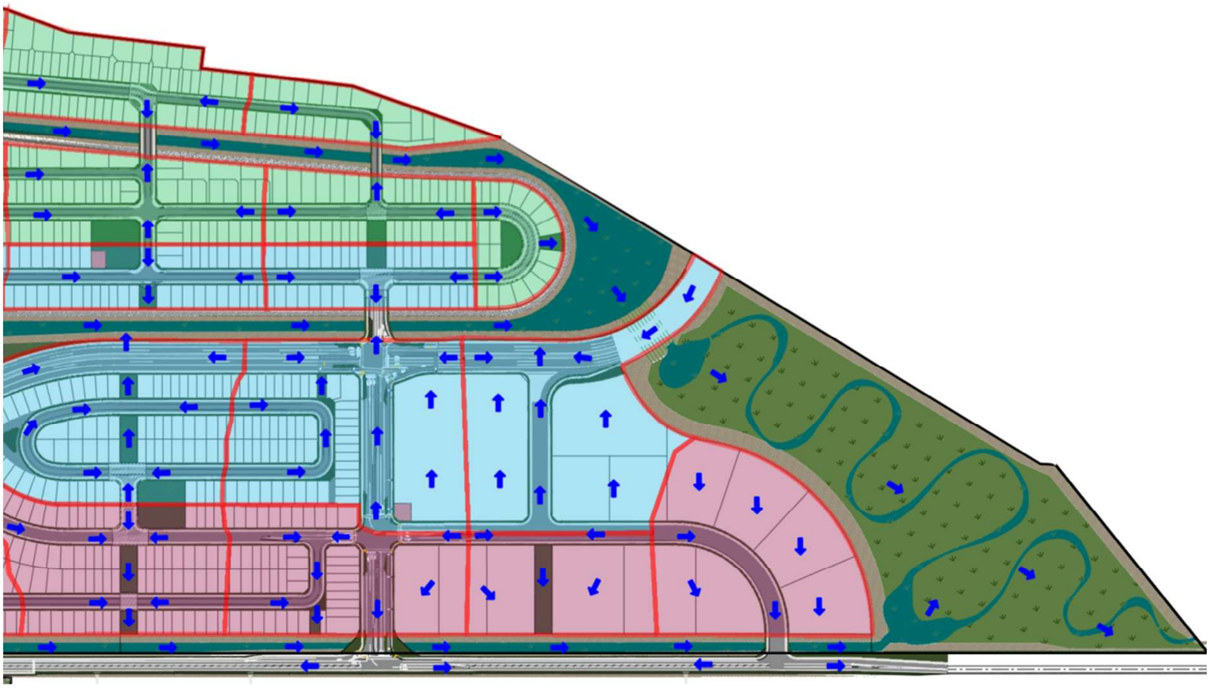


Figure 9: Overland Flows (Source: Maven)

All the roads within the development are configured as dual carriageways, with one or two traffic lanes in each direction, a dual crossfall, and kerb and channel or dish channel drainage provided on both sides. The development is located predominantly over a fill platform, with the road network constructed to a minimum longitudinal grade of 0.5%. Due to the location of the proposed stormwater discharge points, the underground reticulation system does not extend over long lengths and discharges to downstream swales and a floodplain area forming part of the wider master plan drainage system.

During storm events exceeding the capacity of the primary piped system, surcharge of the underground network is expected to occur. For larger storms greater than the 10-year ARI, excess runoff is conveyed via the secondary system, with road surfaces acting as the primary overland flow paths. The road network has been configured to direct flows downstream and prevent inundation of adjacent lots.

Overland flow channels and secondary flow paths have been designed to safely convey major storm events up to the 100-year ARI. Road corridor and service corridor conveyance capacity has been assessed assuming the primary piped network is fully blocked and that all runoff is conveyed via overland flow paths. Under this scenario, stormwater is directed and contained within road and service corridors, which function as the secondary conveyance route for major storm events.

Road overtopping of the verge is not anticipated under the design storm conditions. At localised low points where flood depths exceed the kerb height, a defined and safe overland flow path is provided to ensure runoff is conveyed without adverse effects until it discharges into the treatment swales.

5.2.3. ATTENUATION, RETENTION, AND PUMPING

Flood Management

The site receives significant runoff from the upstream catchment. During major storm events, the existing site and adjacent rural land currently floods. In the same events, water levels in the Kaituna River rise above the flood levels at Bell Road. The proposed development displaces approximately 3,000,000 m^3 of existing flood storage and creates approximately 600,000 m^3 of new flood storage. The net loss of flood storage is offset by proposed pump station infrastructure, which provides controlled discharge to the Kopuaroa Canal and Kait, achieving acceptable post- vs pre-development flood levels. For further details on flood management, refer to Maven's Stormwater Management Plan (Appendix G of the AEE) and Flood Modelling Report (Appendix H of the AEE).

Internal Attenuation Strategy

During major storms, external runoff will be diverted to a large stormwater attenuation area in the south of the development, where it will be attenuated before being pumped into the Kopuaroa Canal. Internal runoff for the South Block during storms will be separated from external runoff by stop banks and will be attenuated in large internal wetland swales that outflow to a southern attenuation area (refer to section 5.2.4). Internal runoff for the North Block during storms will function similarly to the South Block, with large wetland swales that discharge to an attenuation area that discharges under the existing State Highway 2 culvert and pump station to the Kaituna River.

During major storms exceeding the 10-year ARI, external runoff will overtop the stop banks, combining with internal runoff and increasing the attenuation available to external flows.

Figure 10: Overland Flows **(C400s - Appendix D of the AEE)**

Pump Station Infrastructure

Following a storm event, draining of flood water in Bell Road is currently bottlenecked by the culvert under the State Highway and by the existing Bell Road A Pump Station, which has an existing capacity of 2.37m^3/s. The development proposes additional pumps adjacent to the existing Bell Road A Pump Station, increasing capacity to 8.37m^3/s. The development also proposes a new pump station at the southern end of the development. The proposed South Block Pump Station capacity is 12.8m^3/s.

A proposed pump configuration is shown in the Engineering Drawings (Appendix D of the AEE).

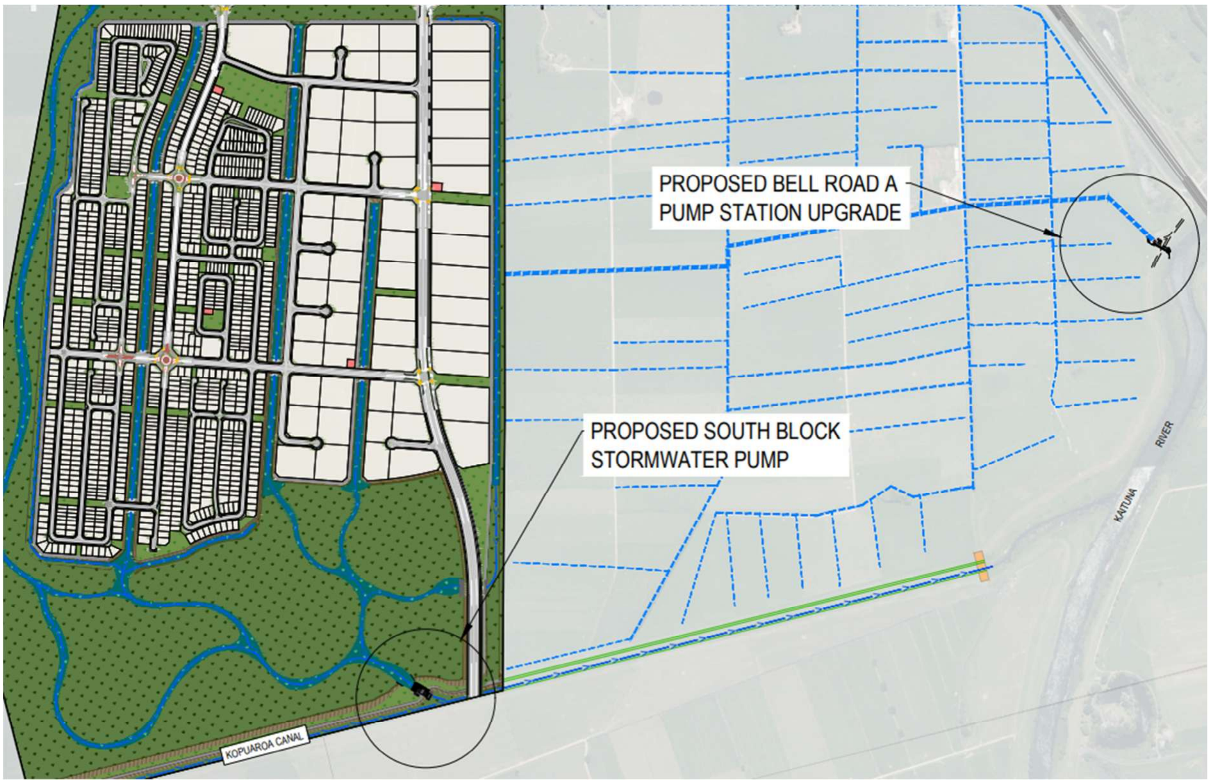


Figure 11: Stormwater Pump Locations **(C400s - Appendix D of the AEE)**

5.2.4. QUALITY TREATMENT

Stormwater quality treatment for the development is provided through constructed wetland swales distributed across the site. The wetland swales form the primary stormwater quality treatment devices for both the northern and southern development areas and have been designed in accordance with the Stormwater Management Guidelines for the Bay of Plenty Region. Pre-treatment of stormwater upstream of the wetland swales is provided by the stormwater catchpit network, which captures gross pollutants and coarse sediment prior to discharge into the swale system.

Catchment Layout

The southern area is split into six catchments with each directing stormwater runoff to its own wetland swale labelled S1 to S7. These swales all flow to the south and discharge to a large basin area for extended detention. The northern area contains four catchment areas each with its own wetland swale for stormwater discharge. Swales N1, N2, N3, N6, and N7 flow to the east and discharge to an extended detention area. Swale N5 directs flows from its contributing catchment to the south before discharging to a larger conveyance channel north of Bell Road.

Figure 12: Water Quality Catchments **(C400s - Appendix D of the AEE)**

Swale Design

The swales are designed to treat the full water quality flows (WQF) from the developed catchments, while also providing conveyance and storage capacity for larger storm events. Water quality flows have been calculated based on the 2-year 1-hour storm event plus climate change at a depth of 41.3mm. The post-development scenario has been assessed as 78.4% impervious, with a runoff coefficient of 0.76 used to determine flows. A Manning's roughness coefficient of 0.1 has been adopted as specified in the wetland swale design standards.

All swales are trapezoid shaped and will be planted with appropriate species detailed in Boffa Miskell's Subdivision Consent Landscape Package (Appendix E of the AEE). The base and bottom of batters will be planted, removing the requirement to mow. The top of batters will remain unplanted for mowing. Levels determines by ENGEO's Hydrogeological Assessment Report (Appendix R of the AEE) indicate that swale bases will be close to ground water level meaning that on a seasonal basis there is likely to be base flow and saturated soil conditions. The wetland swales function similarly to constructed wetlands in their use of vegetation to treat stormwater run-off, and act as a long and linear shallow wetland treatment practice.

The approach taken to size the wetland swales is to ensure that the swale residence times exceed nine minutes. This is the recommended approach in the Bay of Plenty Guidelines. The longitudinal slope is very flat at 0.02% and therefore no check dams are proposed to reduce velocities. Velocity of water quality flows remain well under the maximum 0.8m/s.

The Bay of Plenty Guidelines suggest a base width of up to 7m and a maximum of 1 in 4 side slopes. To accommodate the flood storage and conveyance requirements and further improve treatment opportunities, some swale base widths are wider than 7m, matching the width required for flood conveyance. Side slopes have been designed at 1 in 3 which has been confirmed as suitable for stability by ENGEO.

Swale Conveyance and Flood Storage

The swales double as conveyance channels and flood storage during flood events. During storm events under the 5-Year ARI event, the flow in the swales comes only from the proposed development catchments immediately upstream, discharging to the swales by outfall structure. Piped stormwater enters each swale through wingwalls at the head and at multiple locations along the swale banks. Swales S1, S3, S4, S5, N1, N5, N6, and N7 are separated from external upstream flows by stop banks, typically at the top end of each swale. Once a storm exceeds the 5 Year ARI event, flows will overtop these stop banks and be conveyed through the swales. Checks of the stormwater model have confirmed that velocities within the swales during a 10-Year ARI event do not exceed 1.5m/s. The swales will remain inundated after storm events until the downstream stormwater detention volumes have dissipated.

Swale dimensions vary across the site, but a typical cross section is shown in Figure 13 below. Details for individual swales can be found in Table 4.

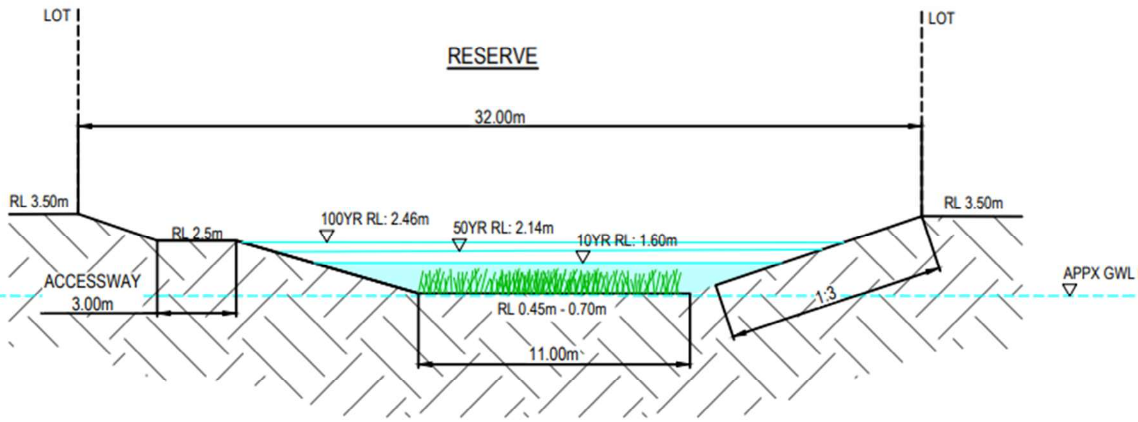


Figure 13: Typical Swale Cross section **(C400s - Appendix D of the AEE)**

Table 4 – Wetland Swale design parameters (Appendix A – Stormwater Calculations)

Swale Name	Catchment Area ha	Base width m	Side slopes	Length m	Min. Length for residence time m	Maximum WQ Flow m^3/s	Maximum WQ Depth m	Maximum WQ velocity m/s
S1	13	7.5	1:3	1466	60	1.13	0.954	0.135
S3	20	15.2	1:3	1276	60	1.72	0.846	0.115
S4	35	18	1:3	1271	70	3.04	1.072	0.134
S5	34	18.5	1:3	1104	68	2.94	1.036	0.131
S6	22	19	1:3	672	59	1.93	0.801	0.113
S7	4	7	1:3	300	40	0.31	0.480	0.077
N1*	50	11	1:3	1981	85	4.32	1.662	0.163
N2	39	11	1:3	1547	79	3.39	1.456	0.151
N3	17	8	1:3	1218	65	1.52	1.088	0.124
N5	10	7	1:3	694	56	0.87	0.854	0.107
N7	21	6	1:3	1012	70	1.81	1.340	0.135

*Includes swale N6.

5.2.5. STORMWATER AND FLOOD MODELLING

Flood behaviour for the development has been assessed in the Flood Modelling Report (Appendix H of the AEE) prepared by Maven. The report presents a hydrological and hydraulic assessment of pre- and post-development conditions across a range of storm events with scenarios that incorporate future climate change allowances and sea level rise.

The following scenarios have been assessed:

- 5-Year ARI + 3.68°C Climate Change + 1.59 m Sea Level Rise
- 10-Year ARI + 3.68°C Climate Change + 1.59 m Sea Level Rise
- 50-Year ARI + 3.68°C Climate Change + 1.59 m Sea Level Rise
- 100-Year ARI + 3.68°C Climate Change + 1.59 m Sea Level Rise
- 100-Year ARI + 3.68°C Climate Change + 1.59 m Sea Level Rise + Full Pump Failure
- 500-Year ARI + 3.68°C Climate Change + 1.59 m Sea Level Rise

At a high level, the Flood Modelling Report concludes that the proposed development delivers a net positive outcome for flood management within the Bell Road catchment, with water levels and flows managed such that critical assets and building platforms are protected under the assessed design events, including future climate scenarios. The report also identifies that the overall stormwater and flood mitigation strategy is supported by key infrastructure measures, including the proposed pump station upgrades/new pumping capacity, and associated flood management controls. Water surface elevations determined during flood modelling were used to inform various aspects of design as mentioned throughout this report.

Further detail regarding the modelling setup, assumptions, scenarios, results, and limitations is provided in the Maven Flood Modelling Report and its appendices.

6. WASTEWATER

The WBOPDC Development Code sets out the design principles for wastewater and requires any development project to be provided with an appropriate means of wastewater disposal. Wastewater Calculations are attached as Appendix B.

6.1. EXISTING WASTEWATER NETWORK

There is no existing WBOPDC wastewater reticulation in the immediate vicinity of the subject site. The nearest identified wastewater main is 225mm uPVC main located on Te Okuroa Drive which is a Tauranga City Council asset and is not available for use.

6.2. PROPOSED WASTEWATER NETWORK

Wastewater generated from the development is proposed to discharge to the Te Puke Wastewater Treatment Plant, located approximately 8km south of the site. The proposed wastewater system consists of gravity collection main, on-site pump stations, and dedicated rising mains. Figure 14 below shows an overall diagram of the wastewater network.

Figure 14: Wastewater Overview Plan **(C500s - Appendix D of the AEE)**

6.2.1. PIPED RETICULATION

Wastewater will be collected and conveyed via 150mm diameter uPVC mains. The reticulation lines will gravity feed into proposed pump stations, which will pressurise the flow for discharge via rising mains. The rising main will collectively discharge all wastewater to the Te Puke Wastewater Treatment Plant. All networks are designed to achieve self-cleansing velocity as per the Western Bay of Plenty District Council Development Code. Refer to engineering drawing C500 for the reticulation layout plan.

The formed road corridor provides an appropriate location for wastewater infrastructure, supporting efficient gravity operation, secure maintenance access, and coordinated servicing that avoids conflicts with water supply and other utilities.

6.2.2. PUMPSTATIONS AND PRESSURE SYSTEMS

Eleven (11) wastewater pump stations have been proposed throughout the site to cater for the development. Each station will be fed by its respective local gravity wastewater network from a dedicated 1200mm diameter receiving manhole located immediately upstream.

The pump station design including wet well sizing and emergency storage has been undertaken with reference to the WBOPDC DS11. Each pump station will be situated on a separate wastewater reserve with permanent vehicle access for maintenance. The layout provides a 5.0m x 5.0m area to accommodate a biofilter and includes adequate space for maintenance vehicle access and turning, with control cabinets sited away from roadways.

The wet well for each station is sized in accordance with WBOPDC DS-11 .4.4, ensuring pump starts remaining below the acceptable limit of 15 per hour and providing a minimum operational water depth of 1.5 metres from the inlet pipe invert. Each station is proposed with a duplex pump system, where each pump is sized to handle the peak wastewater flow from its catchment area. All fittings and materials will comply with the WBOPDC specification.

Emergency storage is provided at each pump station and is sized to store nine (9) hours of wastewater flow as per WBOPDC DS-11 .4.11. The proposed control system includes standard start, stop, and alarm levels for reliable operation. The design incorporates the necessary connections for power and telemetry for remote monitoring and is sited to be protected from stormwater overland flow paths.

Pump station layouts and cross-section drawings contained within the Engineering Drawings. Pump sizing calculations are included within Appendix B.

Wastewater from the proposed pump stations will be discharged to the Te Puke Wastewater Treatment Plant via a dedicated bulk rising main network. The network is divided into two independent catchment areas, North Block and South Block, each served by a separate DN400 bulk rising main. The two bulk mains will run in parallel, following the same alignment along the corridor of the Waiāri trunk water main, optimising the use of the existing service corridor.

The rising main design includes scour valves, air valves, isolating gate valve and maintenance junctions for operational control and access.

The mains have been sized to convey the peak wet weather flows efficiently to the Te Puke Wastewater Treatment Plant.

6.2.3. BULK RISING MAIN HYDRAULIC PERFORMANCE

The wastewater collection network is divided into two independent catchment areas, North Block and South Block. Each block is served by a dedicated DN400 bulk rising main conveying flows directly to the Wastewater Treatment Plant (WWTP). This parallel arrangement simplifies the hydraulic design, minimizes individual pipe lengths, and facilitates staged development of the network.

North Block Configuration

The North Block catchment encompasses Pump Stations 1, 2, 3, 4, 5, and 11, configured to convey flows progressively to a central collection point at Pump Station 1.

- Pump Station 3 discharges directly into the wet well of Pump Station 2.
- The rising main from Pump Station 2 carries the combined flow from Pump Stations 2 and 3 to Junction 1.
- At Junction 1, the rising main from Pump Station 11 connects, adding its flow to the combined stream.
- The aggregated flow continues to Junction 2, where the rising main from Pump Station 5 connects, further increasing the cumulative flow.
- From Junction 2, the total combined flow is conveyed to Pump Station 1.
- Pump Station 4 discharges independently via a dedicated rising main directly to Pump Station 1, remaining separate from the junction network.

Pump Station 1 functions as the central collection hub for the North Block, receiving the combined flow from Pump Stations 2, 3, 11, and 5 via the junction network, as well as the independent flow from Pump Station 4. A duty pump rated at 91 L/s at Pump Station 1 lifts the total combined flow through the North Block DN400 bulk rising main, discharging directly to the Wastewater Treatment Plant.

During early stages of development, prior to full build out of the North Block stations, cumulative flows reaching Pump Station 1 will be insufficient to achieve the minimum self-cleansing velocity of 1.0 m/s in the bulk main. To address this, a temporary external water flush system will be implemented at Pump Station 1 to maintain solids transport until natural inflows reach the required level. Detailed design of the external flush system will be developed during the detailed design phase.

South Block Configuration

The South Block catchment comprises Pump Stations 6, 7, 8, 9, and 10, arranged to convey flows progressively to a central collection point at Pump Station 6.

- Pump Station 8 discharges directly into the wet well of Pump Station 7.
- Pump Station 7 conveys the combined flow from Pump Station 8 and its own catchment to Pump Station 6.
- Pump Station 10 discharges directly into the wet well of Pump Station 9.
- Pump Station 9 conveys its flow independently to Pump Station 6.

- No intermediate junctions exist between these branches, Pump Station 7, and Pump Station 9 each discharge independently into Pump Station 6.

Pump Station 6 functions as the central collection hub for the South Block, receiving the combined flow from Pump Stations 7 and 8, as well as the independent flow from Pump Stations 9 and 10 via Pump Station 9. A duty pump rated at 91 L/s at Pump Station 6 lifts the total combined flow through the South Block DN400 bulk rising main, discharging directly to the Wastewater Treatment Plant.

During early stages of development, prior to full build out of the South Block stations, cumulative flows reaching Pump Station 6 will be insufficient to achieve the minimum self-cleansing velocity of 1.0 m/s in the bulk main. To address this, a temporary external water flush system will be implemented at Pump Station 6 to maintain solids transport until natural inflows reach the required level. Detailed design of the external flush system will be developed during the detailed design phase.

System Wide Hydraulic Control

To maintain self-cleansing velocity in both bulk mains during low-flow periods, a daily scour cycle is required until natural flows are adequate. Based on hydraulic analysis, each DN400 main must achieve a minimum velocity of 1.0 m/s for 133 minutes per 24-hour cycle to fully displace the 726 m^3 pipe volume and transport settled solids to the treatment plant.

During this scour cycle, the temporary external water flush system will provide supplementary flow of up to 80 L/s when natural inflows are insufficient. The timing of the daily scour cycle (approximately 133 minutes) will be coordinated to occur during diurnal low-flow periods, ensuring the additional hydraulic load does not exceed the downstream WWTP's peak processing capacity.

6.2.4. CONNECTION TO EXISTING NETWORK

The proposed wastewater system will connect and discharge to the Te Puke Wastewater Treatment Plant. Capacity for the proposed development has been confirmed by Western Bay of Plenty District Council (WBOPDC).

This correspondence is included within the consultation record.

7. WATER SUPPLY

The WBOPDC Development Code sets out the design principles for water supply and requires assessment against SNZ PAS 4509:2008 NZ Fire Service Fire Fighting Water Supply Code of Practice.

In conjunction with reading this report, please refer to the proposed water supply plans prepared by Maven. Water Supply Calculations are attached as Appendix C.

7.1. EXISTING WATER SUPPLY

The existing water supply network servicing the Bell Road area is owned by Tauranga City Council and consists of a 150mm diameter uPVC water main running along Bell Road. Hydraulic modelling undertaken as part of the Bell Road Water Supply Network Impact Assessment by HAL (Appendix D) confirms that the existing DN150mm main has limited capacity and is only able to service a small number of additional residencies. As a result, the existing infrastructure requires upgrading to service the proposed development.

7.2. PROPOSED WATER SUPPLY

A 560mm OD PE bulk main is proposed along the western boundary of the South Block to connect into the existing Waiāri trunk water main. The internal water supply network has been designed as a looped reticulation system to improve reliability and operational resilience. The network will maintain a minimum residential working pressure of 300 kPa, provide sufficient capacity for peak demand and firefighting supply complying with WBOPDC Development Code. Figure 15, below, shows an overall diagram of the water supply network.

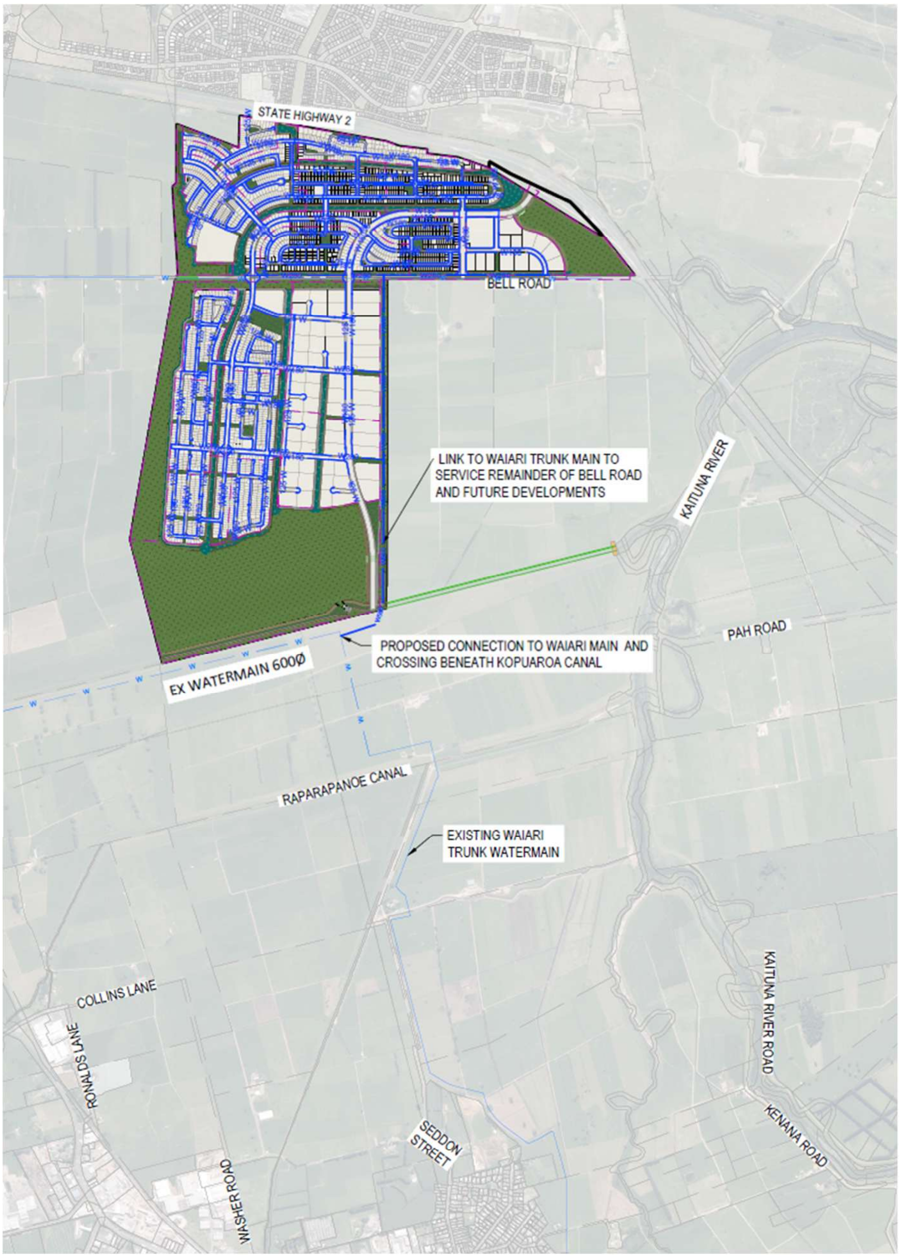


Figure 15: Water Supply Network **(C600s - Appendix D of the AEE)**

7.2.1. POTABLE SUPPLY

The proposed water supply pipe reticulation has been sized using EPANET hydraulic modelling to accommodate for 2750 lots, ensuring compliance with the WBOPDC Development Code requirements for capacity and pressure. The proposed reticulation network is shown on the associated water supply drawings.

Pre-treatment of water is provided by Council, and no further treatment is required.

7.2.2. FIRE FIGHTING

The minimum firefighting water supply classification required by the WBOPDC Development Code is to be in accordance with SNZ PAS 4509 NZ Fire Fighting Supply Code of Practice.

Minimum water supply is specified as FW2. Therefore, the proposed development must meet the following water supply requirements:

- A primary water flow of 25L/s within a distance of 135m
- An additional secondary flow of 25L/s within a distance of 270m
- The required flow must be achieved from a maximum of 3 hydrants operating simultaneously.
- A minimum firefighting residential running pressure shall be 100kPa.
- A minimum working residential water pressure shall be 300kPa.

Within the industrial and commercial lots, the subdivision water supply network will provide FW2 firefighting coverage via fire hydrants, with hydrants spaced at 90m achieving compliant access and coverage in accordance with SNZ PAS 4509. Any firefighting requirements exceeding FW2 will be addressed at the Building Consent stage through building-specific firefighting systems, such as on-site fire storage tanks and pumps.

7.2.3. WATER SUPPLY MODELLING

The peak water demand for the proposed development has been calculated as 214.15 L/s in accordance with the WBOPDC Development Code. A summary of the demand calculations is provided in Appendix C.

Hydraulic modelling of the proposed internal water supply network was undertaken using EPANET to assess system performance under critical loading conditions. The model adopted an available head of 50 m at the point of connection to the existing Waiāri trunk water main, representing a conservative upstream supply condition.

Peak Demand Scenario 1

A steady-state analysis was undertaken applying the full calculated peak demand of 214.15 L/s uniformly across the development (Figure 16). This represents a conservative assessment assuming simultaneous peak demand throughout the network.

The model confirms that the proposed network maintains adequate capacity and achieves the required minimum residual pressures under this peak demand condition. The peak demand scenario was also assessed in combination with firefighting flow requirements in accordance with SNZ PAS 4509, confirming compliance with pressure and flow requirements during emergency conditions.

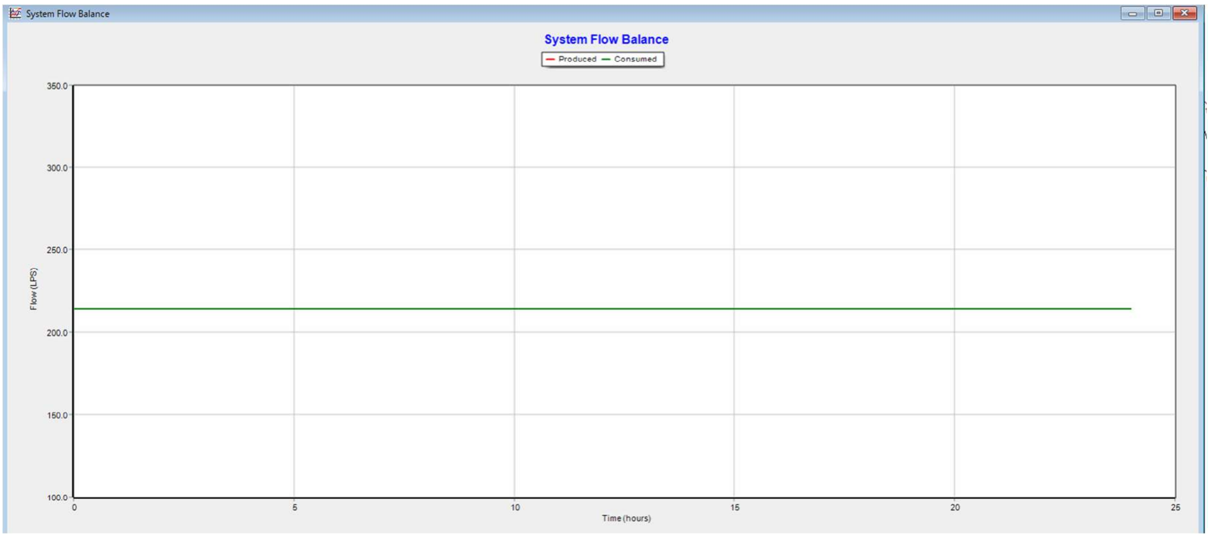


Figure 16: System Flow Scenario 1

Figure 17: Pressure Contour Scenario 1

Average Demand Scenario 2

A separate extended period simulation was undertaken to assess network performance under normal operating conditions. An average system demand of 42.9 L/s was applied using a representative diurnal demand pattern to simulate daily variations in water use.

The time-series analysis confirms that, throughout the daily demand cycle, the network operates within the specified hydraulic performance criteria, maintaining a minimum pressure of 30m.

Relevant modelling outputs are provided in figure 18 & 19, below.

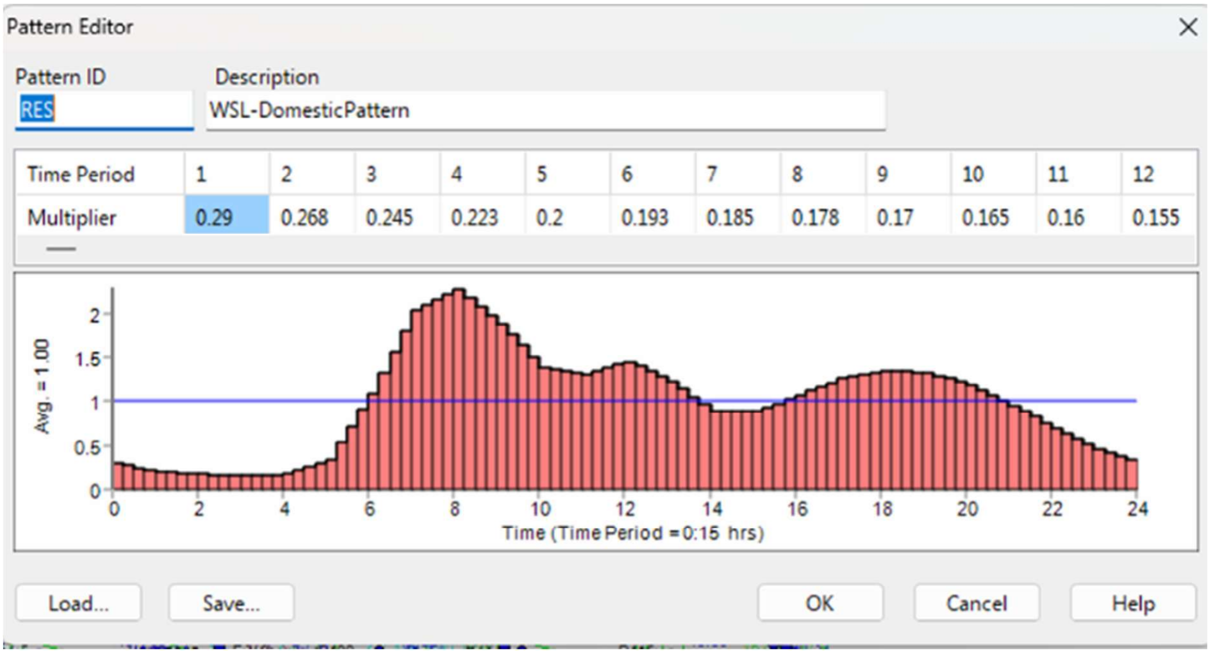


Figure 18: Domestic Pattern-Scenario 2

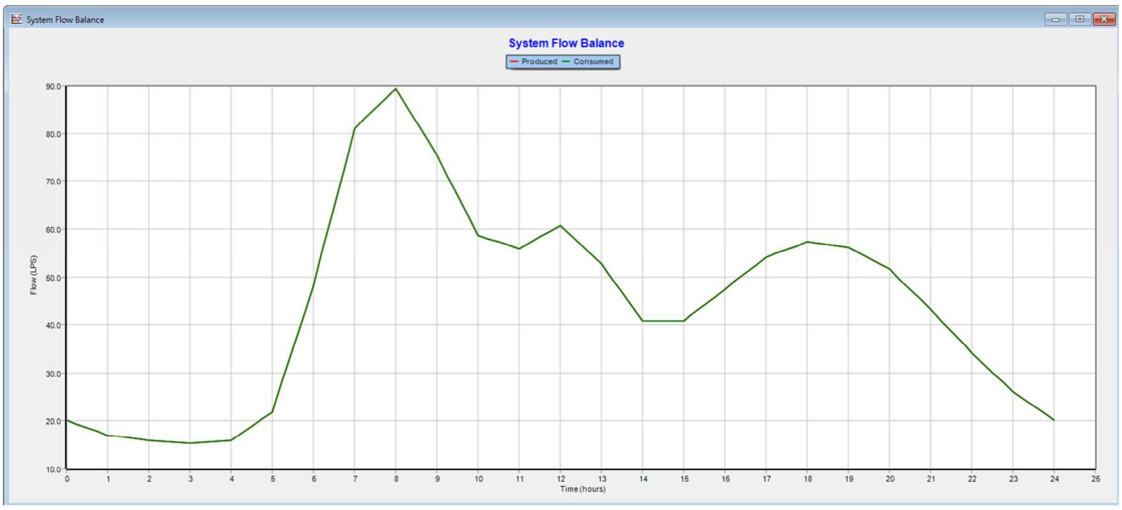


Figure 19: System flow throughout the day Scenario 2

7.2.4. CONNECTION TO EXISTING NETWORK

The proposed development water supply will connect to the existing Waiāri trunk water main. Capacity and formal approval have been confirmed by Western Bay of Plenty District Council (WBOPDC).

This correspondence is included within the consultation record (Appendix AB of the AEE).

8. UTILITIES

8.1. POWER SUPPLY

Power supply within the wider Bay of Plenty area is managed by Powerco. Powerco has been engaged throughout the design process as both a neighbouring landowner and network service provider to confirm the availability of capacity to service the Wairakei South development. Powerco has advised that existing overhead network infrastructure within Bell Road can accommodate the initial 600 lots of the development, with network upgrades required to service the overall development.

Conditional approval and technical guidance have been provided by Powerco (attached as Appendix E), with further details included in the Consultation Report completed by Maven (Appendix AB of the AEE).

A new internal power supply network will be constructed within the common service trenches in the road reserves of the development. A point of supply will be provided to each lot created. Typical servicing arrangements are shown on the common services drawings (C700s - Appendix D of the AEE).

Formal power supply design will be commissioned and provided at Engineering Plan Approval stage.

8.2. COMMUNICATION SUPPLY

Tuatahi First Fibre (TFF) are a telecommunications supplier in Bay of Plenty area. TFF has been engaged throughout the design process to confirm the availability and capacity of fibre infrastructure to service the Wairakei South development. TFF has advised that its network is available in Pāpāmoa East, directly adjacent to the TEL PEI, and can be readily extended south to service the development site.

Conditional approval and technical guidance have been provided by TFF (Appendix E), with further details included in the Consultation Register.

A new internal fibre telecommunications network will be constructed within the common service trenches in the road reserves of the development. A point of connection will be provided to each lot created. Typical servicing arrangements are shown on the common services drawings. Refer to the Engineering Drawings (C700s - Appendix D of the AEE) for further detail.

Formal telecommunications network design will be commissioned and provided at Engineering Plan Approval stage.

8.3. GAS SUPPLY

Gas reticulation within the wider Bay of Plenty area is managed by Firstgas, who were consulted to confirm the availability and feasibility of a reticulated gas connection to the development. Firstgas advised that there is no existing gas reticulation infrastructure in the immediate vicinity of the site and that extension of the network would not be practical. As an alternative, Firstgas recommended that the development be serviced by individual bottled LPG systems. Accordingly, provision for gas will be on a lot-by-lot basis, with individual landowners responsible for determining and arranging their own energy supply solutions. Evidence of consultation with Firstgas is provided in the Consultation Register and attached as Appendix E.

8.4. LIGHTING

Lighting of public roads will be designed to conform with Western Bay of Plenty District Council and NZTA requirements, and the position of light poles is shown on the typical roading cross sections. Further lighting detail will be provided at Engineering Plan Approval stage.

9. DEPARTURES FROM REGULATORY OR DESIGN CODES

There are no known departures from WBOPDC design standards.

Proposed infrastructure servicing can be achieved consistent with the requirements of the WBOPDC Development Code, and other relevant engineering standards. Subject to detailed design and approval we believe there are no infrastructure issues that would preclude the Site being developed for the proposed land use.

Final servicing solutions will be confirmed in consultation with WBOPDC.

10. CONCLUSION

The proposed development has been designed to provide a comprehensive and integrated infrastructure servicing solution that supports the intended use of the site and the delivery of housing employment/industrial land, and infrastructure. Roading, earthworks, stormwater, wastewater, water supply, and utilities have been assessed and designed in accordance with the Bay of Plenty Regional Council (BOPRC) guidelines, the Western Bay of Plenty District Council (WBOPDC) Development Code, NZS 4404:2010, and the Tauranga City Council Infrastructure Development Code (IDC), as applicable.

The earthworks strategy, including raising of the site and ground improvement measures, addresses existing flood and geotechnical constraints and has been designed to protect future homes and businesses from flood risk while appropriately managing floodplain displacement effects.

The stormwater system incorporates conveyance swales, wetlands, and attenuation measures to avoid any adverse impacts on adjoining properties while providing treatment and storage to meet Council requirements prior to discharge.

Wastewater and water supply servicing can be provided efficiently via connection to existing trunk infrastructure, with reticulation and pump stations designed to support staged development and long-term network operation.

Roading infrastructure provides safe and efficient access to and within the site and integrates with the surrounding transport network.

Electricity and telecommunications services can be readily extended to service the development.

Overall, no infrastructure constraints have been identified that would prevent the development of the site. Subject to detailed design and the relevant engineering and building approvals, the proposal is capable of being delivered in a practical, efficient, and resilient manner.

11. LIMITATIONS

This report is solely for our clients use for the purpose for which it is intended in accordance with the agreed scope of work. It may not be disclosed to any person other than the client and any use or reliance by any person contrary to the above, to which Maven has not given its prior written consent, is prohibited. Notwithstanding the above, the Panel may rely on the assessments and conclusions in this report for the purposes of assessing and determining the fast-track application.

This report must be read in its entirety and no portion of it should be relied on without regard to the limitations and disclaimers set out.

Maven BOP Limited makes no assurances with respect to the accuracy of assumptions and exclusions listed within this report and some may vary significantly due to ongoing stakeholder engagement.

APPENDIX A – STORMWATER CALCULATIONS

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	MB
Reviewed By	RC
Date	23/04/2026
Calculation Title	SW RUNOFF PRELIMINARY CALCUATIONS
Calculation No.	SW-1

Maven Bay of Plenty

Estimated Land Use Post-Development, per 1000m²

Land Use Breakdown - Residential Zone

Catchment	Area	Runoff Area (to Catchpits)	Lot Connection (Roofs)	Notes
Road Reserve	210m²	210m²	0m²	
ROW's	48m²	48m²	0m²	
Residential Lots	729m²	365m²	365m²	Roof area = 50% of lot area
Additional Driveways	13m²	13m²	0m²	
TOTAL	**1000m²**	**636m²**	**365m²**	

Land Use Breakdown - Industrial Zone

Catchment	Area	Runoff Area (to Catchpits)	Lot Connection (Lots)	Notes
Road Reserve	210m²	210m²	0m²	
ROW's	48m²	48m²	0m²	
Industrial Lots (80% MPD)	729m²	0m²	729m²	All lot runoff direct to retic
Additional Driveways	13m²	13m²	0m²	
TOTAL	**1000m²**	**271m²**	**729m²**	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	MB
Reviewed By	RC
Date	23/04/2026
Calculation Title	SW RUNOFF PRELIMINARY CALCUATIONS
Calculation No.	SW-2

MAVEN
Maven Bay of Plenty

Residential Zone C Values

Impervious Coverage Assumptions

Surface	Impervious %	Impervious C	Pervious %	Pervious C
Road Reserve	70.0%	0.90	30.0%	0.25
ROWs	85.0%	0.90	15.0%	0.25
Residential Lots	80.0%	0.90	20.0%	0.25
Residential Roofs	100.0%	0.90	0.0%	0.25
Residential Lots (Excl. Roofs)	60.0%	0.90	40.0%	0.25
Industrial Lots (80% MPD)	80.0%	0.90	20.0%	0.25
Additional Driveways	100.0%	0.90	0.0%	0.25

Residential Zone Average

(Per 1000m²)

Surface	Area (m²)	Impervious Area (m²)	Pervious Area (m²)	Weighted C
Road Reserve	210	147	63	
ROWs	48	41	7	
Residential Lots	729	583	146	
Additional Driveways	13	13	0	
TOTAL	**1000m²**	**784m²**	**216m²**	
Impervious %	**78%**		**C:**	**0.76**

Residential Zone Runoff to Catchpits

(Overland flow)

Surface	Area (m²)	Impervious Area (m²)	Pervious Area (m²)	Weighted C
Road Reserve	210	147	63	
ROWs	48	41	7	
Residential Lots (Excl. Roofs)	365	219	146	
Additional Driveways	13	13	0	
TOTAL	**636m²**	**420m²**	**216m²**	
Impervious %	**66%**		**C:**	**0.68**

Residential Zone Lot Connections

(Direct connection to SW reticulation)

Surface	Area (m²)	Impervious Area (m²)	Pervious Area (m²)	Weighted C
Residential Roofs	365	365	0	
TOTAL	**365m²**	**365m²**	**0m²**	
Impervious %	**100%**		**C:**	**0.90**

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	MB
Reviewed By	RC
Date	23/04/2026
Calculation Title	SW RUNOFF PRELIMINARY CALCUATIONS
Calculation No.	SW-3

MAVEN
Maven Bay of Plenty

Industrial Zone C Values

Impervious Coverage Assumptions

Surface	Impervious %	Impervious C	Pervious %	Pervious C
Road Reserve	70.0%	0.90	30.0%	0.25
ROWs	85.0%	0.90	15.0%	0.25
Residential Lots	80.0%	0.90	20.0%	0.25
Residential Roofs	100.0%	0.90	0.0%	0.25
Residential Lots (Excl. Roofs)	60.0%	0.90	40.0%	0.25
Industrial Lots (80% MPD)	80.0%	0.90	20.0%	0.25
Additional Driveways	100.0%	0.90	0.0%	0.25

Industrial Zone Average

(Per 1000m²)

Surface	Area (m²)	Impervious Area (m²)	Pervious Area (m²)	Weighted C
Road Reserve	210	147	63	
ROWs	48	41	7	
Industrial Lots (80% MPD)	729	583	146	
Additional Driveways	13	13	0	
TOTAL	**1000m²**	**784m²**	**216m²**	
Impervious %	**78%**		**C:**	**0.76**

Industrial Zone Runoff to Catchpits

(Overland flow)

Surface	Area (m²)	Impervious Area (m²)	Pervious Area (m²)	Weighted C
Road Reserve	210	147	63	
ROWs	48	41	7	
Additional Driveways	13	13	0	
TOTAL	**271m²**	**201m²**	**70m²**	
Impervious %	**74%**		**C:**	**0.73**

Industrial Zone Lot Connections

(Direct connection to SW reticulation)

Surface	Area (m²)	Impervious Area (m²)	Pervious Area (m²)	Weighted C
Industrial Lots (80% MPD)	729	583	146	
TOTAL	**729m²**	**583m²**	**146m²**	
Impervious %	**80%**		**C:**	**0.77**

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	MB
Reviewed By	RC
Date	23/04/2026
Calculation Title	SW RUNOFF PRELIMINARY CALCUATIONS
Calculation No.	SW-4

Maven Bay of Plenty

Primary and Secondary System - Design Rainfall Data

	Primary System Design - RCP8.5 2081-2100 HIRDS		
Event	2 Year ARI	5 Year ARI	10 Year ARI
10min	84.7mm/hr	115.0mm/hr	139.0mm/hr
20min	66.0mm/hr	89.7mm/hr	108.0mm/hr
30min	56.0mm/hr	76.0mm/hr	91.4mm/hr
1hr	41.0mm/hr	55.5mm/hr	66.6mm/hr
2hr	28.6mm/hr	38.5mm/hr	46.2mm/hr
6hr	14.6mm/hr	19.5mm/hr	23.3mm/hr
12hr	9.0mm/hr	12.0mm/hr	14.4mm/hr
24hr	5.3mm/hr	7.1mm/hr	8.5mm/hr
48hr	3.1mm/hr	4.1mm/hr	4.8mm/hr
72hr	2.2mm/hr	2.9mm/hr	3.4mm/hr
96hr	-	-	-
120hr	-	-	-

	Secondary System Design - HIRDS with 3.68°C CC adjustment	
Event	50 Year ARI	100 Year ARI
10min	-	-
20min	-	-
30min	-	-
1hr	95.0mm/hr	120.2mm/hr
2hr	65.5mm/hr	82.6mm/hr
6hr	32.7mm/hr	41.1mm/hr
12hr	19.9mm/hr	24.8mm/hr
24hr	11.5mm/hr	14.3mm/hr
48hr	6.5mm/hr	8.1mm/hr
72hr	4.6mm/hr	5.7mm/hr
96hr	3.5mm/hr	4.3mm/hr
120hr	2.9mm/hr	3.5mm/hr

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	MB
Reviewed By	RC
Date	23/04/2026
Calculation Title	SW RUNOFF PRELIMINARY CALCUATIONS
Calculation No.	SW-5

MAVEN
Maven Bay of Plenty

Design Flows - Stormwater Reticulation

Runoff Category	C	I (mm/hr)	A (m²)	Q (L/s)	Notes
Residential Runoff to Catchpits	0.68	139	**1619**	27.0*	A = Max area per catch pit
Residential Lot Connections	0.90	139	1000	**12.7**	Q = Roof runoff per 1000m² (364.5m² roof per 1000m²)
Industrial Runoff to Catchpits	0.73	139	**955**	27.0*	A = Max area per catch pit
Industrial Lot Connections	0.77	139	1000	**29.8**	Q = Lot runoff per 1000m²

*Catchpit maximum design flow rate of 27L/s assumed based on Hynds D5A Catchpit Flow Rate Information

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	MB
Reviewed By	RC
Date	24/03/2026
Calculation Title	SW PIPE CAPACITY CALCULATIONS
Calculation No.	SW-6

Maven Bay of Plenty

Stormwater Pipe Capacity Calculations

Pipe Name	Pipe Material	Diameter (mm)	Slope (%)	Mannings Formula			
				Mannings n	Depth Ratio	Velocity (m/s)	Capacity (L/s)
300	uPVC	0.300	0.55	0.011	0.8	1.4	82.8
375	uPVC	0.375	0.55	0.011	0.8	1.6	150.2
450	RCRRJ	0.450	0.55	0.013	0.8	1.5	206.7
525	RCRRJ	0.525	0.55	0.013	0.8	1.7	311.8
600	RCRRJ	0.600	0.55	0.013	0.8	1.8	445.1
675	RCRRJ	0.675	0.55	0.013	0.8	2.0	609.3
750	RCRRJ	0.750	0.55	0.013	0.8	2.1	807.0
825	RCRRJ	0.825	0.55	0.013	0.8	2.3	1040.6
900	RCRRJ	0.900	0.55	0.013	0.8	2.4	1312.3
975	RCRRJ	0.975	0.55	0.013	0.8	2.5	1624.6
1050	RCRRJ	1.050	0.55	0.013	0.8	2.7	1979.5

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-7

MAVEN
Maven Bay of Plenty

Wetland Preliminary Design - Runoff - General

Estimated Post Development Residential Land Use (per 1000m²)

Catchment	A (m²)	A (ha)	C
Land use in Runoff Calculations SW-1 to SW-3.			
Impervious %	78.4%		0.76

Design Storm

Storm Event	I (mm/h)	Duration
Water Quality Storm (WQS)	30	1 hour

**WQS Rainfall intensity taken from Stormwater Management Guidelines for the Bay of Plenty region 7.3.3, page 92*

Subcatchment Info - Pre Development

C	0.20		
2-yr 1-hr rainfall	31.4	mm	← *HIRDS Historical Data (10min Tc)*
10-yr 1-hr rainfall	50.1	mm	← *HIRDS Historical Data (10min Tc)*

Subcatchment	Area	Q_2	Q_{10}
S1	13 ha	0.23m³/s	0.36m³/s
S3	20 ha	0.34m³/s	0.55m³/s
S4	35 ha	0.61m³/s	0.97m³/s
S5	34 ha	0.59m³/s	0.94m³/s
S6	22 ha	0.39m³/s	0.62m³/s
S7	4 ha	0.06m³/s	0.10m³/s
N1 & N6	50 ha	0.87m³/s	1.38m³/s
N2	39 ha	0.68m³/s	1.08m³/s
N3	17 ha	0.31m³/s	0.49m³/s
N5	10 ha	0.17m³/s	0.28m³/s
N7	21 ha	0.36m³/s	0.58m³/s

**Runoff rates determined using Rational Method Q=0.00278(C)(I)(A) where A = hectares*

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

Subcatchment	Area	Q_2	V_2	Q_{10}	V_{10}
S1	13 ha	1.13m³/s	6,127m³	1.84m³/s	9,939m³
S3	20 ha	1.72m³/s	9,289m³	2.79m³/s	15,069m³
S4	35 ha	3.04m³/s	16,408m³	4.93m³/s	26,618m³
S5	34 ha	2.94m³/s	15,859m³	4.76m³/s	25,728m³
S6	22 ha	1.93m³/s	10,437m³	3.14m³/s	16,932m³
S7	4 ha	0.31m³/s	1,688m³	0.51m³/s	2,739m³
N1 & N6	50 ha	4.32m³/s	23,347m³	7.01m³/s	37,876m³
N2	39 ha	3.39m³/s	18,281m³	5.49m³/s	29,657m³
N3	17 ha	1.52m³/s	8,229m³	2.47m³/s	13,350m³
N5	10 ha	0.87m³/s	4,716m³	1.42m³/s	7,651m³
N7	21 ha	1.81m³/s	9,753m³	2.93m³/s	15,822m³

**Runoff rates determined using Rational Method Q=0.00278(C)(I)(A) where A = hectares*

**Volume=1.5(Q)(D) per SWM for the Bay of Plenty region*

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-8

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S1

Wetland Swale S1 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale S1 Flow rates

Water quality Flow rate (WQF)	1.13	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	1.84	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale S1 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	7.5	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1466	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	15.5	m	*← Includes freeboard above 10 year event*
Water width WQF =	13.2	m	

Wetland Swale S1 Swale calculations

	WQF	**10 Year**	
Water depth (D) =	0.954	1.239	*m*
Water surface width =	13.23	14.93	*m*
Cross sectional area (A)=	9.89	13.90	*m^2*
Wetted perimeter (P) =	13.54	15.34	*m*
Hydraulic Radius (R(hy)) =	0.73	0.91	*m*
Swale Velocity (V)=	0.115	0.132	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	1.135	1.841	m^3/s
Required flow (Q) =	1.135	1.841	m^3/s
Q OK?	OK	OK	

Wetland Swale S1 Hydraulic Residence Time (HTR)

HTR WQF		213	min	*← min. 9min for WQ*
Minimum HTR OK?	OK			
Min. Length of swale to meet WQF		62	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-9

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S1 Inflows

Wetland Swale S1 Inflows Specifications

Longitudinal grade =	0.02	%	← *Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	7.5	m	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1466	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		← *0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	8.1	m	← *Includes freeboard above 10 year event*
Water width WQF =	7.5	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality											10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	0.879	0.879	0.077	0.204	1466	1.65	8.79	0.188	0.046	OK	526	OK	8.72	0.124	0.271	2.25	9.21	0.244	0.055	OK	9.12
B	1.644	2.523	0.220	0.378	1327	3.26	9.89	0.330	0.067	OK	328	OK	9.77	0.357	0.499	4.49	10.66	0.421	0.079	OK	10.49
C	0.512	3.035	0.265	0.420	1295	3.68	10.16	0.362	0.072	OK	300	OK	10.02	0.429	0.555	5.08	11.01	0.462	0.084	OK	10.83
D	3.101	6.135	0.535	0.628	1081	5.90	11.47	0.514	0.091	OK	199	OK	11.27	0.868	0.824	8.21	12.71	0.646	0.106	OK	12.44
E	1.658	7.793	0.680	0.719	813	6.94	12.05	0.576	0.098	OK	138	OK	11.81	1.103	0.940	9.69	13.44	0.721	0.114	OK	13.14
F	1.096	8.889	0.775	0.774	665	7.60	12.39	0.613	0.102	OK	109	OK	12.14	1.258	1.009	10.63	13.88	0.765	0.118	OK	13.56
G	1.566	10.455	0.912	0.846	563	8.50	12.85	0.661	0.107	OK	87	OK	12.58	1.479	1.102	11.91	14.47	0.823	0.124	OK	14.11
H	2.591	13.046	1.138	0.956	314	9.91	13.55	0.732	0.115	OK	46	OK	13.23	1.846	1.241	13.93	15.35	0.907	0.133	OK	14.95

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-10

M A E N
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S3

Wetland Swale S3 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale S3 Flow rates

Water quality Flow rate (WQF)	1.72	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	2.79	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale S3 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	15.2	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1276	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	22.5	m	*← Includes freeboard above 10 year event*
Water width WQF =	20.3	m	

Wetland Swale S3 Swale calculations

	WQF	**10 Year**	
Water depth (D) =	0.846	1.116	*m*
Water surface width =	20.27	21.90	*m*
Cross sectional area (A)=	15.00	20.71	*m^2*
Wetted perimeter (P) =	20.55	22.26	*m*
Hydraulic Radius (R(hy)) =	0.73	0.93	*m*
Swale Velocity (V)=	0.115	0.135	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	1.720	2.791	m^3/s
Required flow (Q) =	1.720	2.791	m^3/s
Q OK?	OK	OK	

Wetland Swale S3 Hydrauli Residence Time (HTR)

HTR WQF		185	min	*← min. 9min for WQ*
Minimum HTR OK?	OK			
Min. Length of swale to meet WQF		62	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-11

Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S3 Inflows

Wetland Swale S3 Inflows Specifications

Longitudinal grade =	0.02	%	← *Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	15.2	m	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1276	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		← *0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	15.8	m	← *Includes freeboard above 10 year event*
Water width WQF =	15.2	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality											10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	1.094	1.094	0.095	0.154	1276	2.40	16.17	0.149	0.040	OK	536	OK	16.12	0.155	0.205	3.24	16.50	0.196	0.048	OK	16.43
B	2.865	3.959	0.345	0.330	1047	5.34	17.29	0.309	0.065	OK	270	OK	17.18	0.560	0.439	7.25	17.98	0.403	0.077	OK	17.83
C	2.433	6.392	0.557	0.438	907	7.23	17.97	0.402	0.077	OK	196	OK	17.83	0.904	0.582	9.86	18.88	0.522	0.092	OK	18.69
D	2.305	8.697	0.758	0.525	772	8.80	18.52	0.475	0.086	OK	149	OK	18.35	1.230	0.696	12.04	19.60	0.614	0.102	OK	19.38
E	3.056	11.753	1.025	0.626	600	10.69	19.16	0.558	0.096	OK	104	OK	18.96	1.663	0.829	14.67	20.45	0.718	0.113	OK	20.18
F	2.491	14.244	1.242	0.700	450	12.12	19.63	0.617	0.103	OK	73	OK	19.40	2.015	0.927	16.66	21.06	0.791	0.121	OK	20.76
G	2.506	16.750	1.461	0.769	318	13.47	20.07	0.671	0.108	OK	49	OK	19.82	2.370	1.017	18.56	21.63	0.858	0.128	OK	21.30
H	3.020	19.769	1.724	0.847	152	15.02	20.56	0.731	0.115	OK	22	OK	20.28	2.797	1.118	20.74	22.27	0.931	0.135	OK	21.91

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-12

Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S4

Wetland Swale S4 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale S4 Flow rates

Water quality Flow rate (WQF)	3.04	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	4.93	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale S4 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	18	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1271	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	27.1	m	*← Includes freeboard above 10 year event*
Water width WQF =	24.4	m	

Wetland Swale S4 Swale calculations

	WQF	10 Year	
Water depth (D) =	1.072	1.414	*m*
Water surface width =	24.43	26.48	*m*
Cross sectional area (A)=	22.75	31.44	*m^2*
Wetted perimeter (P) =	24.78	26.94	*m*
Hydraulic Radius (R(hy)) =	0.92	1.17	*m*
Swale Velocity (V)=	0.134	0.157	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	3.038	4.929	m^3/s
Required flow (Q) =	3.038	4.929	m^3/s
Q OK?	OK	OK	

Wetland Swale S4 Hydraulic Residence Time (HTR)

HTR WQF	159	min	*← min. 9min for WQ*
Minimum HTR OK?	OK		
Min. Length of swale to meet WQF	72	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-13

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S4 Inflows

Wetland Swale S4 Inflows Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	18	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1271	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	18.6	m	*← Includes freeboard above 10 year event*
Water width WQF =	18.0	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	*← HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	*← HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality											10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	1.841	1.841	0.161	0.189	1271	3.52	19.20	0.183	0.046	OK	464	OK	19.14	0.260	0.253	4.74	19.60	0.242	0.055	OK	19.52
B	2.555	4.395	0.383	0.318	1224	6.03	20.01	0.301	0.064	OK	321	OK	19.91	0.622	0.424	8.17	20.68	0.395	0.076	OK	20.54
C	2.111	6.506	0.567	0.401	1148	7.71	20.54	0.375	0.074	OK	260	OK	20.41	0.921	0.534	10.47	21.38	0.490	0.088	OK	21.21
D	4.441	10.947	0.955	0.546	963	10.72	21.45	0.500	0.089	OK	180	OK	21.28	1.549	0.725	14.63	22.59	0.648	0.106	OK	22.35
E	4.684	15.631	1.363	0.673	794	13.47	22.26	0.605	0.101	OK	131	OK	22.04	2.212	0.892	18.45	23.64	0.780	0.120	OK	23.35
F	4.272	19.903	1.736	0.775	669	15.75	22.90	0.688	0.110	OK	101	OK	22.65	2.816	1.026	21.63	24.49	0.883	0.130	OK	24.16
G	2.743	22.646	1.975	0.836	522	17.13	23.28	0.736	0.115	OK	75	OK	23.01	3.204	1.105	23.56	24.99	0.943	0.136	OK	24.63
H	5.995	28.641	2.498	0.958	401	19.99	24.06	0.831	0.125	OK	53	OK	23.75	4.052	1.265	27.56	26.00	1.060	0.147	OK	25.59
I	4.747	33.388	2.912	1.046	168	22.12	24.62	0.898	0.132	OK	21	OK	24.28	4.724	1.380	30.55	26.73	1.143	0.155	OK	26.28
J	1.447	34.835	3.038	1.072	73	22.75	24.78	0.918	0.134	OK	9	OK	24.43	4.929	1.414	31.44	26.94	1.167	0.157	OK	26.48

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-14

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S5

Wetland Swale S5 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale S5 Flow rates

Water quality Flow rate (WQF)	2.94	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	4.76	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale S5 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	18.5	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1104	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	27.3	m	*← Includes freeboard above 10 year event*
Water width WQF =	24.7	m	

Wetland Swale S5 Swale calculations

	WQF	10 Year	
Water depth (D) =	1.036	1.367	*m*
Water surface width =	24.72	26.70	*m*
Cross sectional area (A)=	22.39	30.90	*m^2*
Wetted perimeter (P) =	25.05	27.15	*m*
Hydraulic Radius (R(hy)) =	0.89	1.14	*m*
Swale Velocity (V)=	0.131	0.154	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	2.937	4.764	m^3/s
Required flow (Q) =	2.937	4.764	m^3/s
Q OK?	OK	OK	

Wetland Swale S5 Hydraulic Residence Time (HTR)

HTR WQF	140	min	*← min. 9min for WQ*
Minimum HTR OK?	OK		
Min. Length of swale to meet WQF	71	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-15

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S5 Inflows

Wetland Swale S5 Inflows Specifications

Longitudinal grade =	0.02	%	← *Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	18.5	m	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1104	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		← *0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	19.1	m	← *Includes freeboard above 10 year event*
Water width WQF =	18.5	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality											10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	7.577	7.577	0.661	0.432	956	8.56	21.24	0.403	0.077	OK	206	OK	21.09	1.072	0.575	11.64	22.14	0.526	0.092	OK	21.95
B	5.380	12.957	1.130	0.594	830	12.04	22.25	0.541	0.094	OK	147	OK	22.06	1.833	0.788	16.44	23.48	0.700	0.112	OK	23.23
C	3.871	16.829	1.468	0.692	700	14.24	22.88	0.622	0.103	OK	113	OK	22.65	2.381	0.917	19.50	24.30	0.802	0.122	OK	24.00
D	4.796	21.625	1.886	0.801	546	16.75	23.57	0.711	0.113	OK	81	OK	23.31	3.060	1.061	23.00	25.21	0.912	0.133	OK	24.86
E	1.340	22.965	2.003	0.830	410	17.41	23.75	0.733	0.115	OK	59	OK	23.48	3.249	1.098	23.93	25.45	0.941	0.136	OK	25.09
F	4.633	27.597	2.407	0.923	262	19.64	24.34	0.807	0.123	OK	36	OK	24.04	3.905	1.220	27.04	26.22	1.032	0.144	OK	25.82
G	4.370	31.967	2.788	1.005	159	21.63	24.86	0.870	0.129	OK	21	OK	24.53	4.523	1.327	29.84	26.89	1.110	0.152	OK	26.46
H	1.606	33.573	2.928	1.034	94	22.34	25.04	0.892	0.131	OK	12	OK	24.70	4.750	1.365	30.84	27.13	1.137	0.154	OK	26.69

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-16

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S6

Wetland Swale S6 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale S6 Flow rates

Water quality Flow rate (WQF)	1.93	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	3.14	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale S6 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	19	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	672	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	26.0	m	*← Includes freeboard above 10 year event*
Water width WQF =	23.8	m	

Wetland Swale S6 Swale calculations

	WQF	10 Year	
Water depth (D) =	0.801	1.061	*m*
Water surface width =	23.80	25.36	*m*
Cross sectional area (A)=	17.14	23.52	*m^2*
Wetted perimeter (P) =	24.06	25.71	*m*
Hydraulic Radius (R(hy)) =	0.71	0.92	*m*
Swale Velocity (V)=	0.113	0.133	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	1.933	3.136	m^3/s
Required flow (Q) =	1.933	3.136	m^3/s
Q OK?	OK	OK	

Wetland Swale S6 Hydraulic Residence Time (HTR)

HTR WQF	99	min	*← min. 9min for WQ*
Minimum HTR OK?	OK		
Min. Length of swale to meet WQF	61	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-17

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S6 Inflows

Wetland Swale S6 Inflows Specifications

Longitudinal grade =	0.02	%	← *Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	19	m	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	672	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		← *0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	19.6	m	← *Includes freeboard above 10 year event*
Water width WQF =	19.0	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality												10 Year							
Swale Sub Catchment	**Area (ha)**	**Cumulitive Area (ha)**	**Q2 (m^3/s)**	**Water depth (m)**	**Swale Length (m)**	**Cross sectional area (m^2)**	**Wetted perimeter**	**Hydraulic Radius (R(hy))**	**Velocity (m/s)**	**Velocity ok? Max 0.8m/s**	**Residence Time (HTR) (min)**	**Min. 9 minute HTR OK?**	**Water surface width (m)**	**Q10 (m^3/s)**	**Water depth (m)**	**Cross sectional area (m^2)**	**Wetted perimeter**	**Hydraulic Radius (R(hy))**	**Velocity (m/s)**	**Velocity ok? Max 1.5m/s**	**Water surface width (m)**
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	4.543	4.543	0.396	0.314	677	6.27	20.99	0.299	0.063	OK	179	OK	20.89	0.643	0.419	8.49	21.65	0.392	0.076	OK	21.51
B	1.808	6.351	0.554	0.384	612	7.73	21.43	0.361	0.072	OK	142	OK	21.30	0.899	0.511	10.49	22.23	0.472	0.086	OK	22.06
C	1.377	7.728	0.674	0.431	555	8.74	21.73	0.402	0.077	OK	120	OK	21.59	1.093	0.573	11.88	22.63	0.525	0.092	OK	22.44
D	5.865	13.593	1.186	0.601	333	12.51	22.80	0.549	0.095	OK	59	OK	22.61	1.923	0.798	17.08	24.05	0.710	0.113	OK	23.79
E	3.426	17.019	1.484	0.686	174	14.45	23.34	0.619	0.103	OK	28	OK	23.12	2.408	0.910	19.78	24.76	0.799	0.122	OK	24.46
F	5.021	22.040	1.922	0.798	87	17.08	24.05	0.710	0.113	OK	13	OK	23.79	3.118	1.057	23.44	25.69	0.912	0.133	OK	25.34

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-18

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S7

Wetland Swale S7 Design Considerations

Wetland Swale function	Treatment only		
Swale shape	Trapezoid		
Sizing approach	Residence time		

Wetland Swale S7 Flow rates

Water quality Flow rate (WQF)	0.31	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	0.51	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale S7 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	7	m	*← BoPRC SWMG maximum 7m*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	300	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	11.4	m	*← Includes freeboard above 10 year event*
Water width WQF =	9.9	m	

Wetland Swale S7 Swale calculations

	WQF	10 Year	
Water depth (D) =	0.480	0.631	*m*
Water surface width =	9.88	10.79	*m*
Cross sectional area (A)=	4.05	5.61	*m^2*
Wetted perimeter (P) =	10.03	10.99	*m*
Hydraulic Radius (R(hy)) =	0.40	0.51	*m*
Swale Velocity (V)=	0.077	0.090	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	0.313	0.507	m^3/s
Required flow (Q) =	0.313	0.507	m^3/s
Q OK?	OK	OK	

Wetland Swale S7 Hydraulic Residence Time (HTR)

HTR WQF		65	min	*← min. 9min for WQ*
Minimum HTR OK?	OK			
Min. Length of swale to meet WQF		42	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-19

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale S7 Inflows

Wetland Swale S7 Inflows Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	7	m	*← BoPRC SWMG maximum 7m*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	300	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	7.6	m	*← Includes freeboard above 10 year event*
Water width WQF =	7.0	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	*← HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	*← HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality											10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m^2)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m^2)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	2.048	2.048	0.179	0.347	300	2.79	9.20	0.304	0.064	OK	78	OK	9.08	0.290	0.459	3.85	9.90	0.388	0.075	OK	9.76
B	1.537	3.584	0.313	0.480	130	4.05	10.03	0.403	0.077	OK	28	OK	9.88	0.507	0.631	5.61	10.99	0.511	0.090	OK	10.79

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-20

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N1

Wetland Swale N1 Design Considerations

Wetland Swale function	Treatment only	
Swale shape	Trapezoid	
Sizing approach	Residence time	

Wetland Swale N1 Flow rates

Water quality Flow rate (WQF)	4.32	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	7.01	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale N1 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	11	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1981	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	*← Above 10 year event*
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	24.5	m	*← Includes freeboard above 10 year event*
Water width WQF =	21.0	m	

Wetland Swale N1 Swale calculations

	WQF	10 Year	
Water depth (D) =	1.662	2.147	*m*
Water surface width =	20.97	23.88	*m*
Cross sectional area (A)=	26.56	37.46	*m^2*
Wetted perimeter (P) =	21.51	24.58	*m*
Hydraulic Radius (R(hy)) =	1.23	1.52	*m*
Swale Velocity (V)=	0.163	0.187	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	4.324	7.014	m^3/s
Required flow (Q) =	4.324	7.014	m^3/s
Q OK?	OK	OK	

Wetland Swale N1 Hydraulic Residence Time (HTR)

HTR WQF	203	min	*← min. 9min for WQ*
Minimum HTR OK?	OK		
Min. Length of swale to meet WQF	88	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-21

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N1 Inflows

Wetland Swale N1 Inflows Specifications

Longitudinal grade =	0.02	%	← *Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	11	m	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1981	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		← *0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	23.6	m	← *Includes freeboard above 10 year event*
Water width WQF =	20.3	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality												10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	3.539	3.539	0.309	0.372	1981	4.50	13.35	0.337	0.069	OK	482	OK	13.23	0.501	0.493	6.16	14.12	0.436	0.081	OK	13.96
B	4.161	7.701	0.672	0.585	1671	7.46	14.70	0.508	0.090	OK	309	OK	14.51	1.090	0.773	10.29	15.89	0.648	0.106	OK	15.64
C	0.980	8.681	0.757	0.627	1669	8.08	14.97	0.540	0.094	OK	297	OK	14.76	1.228	0.827	11.15	16.23	0.687	0.110	OK	15.96
D	1.083	9.764	0.852	0.671	1591	8.73	15.24	0.573	0.098	OK	272	OK	15.03	1.381	0.884	12.07	16.59	0.728	0.114	OK	16.31
E	5.037	14.802	1.291	0.851	1349	11.53	16.38	0.704	0.112	OK	201	OK	16.11	2.094	1.117	16.03	18.07	0.888	0.131	OK	17.70
F	1.750	16.551	1.443	0.907	1251	12.44	16.73	0.743	0.116	OK	180	OK	16.44	2.342	1.189	17.32	18.52	0.935	0.135	OK	18.13
G	5.126	21.677	1.891	1.055	1063	14.95	17.67	0.846	0.126	OK	140	OK	17.33	3.067	1.379	20.88	19.72	1.059	0.147	OK	19.28
H	6.300	27.978	2.440	1.216	889	17.81	18.69	0.953	0.137	OK	108	OK	18.30	3.958	1.584	24.96	21.02	1.187	0.159	OK	20.51
I	2.129	30.106	2.626	1.266	732	18.74	19.01	0.986	0.140	OK	87	OK	18.60	4.260	1.648	26.28	21.43	1.227	0.162	OK	20.89
J	2.421	32.528	2.837	1.322	564	19.78	19.36	1.022	0.143	OK	66	OK	18.93	4.602	1.718	27.76	21.87	1.269	0.166	OK	21.31
K	4.762	37.289	3.252	1.424	458	21.75	20.01	1.087	0.150	OK	51	OK	19.54	5.276	1.848	30.58	22.69	1.348	0.173	OK	22.09
L	0.832	38.121	3.325	1.441	400	22.09	20.12	1.098	0.151	OK	44	OK	19.65	5.393	1.870	31.06	22.83	1.361	0.174	OK	22.22
M	2.628	40.749	3.554	1.495	263	23.14	20.45	1.132	0.154	OK	29	OK	19.97	5.765	1.937	32.57	23.25	1.401	0.177	OK	22.62
N	2.782	43.531	3.796	1.549	193	24.24	20.80	1.165	0.157	OK	21	OK	20.29	6.159	2.006	34.13	23.69	1.441	0.180	OK	23.03
O	6.045	49.575	4.324	1.662	100	26.56	21.51	1.235	0.163	OK	10	OK	20.97	7.014	2.147	37.46	24.58	1.524	0.187	OK	23.88

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-22

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N2

Wetland Swale N2 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale N2 Flow rates

Water quality Flow rate (WQF)	3.39	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	5.49	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale N2 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	11	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1547	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	*← Above 10 year event*
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	22.9	m	*← Includes freeboard above 10 year event*
Water width WQF =	19.7	m	

Wetland Swale N2 Swale calculations

	WQF	10 Year	
Water depth (D) =	1.456	1.888	*m*
Water surface width =	19.73	22.33	*m*
Cross sectional area (A)=	22.37	31.46	*m^2*
Wetted perimeter (P) =	20.21	22.94	*m*
Hydraulic Radius (R(hy)) =	1.11	1.37	*m*
Swale Velocity (V)=	0.151	0.175	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	3.385	5.492	m^3/s
Required flow (Q) =	3.385	5.492	m^3/s
Q OK?	OK	OK	

Wetland Swale N2 Hydraulic Residence Time (HTR)

HTR WQF	170	min	*← min. 9min for WQ*
Minimum HTR OK?	OK		
Min. Length of swale to meet WQF	82	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-23

M A E N
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N2 Inflows

Wetland Swale N2 Inflows Specifications

Longitudinal grade =	0.02	%	← *Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	11	m	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1547	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		← *0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	11.6	m	← *Includes freeboard above 10 year event*
Water width WQF =	11.0	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality												10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	3.348	3.348	0.292	0.360	1547	4.35	13.28	0.327	0.067	OK	384	OK	13.16	0.474	0.478	5.94	14.02	0.424	0.080	OK	13.87
B	4.122	7.470	0.651	0.575	1466	7.31	14.64	0.500	0.089	OK	274	OK	14.45	1.057	0.759	10.08	15.80	0.638	0.105	OK	15.56
C	2.044	9.514	0.830	0.661	1271	8.58	15.18	0.565	0.097	OK	219	OK	14.97	1.346	0.871	11.86	16.51	0.719	0.113	OK	16.23
D	1.899	1.899	0.166	0.257	1427	3.03	12.63	0.240	0.055	OK	435	OK	12.54	0.269	0.343	4.12	13.17	0.313	0.065	OK	13.06
E	4.111	6.009	0.524	0.507	1291	6.34	14.20	0.447	0.083	OK	260	OK	14.04	0.850	0.670	8.72	15.24	0.572	0.097	OK	15.02
F	11.466	17.475	1.524	0.935	1192	12.91	16.91	0.763	0.118	OK	168	OK	16.61	2.472	1.225	17.98	18.75	0.959	0.138	OK	18.35
G	4.895	22.370	1.951	1.074	1044	15.27	17.79	0.858	0.128	OK	136	OK	17.44	3.165	1.403	21.34	19.87	1.074	0.148	OK	19.42
H	5.427	27.797	2.424	1.212	869	17.74	18.66	0.950	0.137	OK	106	OK	18.27	3.933	1.579	24.85	20.99	1.184	0.158	OK	20.47
I	5.837	33.635	2.933	1.346	576	20.24	19.51	1.037	0.145	OK	66	OK	19.08	4.759	1.749	28.42	22.06	1.288	0.167	OK	21.50
J	3.979	37.614	3.280	1.431	344	21.88	20.05	1.091	0.150	OK	38	OK	19.59	5.322	1.857	30.77	22.74	1.353	0.173	OK	22.14
K	1.186	38.800	3.384	1.455	83	22.36	20.20	1.107	0.151	OK	9	OK	19.73	5.489	1.888	31.45	22.94	1.371	0.175	OK	22.33

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-24

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N3

Wetland Swale N3 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale N3 Flow rates

Water quality Flow rate (WQF)	1.52	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	2.47	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale N3 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	8	m	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 7m)*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1218	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	*← Above 10 year event*
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	17.1	m	*← Includes freeboard above 10 year event*
Water width WQF =	14.5	m	

Wetland Swale N3 Swale calculations

	WQF	10 Year	
Water depth (D) =	1.088	1.411	*m*
Water surface width =	14.53	16.46	*m*
Cross sectional area (A)=	12.26	17.26	m^2
Wetted perimeter (P) =	14.88	16.92	*m*
Hydraulic Radius (R(hy)) =	0.82	1.02	*m*
Swale Velocity (V)=	0.124	0.143	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	1.524	2.472	m^3/s
Required flow (Q) =	1.524	2.472	m^3/s
Q OK?	OK	OK	

Wetland Swale N3 Hydraulic Residence Time (HTR)

HTR WQF	163	min	*← min. 9min for WQ*
Minimum HTR OK?	OK		
Min. Length of swale to meet WQF	67	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-25

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N5

Wetland Swale N5 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale N5 Flow rates

Water quality Flow rate (WQF)	0.87	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	1.42	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale N5 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	7	m	*← BoPRC SWMG maximum 7m*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	694	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	*← Above 10 year event*
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	14.3	m	*← Includes freeboard above 10 year event*
Water width WQF =	12.1	m	

Wetland Swale N5 Swale calculations

	WQF	10 Year	
Water depth (D) =	0.854	1.109	*m*
Water surface width =	12.12	13.66	*m*
Cross sectional area (A)=	8.16	11.46	*m^2*
Wetted perimeter (P) =	12.40	14.02	*m*
Hydraulic Radius (R(hy)) =	0.66	0.82	*m*
Swale Velocity (V)=	0.107	0.124	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	0.873	1.417	m^3/s
Required flow (Q) =	0.873	1.417	m^3/s
Q OK?	OK	OK	

Wetland Swale N5 Hydraulic Residence Time (HTR)

HTR WQF	108	min	*← min. 9min for WQ*
Minimum HTR OK?	OK		
Min. Length of swale to meet WQF	58	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-26

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N5 Inflows

Wetland Swale N5 Inflows Specifications

Longitudinal grade =	0.02	%	← *Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	7	m	← *BoPRC SWMG maximum 7m*
Side slope (z)=	3	to 1	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	694	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		← *0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	7.6	m	← *Includes freeboard above 10 year event*
Water width WQF =	7.0	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality											10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	1.203	1.203	0.105	0.255	694	1.98	8.61	0.230	0.053	OK	218	OK	8.53	0.170	0.338	2.71	9.14	0.296	0.063	OK	9.03
B	2.295	3.498	0.305	0.473	549	3.98	9.99	0.399	0.077	OK	119	OK	9.84	0.495	0.623	5.52	10.94	0.505	0.090	OK	10.74
C	1.521	5.019	0.438	0.581	476	5.08	10.67	0.476	0.086	OK	92	OK	10.49	0.710	0.762	7.07	11.82	0.598	0.100	OK	11.57
D	1.701	6.720	0.586	0.684	257	6.20	11.33	0.547	0.095	OK	45	OK	11.11	0.951	0.894	8.66	12.66	0.684	0.110	OK	12.37
E	3.280	10.000	0.872	0.853	127	8.15	12.39	0.658	0.107	OK	20	OK	12.12	1.415	1.109	11.45	14.01	0.817	0.124	OK	13.65

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-27

MAVEN
Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N7

Wetland Swale N7 Design Considerations

Wetland Swale function	Treatment only
Swale shape	Trapezoid
Sizing approach	Residence time

Wetland Swale N7 Flow rates

Water quality Flow rate (WQF)	1.81	m^3/s	*← Run-off from water quality storm using 2 year, 1 hour storm*
10 Year Flow Rate	2.93	m^3/s	*← Run-off from 10 year, 1 hour storm*

Wetland Swale N7 Specifications

Longitudinal grade =	0.02	%	*← Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	6	m	*← BoPRC SWMG maximum 7m*
Side slope (z)=	3	to 1	*← Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1012	m	*← Adjust length to get required HTR*
Freeboard =	0.1	m	*← Above 10 year event*
Mannings (n) =	0.1		*← 0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	16.9	m	*← Includes freeboard above 10 year event*
Water width WQF =	14.0	m	

Wetland Swale N7 Swale calculations

	WQF	**10 Year**	
Water depth (D) =	1.340	1.712	*m*
Water surface width =	14.04	16.27	*m*
Cross sectional area (A)=	13.43	19.06	*m^2*
Wetted perimeter (P) =	14.47	16.83	*m*
Hydraulic Radius (R(hy)) =	0.93	1.13	*m*
Swale Velocity (V)=	0.135	0.154	m/s
Velocity ok? Max 0.8m/s, 1.5m/s	OK	OK	
Swale design flow (Q) =	1.806	2.930	m^3/s
Required flow (Q) =	1.806	2.930	m^3/s
Q OK?	OK	OK	

Wetland Swale N7 Hydraulic Residence Time (HTR)

HTR WQF		125	min	*← min. 9min for WQ*
Minimum HTR OK?	OK			
Min. Length of swale to meet WQF		73	m	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	RH
Reviewed By	BB
Date	24/03/2026
Calculation Title	WETLAND SWALE PRELIMINARY DESIGN
Calculation No.	SW-28

Maven Bay of Plenty

Wetland Swale Preliminary Design - Northern Block - Wetland Swale N7 Inflows

Wetland Swale N7 Inflows Specifications

Longitudinal grade =	0.02	%	← *Maximum 2%*
Longitudinal slope (s) =	0.0002	m/m	
Base width (b)=	6	m	← *BoPRC SWMG maximum 7m*
Side slope (z)=	3	to 1	← *Outlier to meet flood storage requirements (BoPRC SWMG maximum 4 to 1)*
Length (l) =	1012	m	
Freeboard =	0.1	m	
Mannings (n) =	0.1		← *0.1 for planted swale as per SW Management Guidelines for the BOP 9.5.15*
Top width =	6.6	m	← *Includes freeboard above 10 year event*
Water width WQF =	6.0	m	

Subcatchment Info - Post Development

C	0.76		
2-yr 1-hr rainfall	41.3	mm	← *HIRDS RCP8.5 2081-2100*
10-yr 1-hr rainfall	67	mm	← *HIRDS RCP8.5 2081-2100*
Event duration (D)	3600	s	

			Water Quality											10 Year							
Swale Sub Catchment	Area (ha)	Cumulitive Area (ha)	Q2 (m^3/s)	Water depth (m)	Swale Length (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 0.8m/s	Residence Time (HTR) (min)	Min. 9 minute HTR OK?	Water surface width (m)	Q10 (m^3/s)	Water depth (m)	Cross sectional area (m²)	Wetted perimeter	Hydraulic Radius (R(hy))	Velocity (m/s)	Velocity ok? Max 1.5m/s	Water surface width (m)
			Q= 0.00278*C*I*A	d		A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		HTR= L/60*V		b+d*z*2	Q= 0.00278*C*I*A	d	A= bd+Zd²	P = b+2y√1+Z²	A / P	V=Q/A		b+d*z*2
A	3.506	3.506	0.306	0.513	1012	3.87	9.24	0.418	0.079	OK	213	OK	9.08	0.496	0.672	5.39	10.25	0.525	0.092	OK	10.03
B	4.240	7.745	0.675	0.796	819	6.68	11.03	0.605	0.101	OK	135	OK	10.78	1.096	1.032	9.39	12.53	0.750	0.117	OK	12.19
C	2.959	10.705	0.934	0.948	611	8.38	11.99	0.699	0.111	OK	91	OK	11.69	1.515	1.223	11.83	13.74	0.861	0.128	OK	13.34
D	1.490	12.195	1.064	1.016	531	9.19	12.43	0.740	0.116	OK	77	OK	12.10	1.725	1.309	12.99	14.28	0.910	0.133	OK	13.85
E	1.368	13.562	1.183	1.075	436	9.92	12.80	0.775	0.119	OK	61	OK	12.45	1.919	1.382	14.03	14.74	0.951	0.137	OK	14.29
F	0.973	14.535	1.268	1.115	373	10.42	13.05	0.798	0.122	OK	51	OK	12.69	2.056	1.432	14.75	15.06	0.979	0.139	OK	14.59
G	1.760	16.295	1.421	1.184	293	11.30	13.49	0.838	0.126	OK	39	OK	13.10	2.306	1.518	16.02	15.60	1.027	0.144	OK	15.11
H	4.441	20.736	1.808	1.341	149	13.44	14.48	0.928	0.135	OK	18	OK	14.05	2.934	1.713	19.08	16.83	1.134	0.154	OK	16.28

APPENDIX B – WASTEWATER CALCULATIONS

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	DP
Reviewed By	RC
Date	Mar-26
Calculation Title	WASTEWATER DEMAND CALCULATION AND STORAGE CHAMBER SIZ
Calculation No.	WW-1

Maven Bay of Plenty

Wastewater Demand and Storage Volume Sizing

Pump Station	LOTS	Population	Commercial Areas	Commercial Flows (L/S)	PWWF (L/S)	ADWF (L/S)	Design Pump Rate (L/S)	ADWF (m^3/day)	Wet well storage volume (m^3)	Storage Chamber volume (m^3)	
PUMP 01	236	708	N/A		9.01	1.80	91.00	155.76	9.10	58.41	
PUMP02	226	678	N/A		8.63	1.73	25.00	149.16	2.50	53.44	
PUMP 03	320	960	3.5 ha School	1.40	13.62	2.72	15.00	235.39	1.50	86.77	
PUMP 04	214	642	9 ha Commercial	3.73	11.91	2.38	15.00	205.73	1.50	75.65	Light industrial = 0.4 as per 6.1.2
PUMP 05	373	1119	N/A		14.25	2.85	15.00	246.18	1.50	92.32	
PUMP 06	429	1287	2 ha Commercial	0.60	16.99	3.40	91.00	293.51	9.10	110.07	Light industrial = 0.4 as per 6.1.2
PUMP 07	393	1179	N/A		15.01	3.00	20.50	259.38	2.05	97.27	
PUMP 08	323	969	N/A		12.34	2.47	30.00	213.18	3.00	79.94	
PUMP 09	0	0	29.7 ha Industrial	11.88	11.88	2.38	15.00	205.29	1.50	75.48	Light industrial = 0.4 as per 6.1.2
PUMP 10	0	0	22.0 ha Industrial	8.80	8.80	1.76	10.00	152.06	1.00	56.02	Light industrial = 0.4 as per 6.1.2
PUMP 11	181	543	N/A		6.91	1.38	10.00	119.46	1.00	43.80	

WBOPDC standards:

Average Dry Weather

Flow =	220	*L/Person/Day*
Population =	3	Per dwelling
Peaking Factor=	5	

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	DP
Reviewed By	RC
Date	Mar-26
Calculation Title	WASTEWATER RISING MAIN CALCULATION
Calculation No.	WW-2

Wastewater Rising Main Calculation 01 (North Block)

Wastewater Rising Main

Segment	Length (m)	Pipe (ID)(M)	Design flow (L/S)	Flow (m3/s)	Cross-Sectional Area of pipe	Velocity (m/s)	RE	f, (ks=1.5mm)	f, (ks=0.5mm)	hf, (ks=1.5)	hf, (ks=0.5)	Velocity head
PS3-PS2	245	0.11	15.00	0.015	0.01	1.700	163795.8	0.0431	0.0304	14.66	10.36	0.147258
PS2-J1	313	0.14	25.00	0.025	0.01	1.747	214350.1	0.0395	0.0283	14.26	10.21	0.155477
PS11-J1	114	0.10	10.00	0.010	0.01	1.273	115749.0	0.0441	0.0312	4.15	2.94	0.082627
J1-J2	133	0.191	35.00	0.035	0.03	1.222	212105.6	0.0353	0.0274	1.87	1.45	0.076054
PS5-J2	236	0.106	15.00	0.015	0.01	1.700	163795.8	0.0431	0.0304	14.12	9.98	0.147258
J2- PS1	258	0.191	50.00	0.050	0.03	1.745	303008.0	0.0352	0.0257	7.38	5.39	0.155213
PS54- PS1	272	0.106	15.00	0.015	0.01	1.700	163795.8	0.0431	0.0304	16.28	11.50	0.147258
PS1- WWTP	7525	0.34	91.00	0.091	0.09	1.002	309798.9	0.0296	0.0223	33.53	25.32	0.051202

Backpressure

**Assembled from shared segment hf values in Table 1 above*

Junction	Pumps	Segments included	(m)	hf ks=0.5(m)
Backpressure at J1	PS2 and PS11	J1→J2 + J2→PS1	9.25	6.84
Backpressure at J2	PS5 only	*J2→PS1 only*	7.38	5.386

PS2 and PS11 discharge into J1. Their pumps must overcome friction in J1→J2 and J2→PS1 to deliver flow to PS1 wet well — both downstream segments are included in their TDH.

PS5 connects AT J2 — it only needs to match pressure AT J2. J1→J2 flow arrives at J2 carried by PS2/PS11 pumps — PS5 does not push through that segment

Pump Total Dynamic

Pump	Q (L/s)	Sub-main Hf ks=0.5 (m)	Sub-main hf ks=1.5 (m)	Backpressure ks=0.5 (m)	Backpressure ks=1.5 (m)	Static head (m)	V-head (m)	TDH ks=0.5 (m)	TDH ks=1.5 (m)	Governing TDH (m)
PS3	15	10.36	14.66	0	0	6.5	0.15	17.01	21.31	21.31
PS2	25	10.21	14.26	6.84	9.25	6.5	0.16	23.71	30.17	30.17
PS11	10	2.94	4.15	6.84	9.25	6.5	0.08	16.36	19.99	19.99
PS5	15	9.98	7.38	5.386	7.38	6.5	0.15	22.01	21.41	21.41
PS4	15	11.50	33.53	0	0.00	6.5	0.15	18.15	40.18	40.18
PS1	91	25.32	33.53	0	0	6.5	0.05	31.87	40.08	40.08

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNERSHIP
Prepared By	DP
Reviewed By	RC
Date	Feb-26
Calculation Title	WASTEWATER RISING MAIN CALCULATION
Calculation No.	WW-3

Wastewater Risisng Main Calculation (South Block)

Wastewater Rising Main

Segment	Length (m)	Pipe (ID)(M)	Design flow (L/S)	Flow (m3/s)	Cross-Sectional Area of pipe	Velocity(m/s)	RE	f, (ks=1.5mm)	f, (ks=0.5mm)	Hf, (ks=1.5)	Hf, (ks=0.5)	Velocity head
PS8-PS7	394	0.14	20.50	0.021	0.01	1.432	175767.1	0.0396	0.0285	12.09	8.68	0.104543
PS7-PS6	313	0.14	30.00	0.030	0.01	2.096	257220.1	0.0395	0.0282	20.51	14.66	0.223887
PS10-PS9	636	0.10	10.00	0.010	0.01	1.273	115749.0	0.0441	0.0312	23.17	16.38	0.082627
PS9-PS6	832	0.15	25.00	0.025	0.02	1.415	192915.1	0.0382	0.0276	21.62	15.62	0.102008
PS6- WWTP	7013	0.34	91.00	0.091	0.09	1.002	309798.9	0.0296	0.0223	31.25	23.59	0.051202

Pump Total Dynamic Head (TDH) Assembly

PUMP	Q (L/s)	Sub-main Hf ks=0.5 (m)	Sub-main Hf ks=1.5 (m)	Backpressure ks=0.5 (m)	Backpressure ks=1.5 (m)	Static head (m)	V-head(m)	TDH, ks=0.5 (m)	TDH, ks=1.5 (m)	Governing TDH (m)
PS8	20.50	8.68	12.09	N/A	N/A	6.5	0.10	15.29	18.69	18.69
PS7	30.00	14.66	20.51	N/A	N/A	7.3	0.22	22.19	28.03	28.03
PS9	10.00	16.38	23.17	N/A	N/A	6.5	0.08	22.97	29.75	29.75
Ps10	25.00	15.62	21.62	N/A	N/A	6.5	0.10	22.22	28.23	28.23
PS6	91.00	23.59	31.25	N/A	N/A	6.5	0.05	30.15	37.80	37.80

APPENDIX C – WATER SUPPLY CALCULATIONS & MODELLING

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-1

Maven Bay of Plenty

WATER SUPPLY DEMAND SUMMARY

Water Demand - Wairekei South					Commercial Flow		Total Flow per Stage		
Stage	**Year**	**Lots**	**Population**	**Commercial Areas**	**commercial Daily Demand (m³/day)**	**CommercialPeak Demand (L/sec)**	**Daily Demand (m³/day)**	**Peak Demand (L/sec)**	**Daily Demand (L/sec)**
1	2029	184	552		-	-	121	7.0	1.4
2	2030	187	561		-	-	123	7.1	1.4
3	2031	181	543		-	-	119	6.9	1.4
4	2032	0	0	12.10 ha (light industrial/Commercial)	313.63	18.15	314	18.2	3.6
5	2033	196	588		-	-	129	7.5	1.5
6	2034	151	453		-	-	100	5.8	1.2
7	2035	187	561		-	-	123	7.1	1.4
8	2036	212	636	3.5 ha School	120.96	3.50	261	15.1	3.0
9	2037	143	429	1.50 ha (light industrial/Commercial)	77.76	2.25	172	10.0	2.0
10	2038	238	714		-	-	157	9.1	1.8
11	2039	181	543		-	-	119	6.9	1.4
12	2040	189	567		-	-	125	7.2	1.4
13	2041	192	576		-	-	127	7.3	1.5
14	2042	205	615		-	-	135	7.8	1.6
15	2043	0	0	31.30 ha (light industrial/Commercial)	811.30	46.95	811	47.0	9.4
16	2044	0	0	22.30 ha (light industrial/Commercial)	578.02	33.45	578	33.5	6.7
17	2045	202	606		-	-	133	7.7	1.5
18	2046	86	258		-	-	57	3.3	0.7

	Peak Demand(L/S	Daily Demand (L/S)
Total	214.5	42.9
North Block	85.7	19.1
South Block	128.7	23.8

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-2

Maven Bay of Plenty

PEAK DEMAND SCENARIO -01 IN EPANET RESULTS (Using Peak Demand)

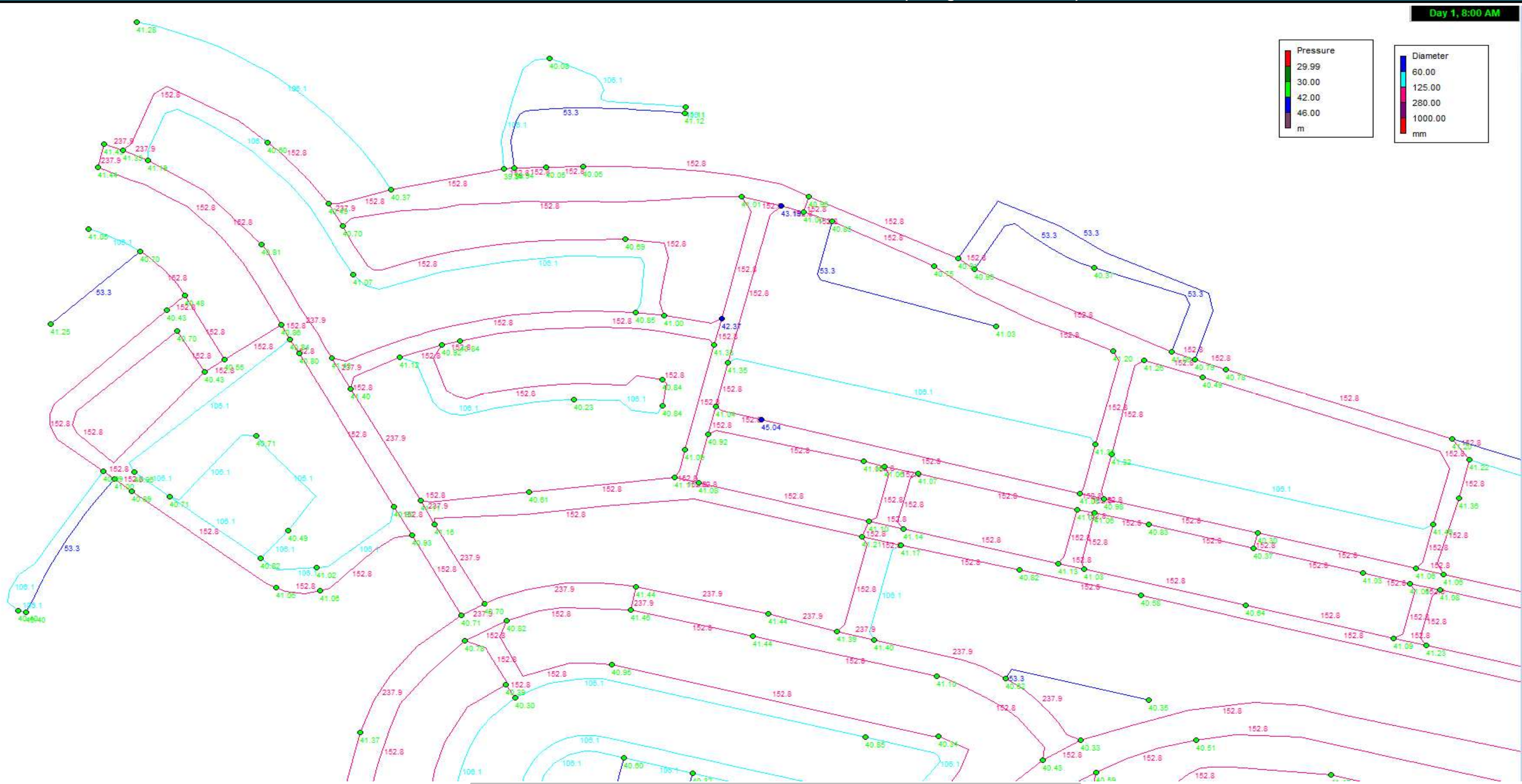


FIGURE 01:PRESSURE IN THE SYSTEM SCENARIO 01

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-3

Maven Bay of Plenty

PEAK DEMAND SCENARIO -01 IN EPANET RESULTS (Using Peak Demand)

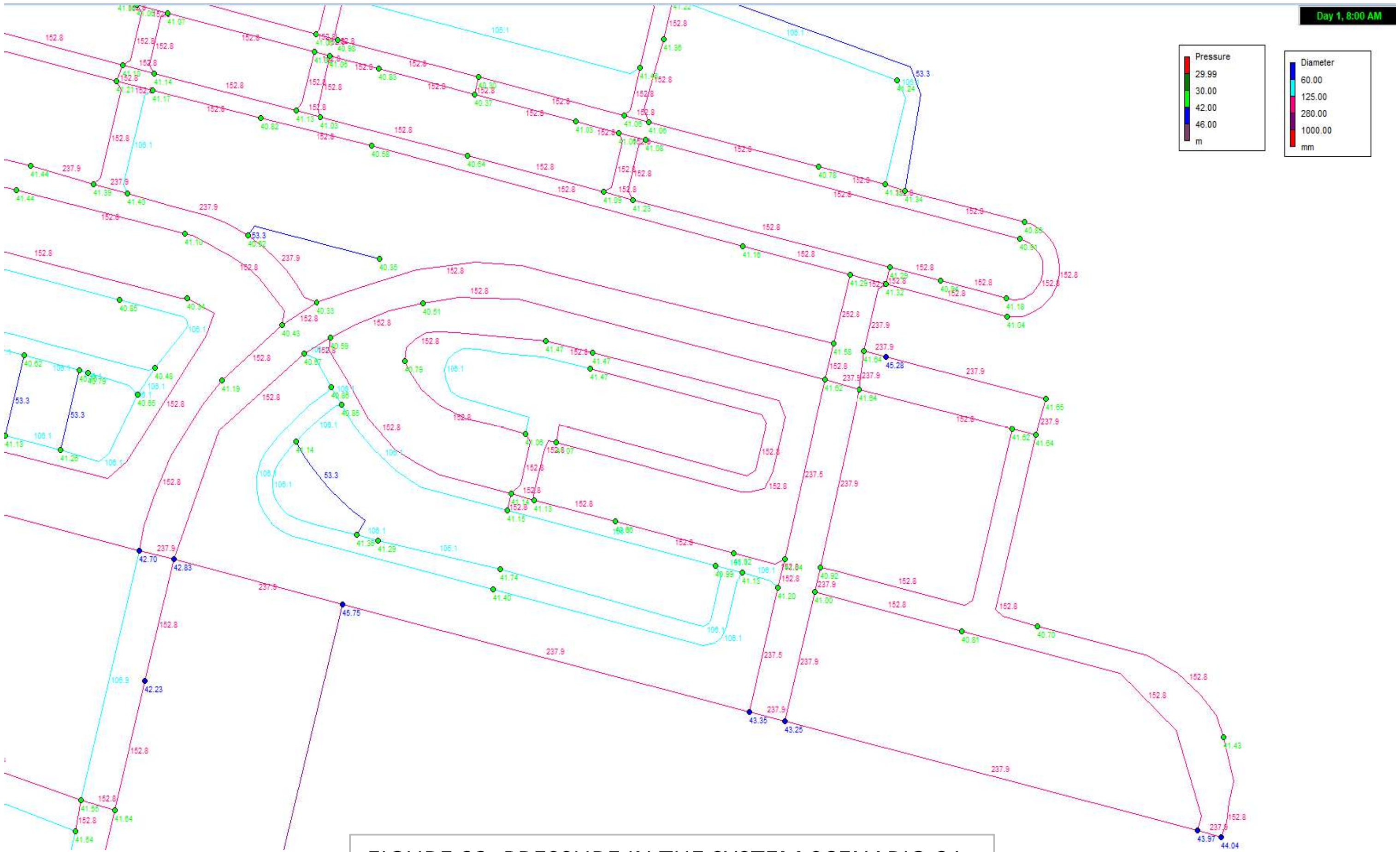


FIGURE 02: PRESSURE IN THE SYSTEM SCENARIO 01

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-4

MAVEN
Maven Bay of Plenty

PEAK DEMAND SCENARIO -01 IN EPANET RESULTS (Using Peak Demand)

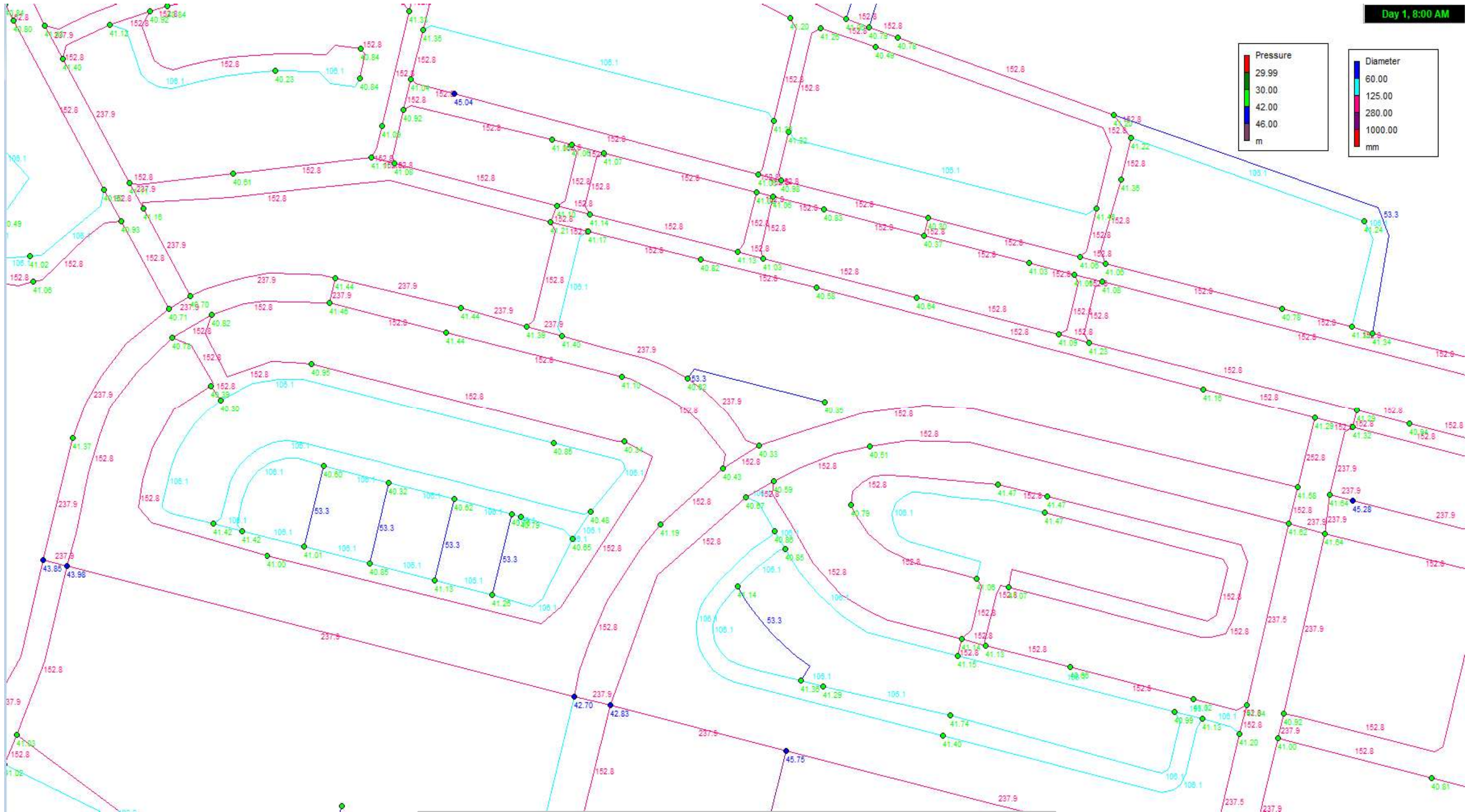


FIGURE 03: PRESSURE IN THE SYSTEM SCENARIO 01

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-5

Maven Bay of Plenty

PEAK DEMAND SCENARIO -01 IN EPANET RESULTS (Using Peak Demand)

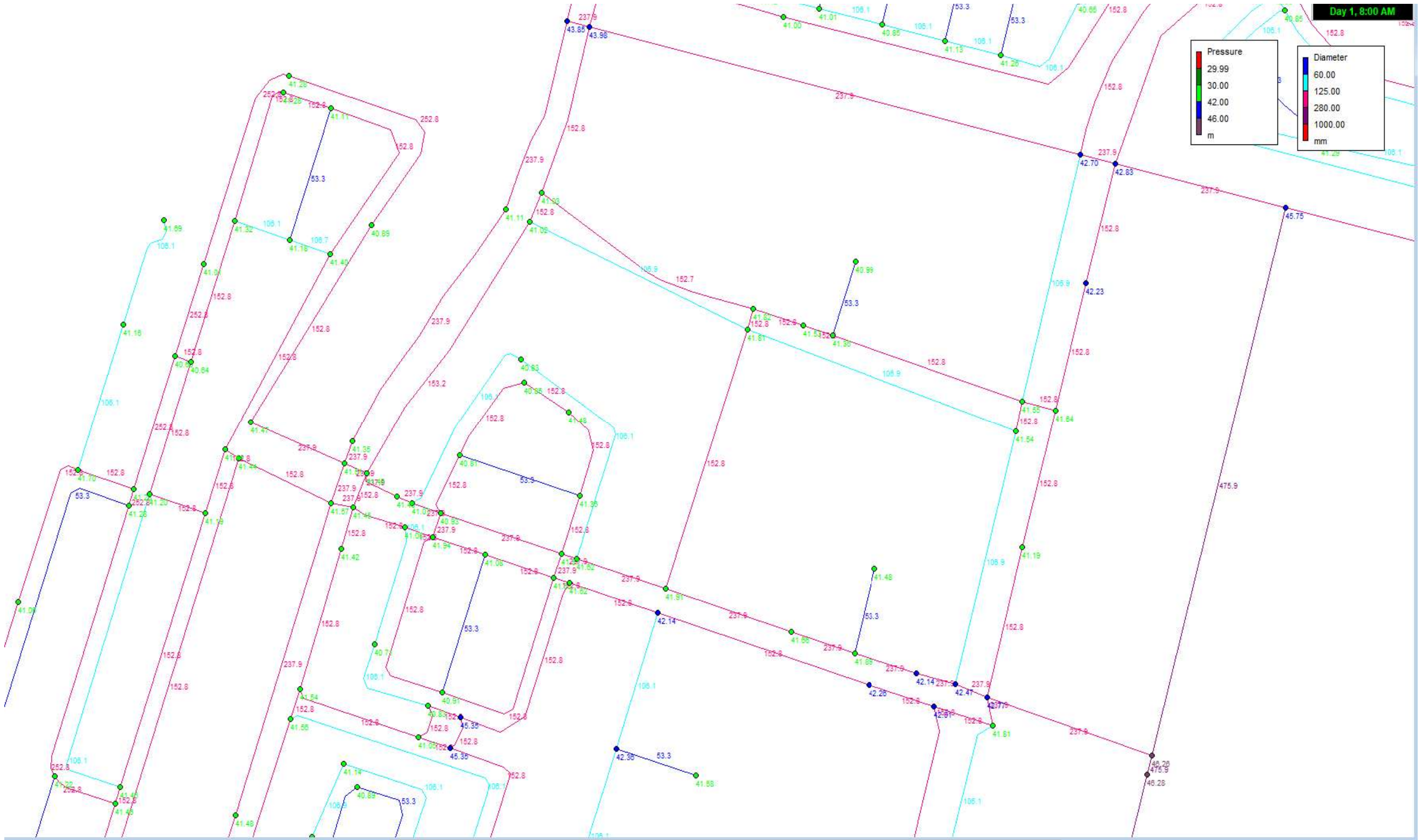


FIGURE 04: PRESSURE IN THE SYSTEM SCENARIO 01

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-6

MAVEN
Maven Bay of Plenty

PEAK DEMAND SCENARIO -01 IN EPANET RESULTS (Using Peak Demand)

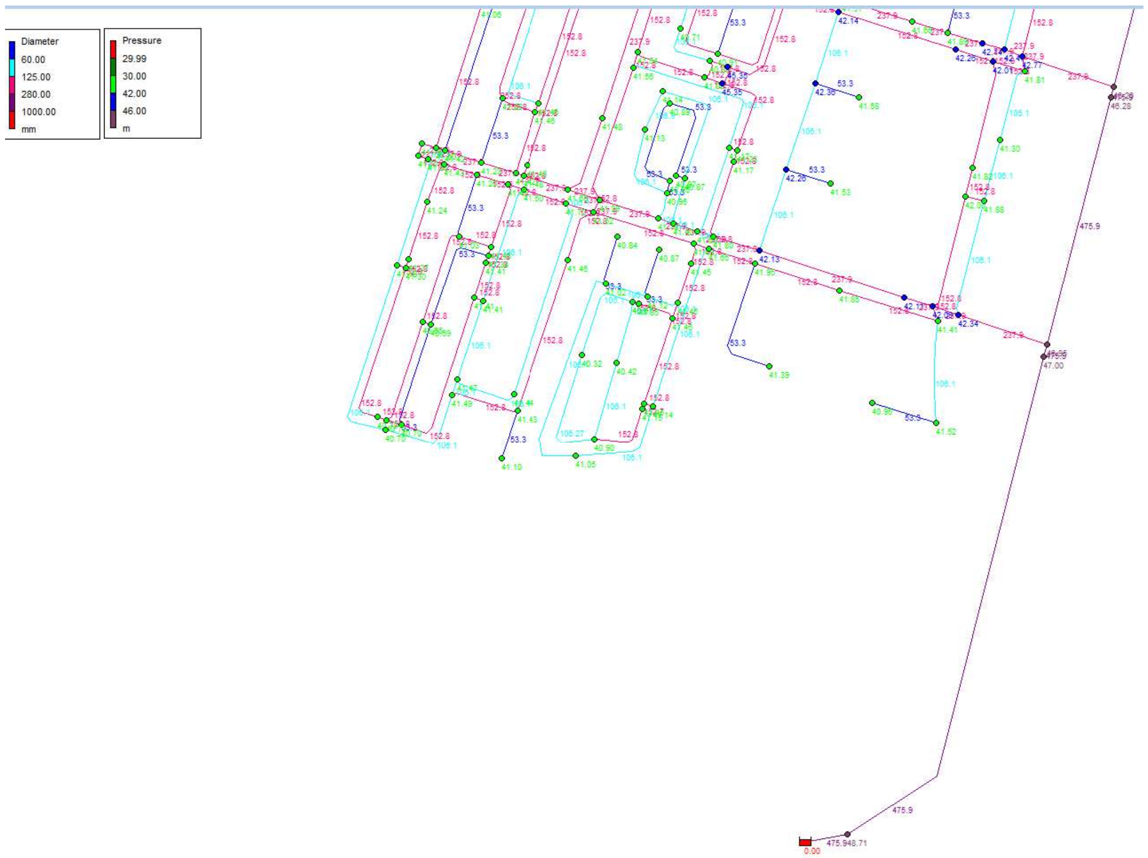
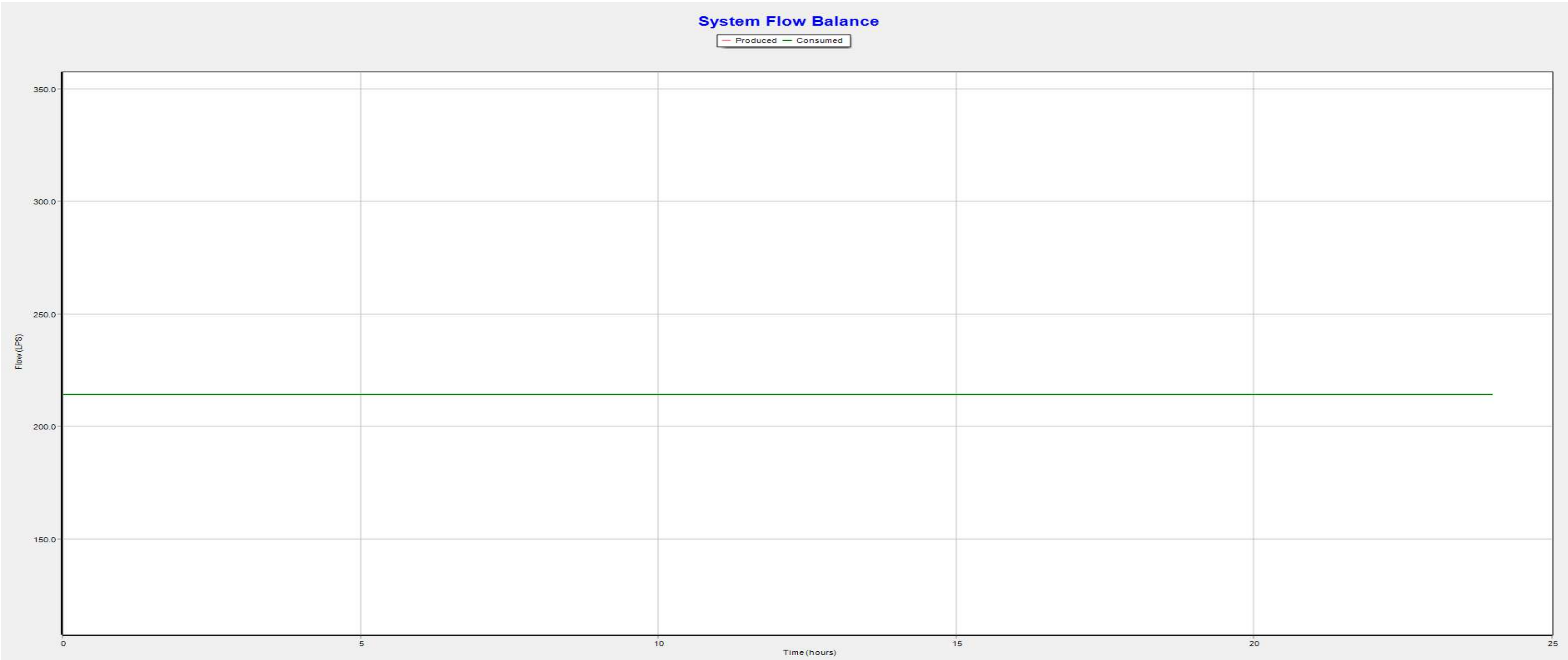


FIGURE 05: PRESSURE IN THE SYSTEM SCENARIO 01

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-7

Maven Bay of Plenty

PEAK DEMAND SCENARIO -01 IN EPANET RESULTS (Using Peak Demand)

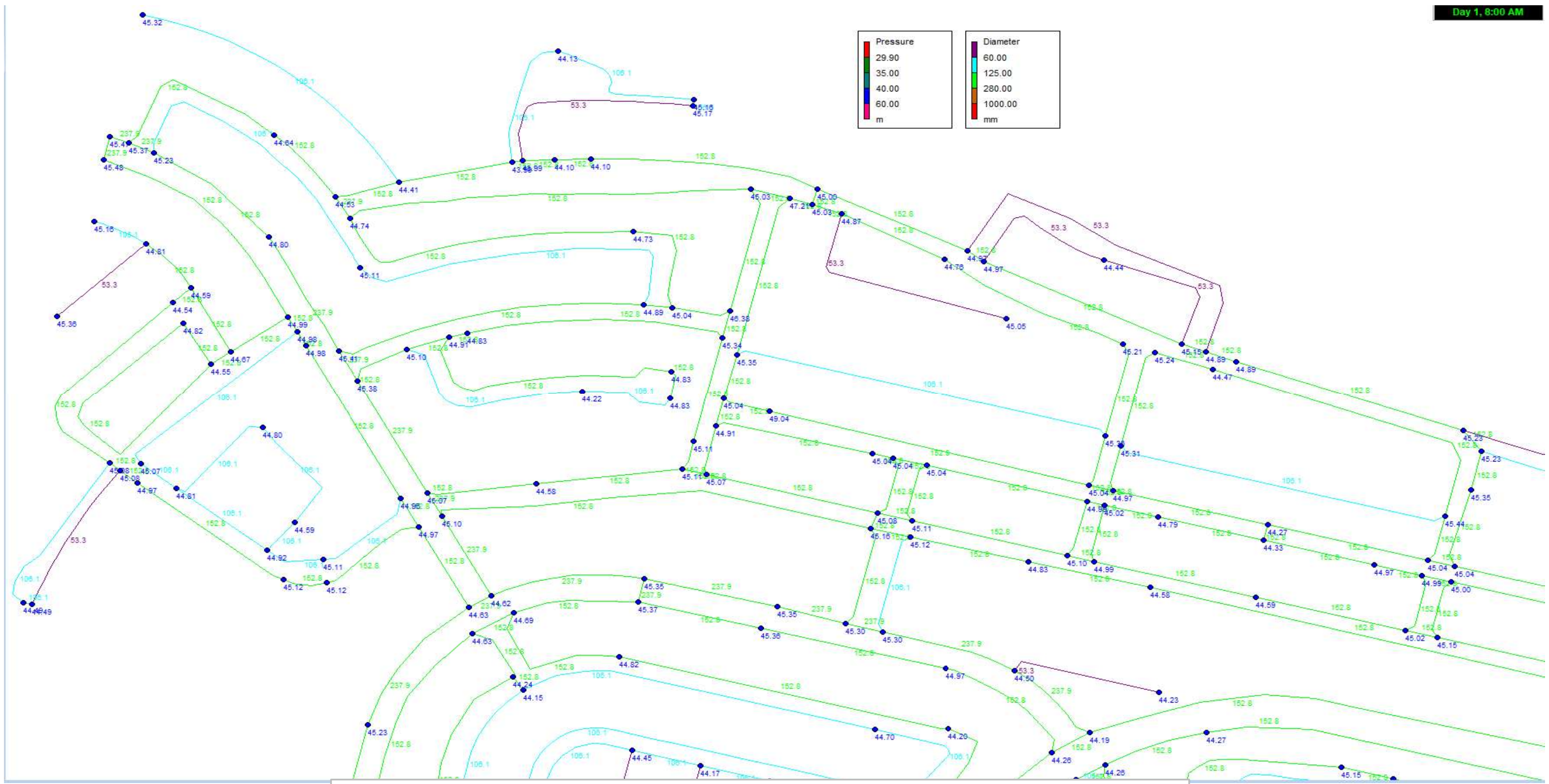


Flow in the system throughout the day-Scenario 01

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-8

Maven Bay of Plenty

AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)

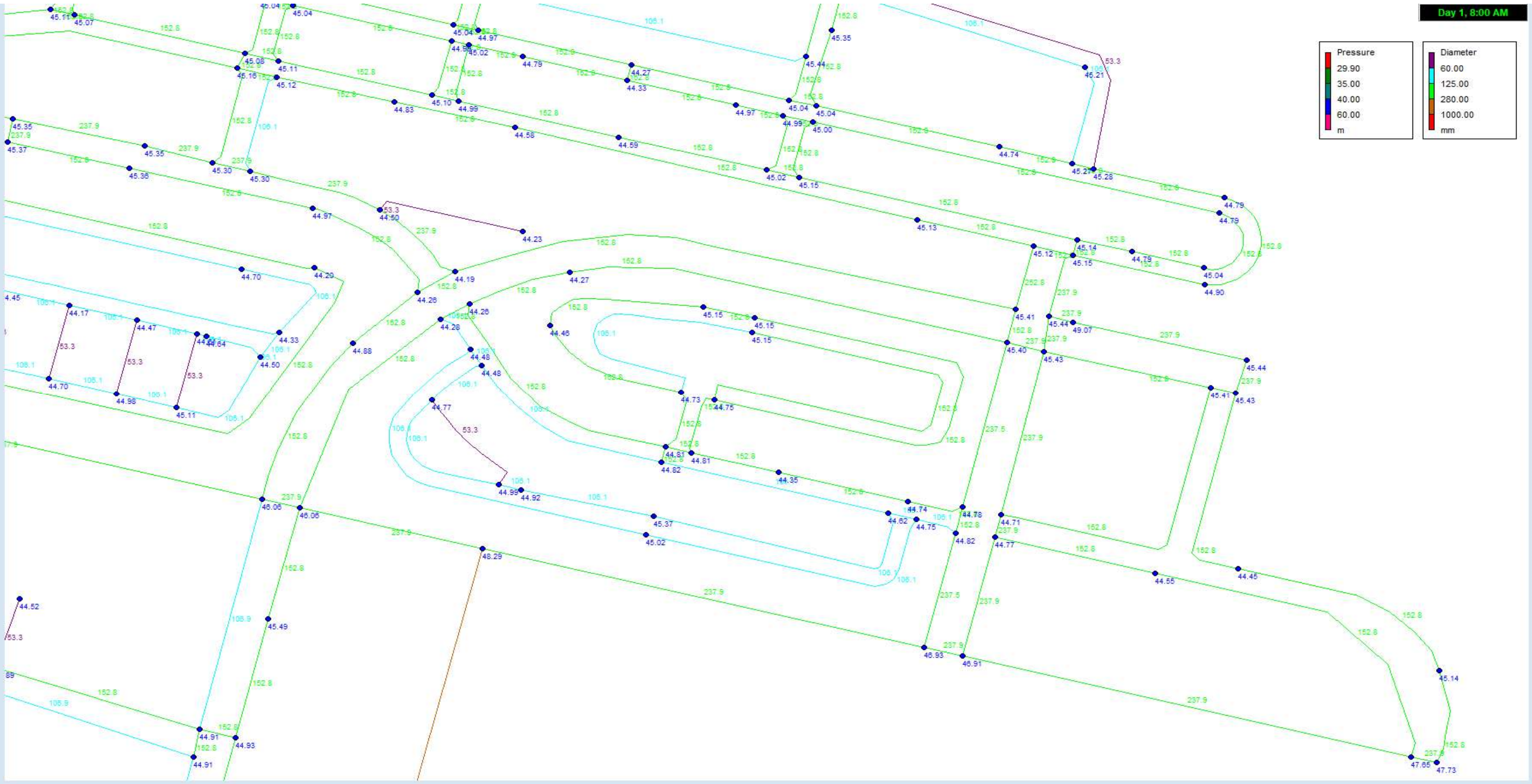


Pressure at peak hour and pipe sizes in the system - Scenario 02

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-9

MAVEN
Maven Bay of Plenty

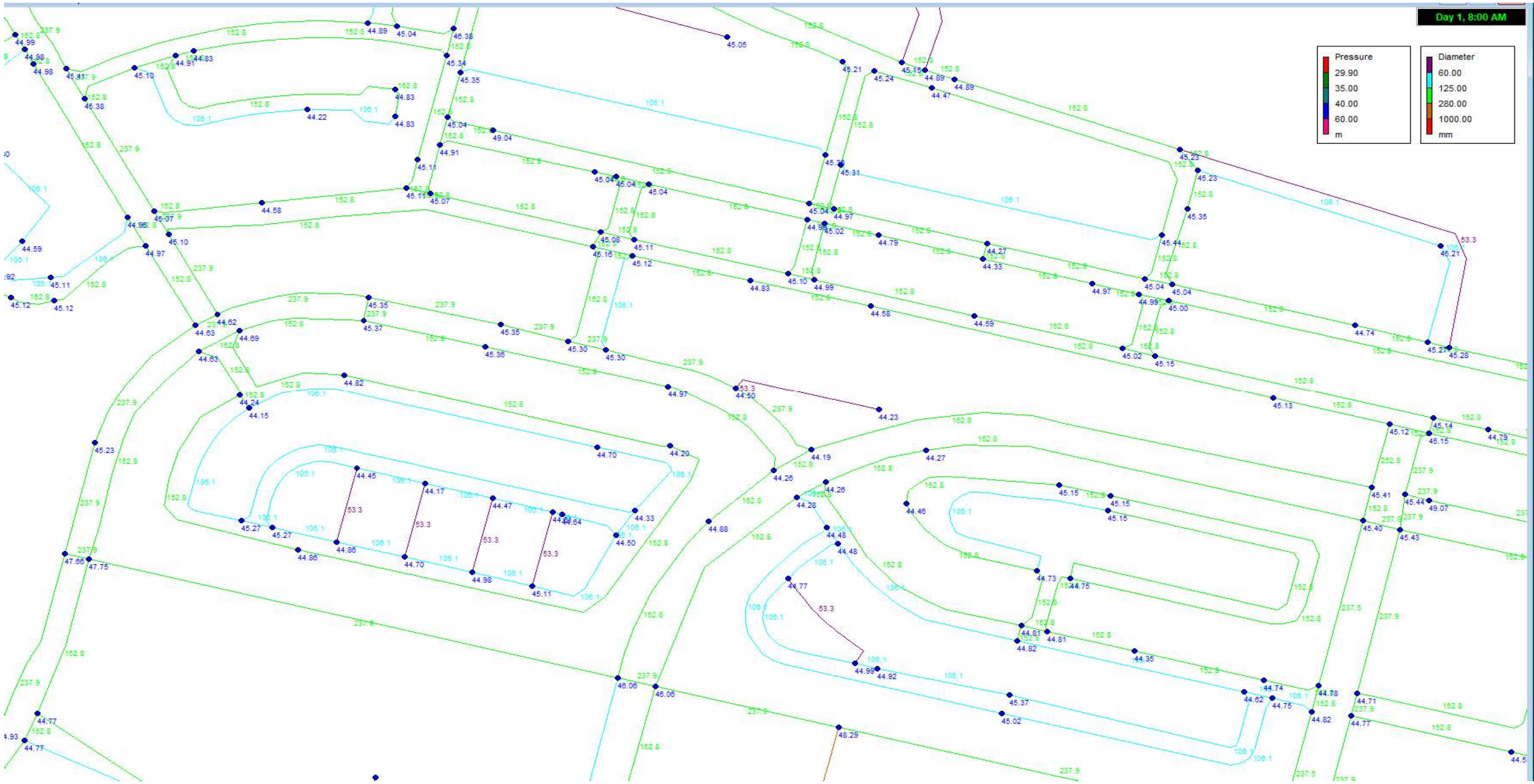
AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)



Pressure at peak hour and pipe sizes in the system - Scenario 02

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-10

AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)

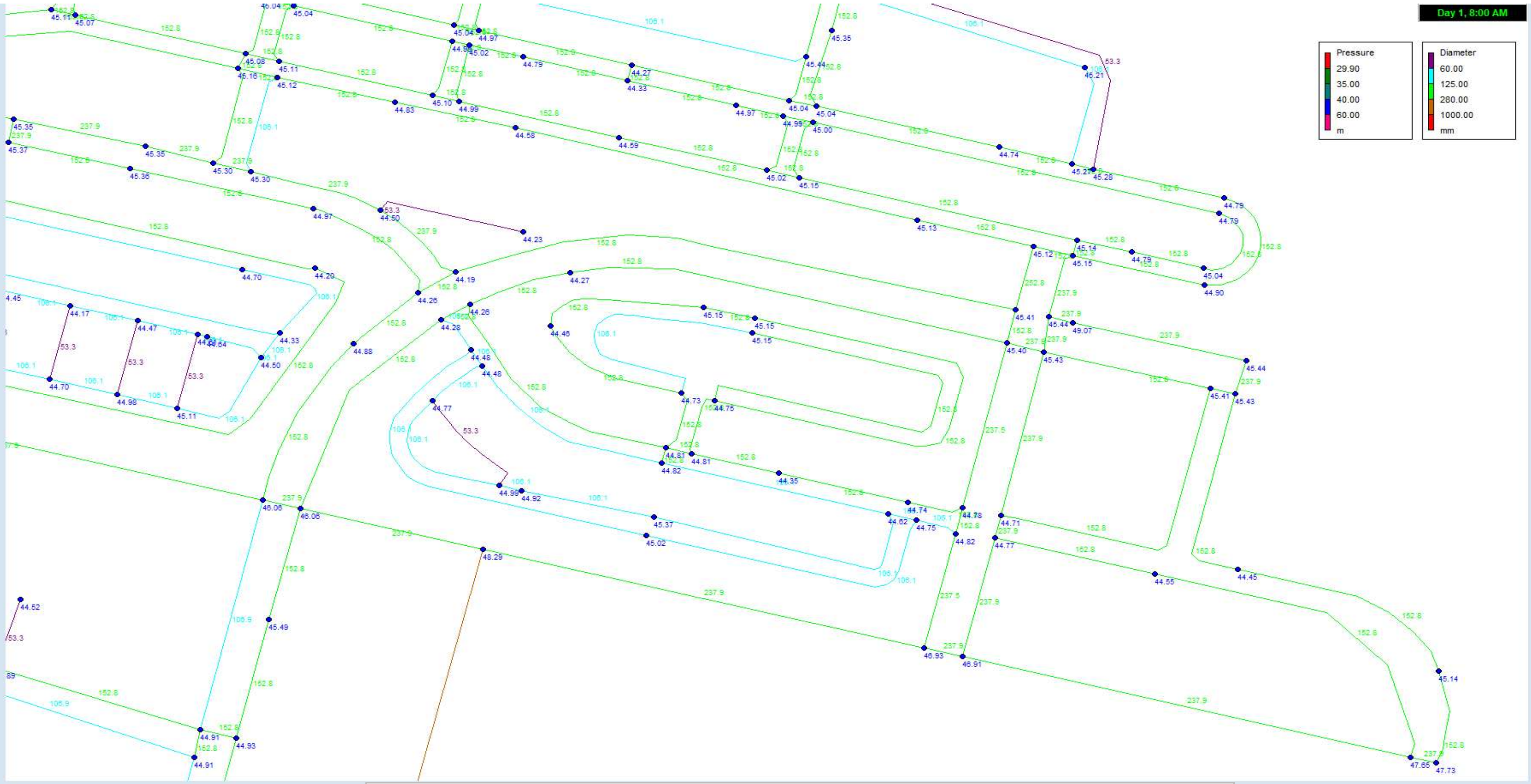


Pressure at peak hour and pipe sizes in the system - Scenario 02

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-11

Maven Bay of Plenty

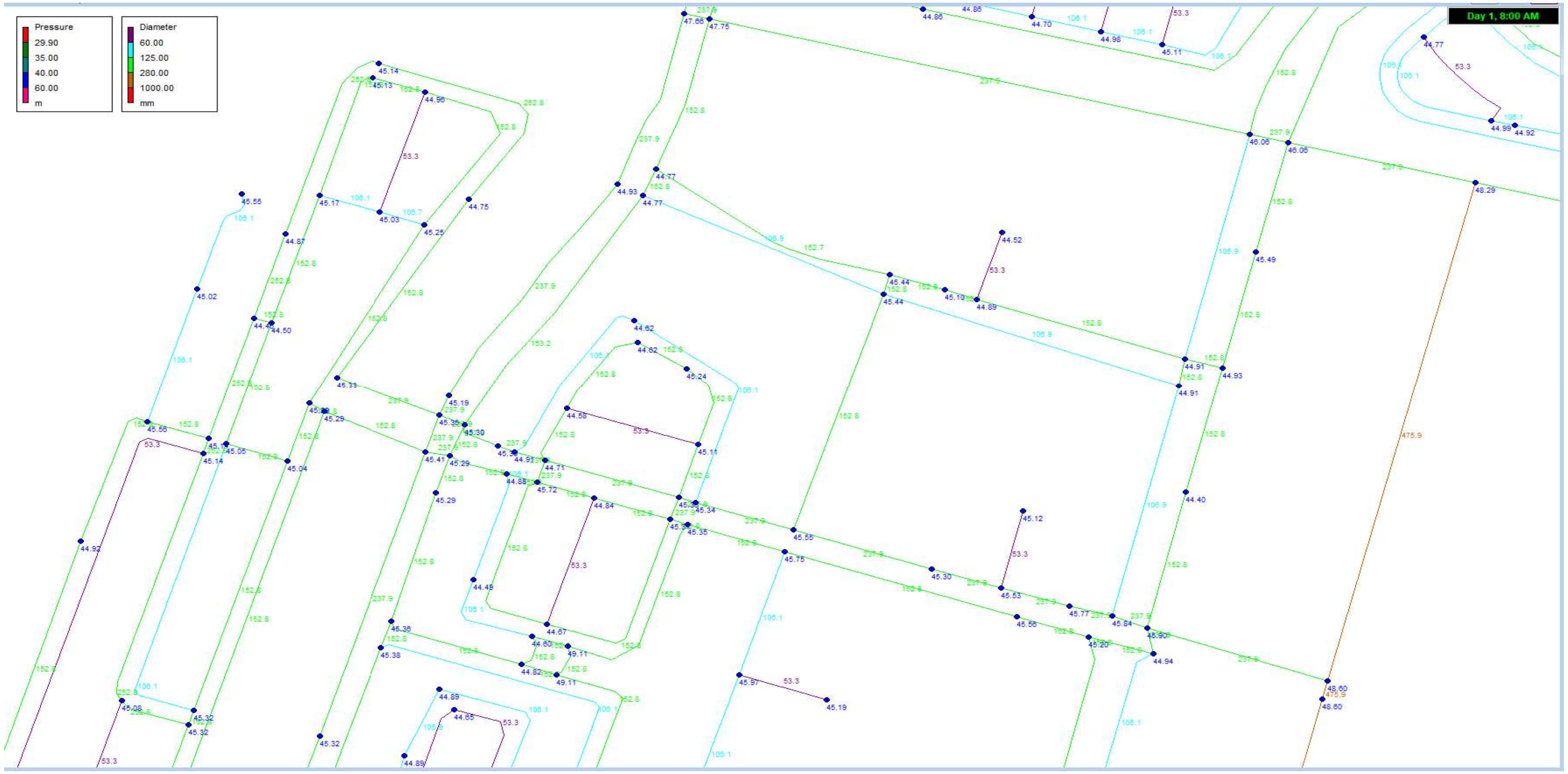
AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)



Pressure at peak hour and pipe sizes in the system - Scenario 02

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-12

AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)

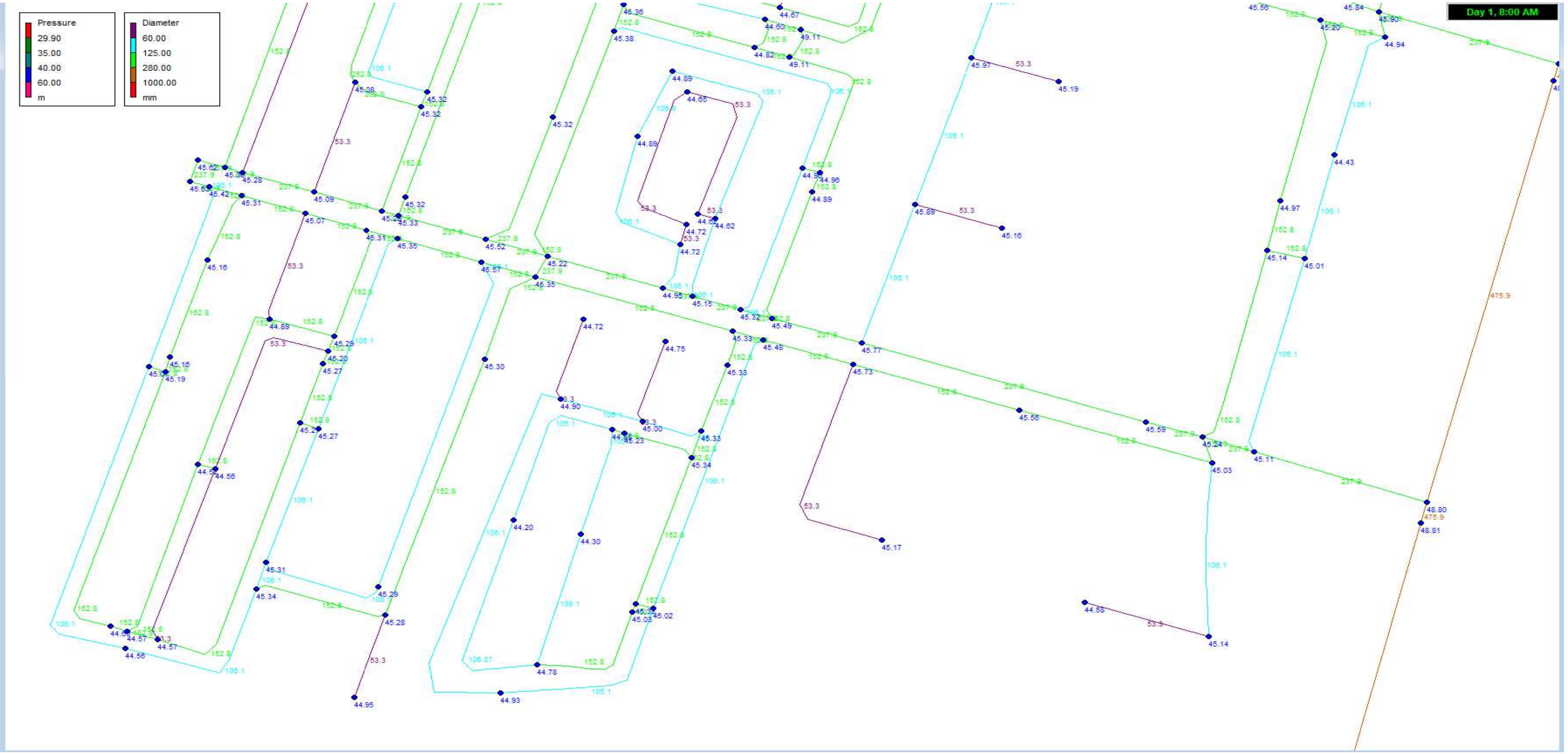


Pressure at peak hour and pipe sizes in the system - Scenario 02

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-13

Maven Bay of Plenty

AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)

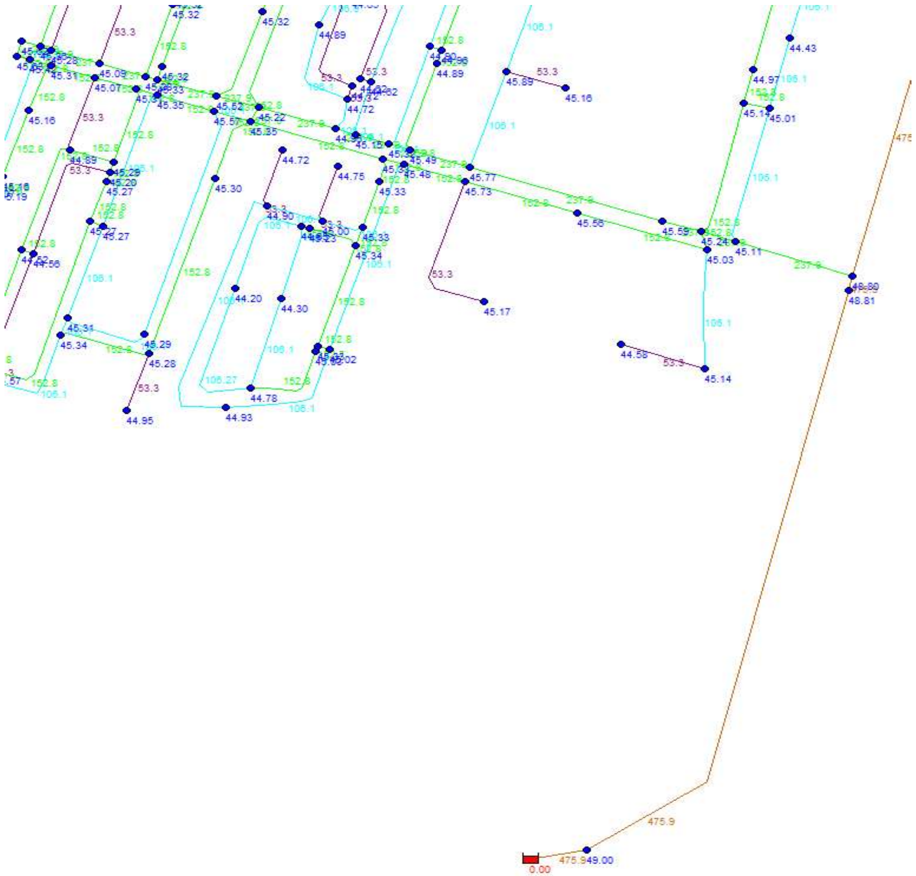


Pressure at peak hour and pipe sizes in the system - Scenario 02

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-14

Maven Bay of Plenty

AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)

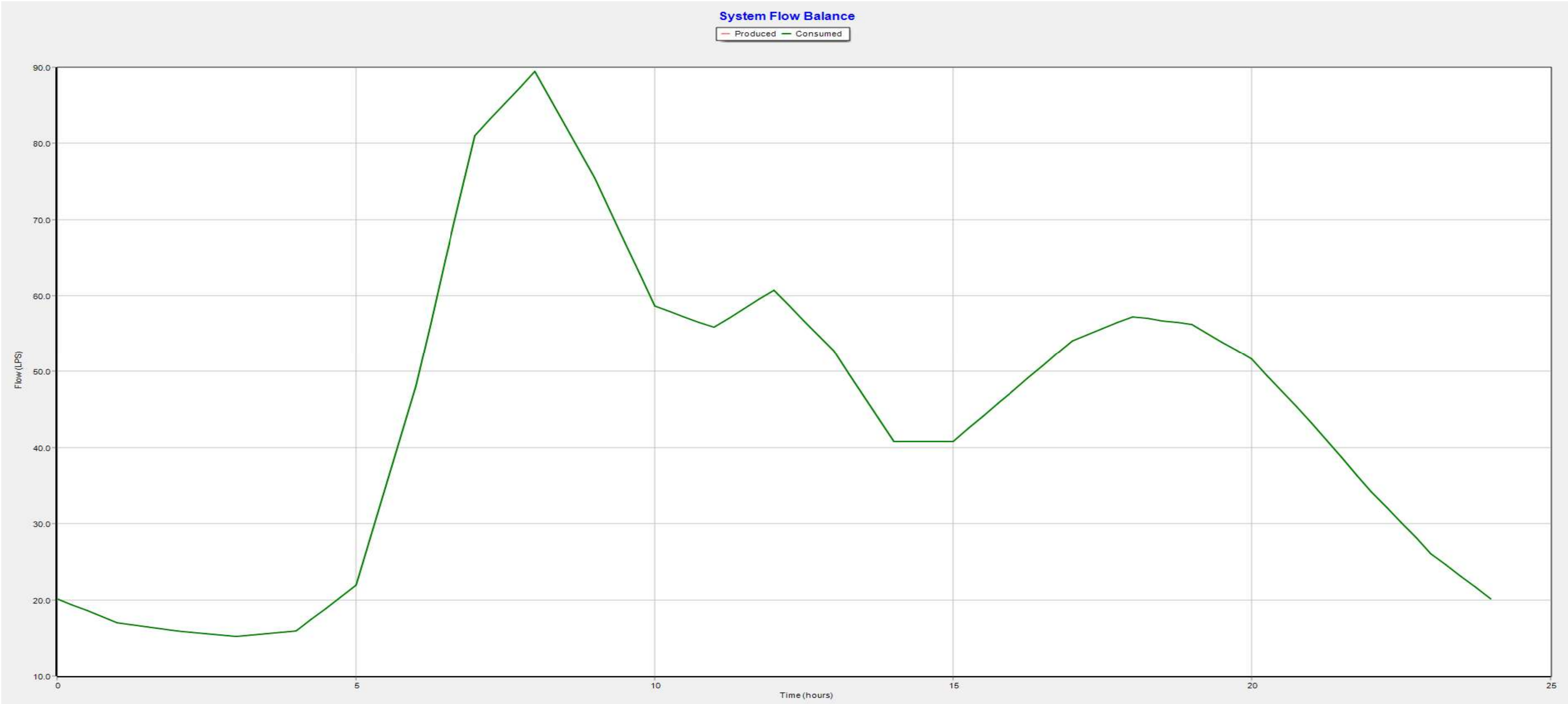


Pressure at peak hour and pipe sizes in the system - Scenario 02

Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-15

MAVEN
Maven Bay of Plenty

AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)



Flow in the system throughout the day-Scenario 02

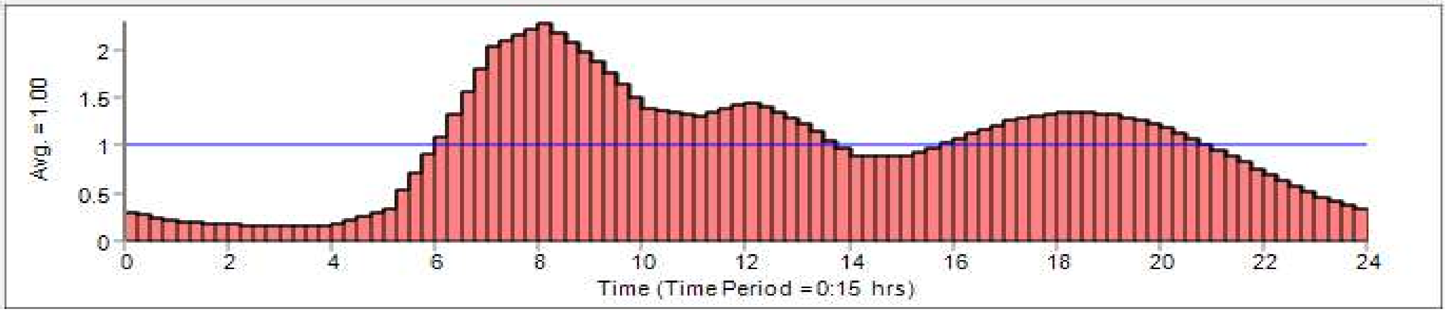
Project Name	WAIRAKIE SOUTH FTA090
Site Address	BELL ROAD, PAPAMOA
Client	BELL ROAD LIMITED PARTNESHIP
Prepared By	DP
Reviewed By	SB
Date	Mar-26
Calculation Title	WATER SUPPLY DEMAND CALCULATION
Calculation No.	WS-16

Maven Bay of Plenty

AVERAGE DEMAND SCENARIO 02 IN EPANET RESULTS (Using Diurnal Demand Pattern)

Pattern ID	Description
RES	WSL-DomesticPattern

Time Period	1	2	3	4	5	6	7	8	9	10	11	12
Multiplier	0.29	0.268	0.245	0.223	0.2	0.193	0.185	0.178	0.17	0.165	0.16	0.155



Diurnal Pattern Applied in Model-Scenario 02

APPENDIX D – WATER SUPPLY NETWORK IMPACT ASSESSMENT

BELL ROAD DEVELOPMENT
WATER SUPPLY NETWORK IMPACT (AUG 2025)

To:	Seemab Ather	Tauranga City Council (TCC)
	Nektaria Papadopoulos	Tauranga City Council (TCC)
Distribution:	Steve Hurley	Tauranga City Council (TCC)
From:	Glaiza Diao, Rebecca Ellmers	HAL
Subject:	Bell Road Development – Water Supply Network Impact (Aug 2025)	
Date:	Wednesday 10 Sep 2025	

1 Background

1.1 Bell Road Development

TCC received a fast-track approval application (dated 2 May 2024) to consider a private plan change request for connection of a proposed mixed-use development of the existing Bell Road / Wairakei South greenfields (rural) site.

The Bell Road development site is located on greenfields land to the far east of the existing TCC water supply network, as shown below in Figure 1. The total area of the site is approximately 349.2 ha. with 185.9 ha (52.9%) proposed to be developed to provide the following (taken from Masterplan V8.0)

- 3,000 residential dwellings (upper estimate – 125ha. @ 20-25 lots/ha.)
- 1 primary school
- ~54 Ha of industrial area (employment zone - assumed light industrial)
- ~2 Ha of commercial area (neighbourhood & local centre)

The development is proposed to be built out to the following timings:

- Resource consents - 2024-2026
- Site earthworks - 2026-2030
- Bulk infrastructure - 2027-2032 (SH2 interchange connection + 3 waters)
- Individual staged infrastructure - 2027-2041 (internal roading, utilities, site engineering)

As agreed with TCC, an assumption was made for connection of 30% of properties by the 10-Year planning horizon (2034) and 100% connection of development properties by the 30-Year planning horizon (2054).

Figure 1: Bell Road Development Overview Map

1.2 Te Tumu Development

As also shown above in Figure 1, the Bell Road site is located close to the proposed Te Tumu development site (approximately 5,500 dwellings plus commercial/industrial land) with full buildout also proposed within the 30-year (2054) horizon.

In April 2022, Stantec delivered a water supply structure plan for the Te Tumu development to determine the required bulk infrastructure for servicing the site, "Te Tumu Water Supply Structure Plan Study, Rev 1, April 2022". The structure plan identified several infrastructure upgrades and trigger points, including increasing storage at the Eastern SR site, upgrade of the existing Bell Road watermain and commissioning of a new No.1 Road reservoir & watermain to provide resilience to final stages of the development.

Connection of the proposed Bell Road development site, and the required infrastructure to support full development needs to be considered alongside proposed buildout of the Te Tumu development, as well as projected infill development within the existing Wairakei network.

1.3 Scope of Works

This modelling assessment considers the hydraulic impact of the Bell Road development on the TCC water supply network, along with the cumulative impact of the Te Tumu development to the east of the site. As discussed with TCC, the following approach to the modelling was undertaken:

1. Existing Scenario (2024) with Bell Road ultimate development (determine trigger for upgrade of existing network)
2. 10-Year (2034) Scenario with interim (30%) buildout of Bell Road & Te Tumu developments
3. 30-Year (2054) Scenario with ultimate (100%) buildout of Bell Road & Te Tumu developments
4. Additional modelled scenario to determine trigger for buildout of both Bell Road & Te Tumu developments before significant upgrade (No.1 Road SR & WM) is required

2 Water Demands

2.1 Bell Road Development

The water supply demands for the Bell Road development were calculated using the following assumptions, based on the TCC Model Management Specification where available, and aligned with demand assumptions made as part of the Te Tumu Structure Plan works:

- Residential – 380 l/p/day with occupancy rate of 2.6 ppl/HH (includes 10 l/p/day leakage)
- Employment Zone – considered light industrial at 0.2 l/s/ha, with 16-hour profile
- Neighbourhood & Local Centre – considered commercial at 0.2 l/s/ha, with 10-hour profile
- Primary School – assume 0.1 l/s/ha in absence of roll numbers typically used

It is important to note these assumptions may be considered appropriate for a high-level modelling assessment at consent application stage, however it is recommended these should be refined with respect to proposed residential housing density & occupancy rates, plus specific commercial/industrial demand once further information is available from the developers.

The demands for the Bell Road development used in this modelling assessment are provided in Table 1 below.

Table 1: Bell Road Development Demand

Development Type	Area (ha.)	Ultimate Population	Assumption	Interim (10-Year)	Ultimate (30-Year)
Residential	125	7,800	*380 l/p/day*	10.3	34.3
Employment Zone	53.7	-	*0.2 l/s/ha*	3.2	10.7
Neighbourhood / Local Centre	1.9	-	*0.2 l/s/ha*	0.1	0.4
Primary School	4.8	-	*0.1 l/s/ha*	0.1	0.5
TOTAL	**185.4 ha.**	**7,800**		**13.7 l/s**	**45.9 l/s**

2.2 Te Tumu Development

The ultimate water supply demands for the Te Tumu Development were taken from the existing Te Tumu Structure Plan (Stantec, 2022), as summarised in Table 2 below.

The interim (10-Year) demands for the Te Tumu development were assumed from buildout rates as specified in the TCC population projections provided in Nov 2022.

Table 2: Te Tumu Development Demand

Development Type	Area (ha.)	Ultimate Population	Interim (10-Year)	Ultimate (30-Year)
Residential	261.5	15,500	8.2	66.7
Non-Residential	79.5		7.6	13.2
TOTAL	**341 ha.**	**15,500**	**15.8 l/s**	**79.9 l/s**

3 Model Scenarios

A number of scenarios were modelled to determine the network impact of the additional demands from the Bell Road development, along with the cumulative demands from the Te Tumu development, and projected infill growth within the Wairakei network as captured in the WMPL58 10-Year & 30-Year Planning models.

The WMPL58 10-Year & 30-Year Planning models are based on population projections received from TCC in Nov 2022 as part of the 2024 LTP works. Updated population projections are expected to be released in Sep 2025 which may change the rate of infill growth expected in the Coastal Strip.

The modelled scenarios also considered planned upgrades proposed as part of the Te Tumu Structure Plan works, to determine the effects on required timing and trigger points for augmentation of the existing network to allow both developments to proceed concurrently.

The modelled scenarios are detailed in Table 3 below.

Table 3: Bell Road + Te Tumu Modelled Scenarios

Scenario	Network + Upgrades	Demand	Base Model
1	Existing	Existing (2024)	WMOP62 Peak Day (53MLD)
2	Existing	Existing (2024) + Ultimate Bell Road	WMOP62 Peak Day (53MLD)
3	Existing + Upgrades (Bell Road DN450)	Existing (2024) + Ultimate Bell Road	WMOP62 Peak Day (53MLD)
4	10-Year Network + Upgrades (Bell Road DN450)	10-Year (2034) **+ 20% Te Tumu**	WMPL58 10-Year PDD (67MLD)
5	10-Year Network + Upgrades (Bell Road DN450)	10-Year (2034) + 30% Bell Road + 20% Te Tumu	WMPL58 10-Year PDD (67MLD)
6	30-Year Network + Upgrades (Bell Road DN450 + Eastern No.2 SR + CWTM1+2)	30-Year (2054) **+ 95% Te Tumu**	WMPL58 30-Year PDD (86MLD)
7	30-Year Network + Upgrades (Bell Road DN450 + Eastern No.2 SR + CWTM1+2)	30-Year (2054) + Ultimate Bell Road + Ultimate Te Tumu	WMPL58 30-Year PDD (86MLD)
8	30-Year Network + Upgrades (Bell Road DN450 + Eastern No.2 SR + CWTM1+2)	30-Year (2054) + 60% Bell Road + 60% Te Tumu	WMPL58 30-Year PDD (86MLD)

4 Existing Network + Bell Road

The proposed connection point for the Bell Road development is the existing DN150 UPVC pipe along Bell Road. The existing WMOP62 model (53MLD) was used for the existing scenario runs.

4.1 Network Performance

Figure 2 below shows a comparison of Scenario 1 and Scenario 2 minimum pressure and maximum headlosses. As shown in Scenario 1, the existing DN150 UPVC network along Bell Road has sufficient capacity to supply existing (2024) demands, with headlosses within 5 m/km and minimum pressures above 30m. In Scenario 2, with the ultimate Bell Road demands added into the model, the capacity of the existing DN150 main is exceeded, resulting in excessive headlosses and low (negative) pressure issues along the pipeline.

4.2 Proposed Upgrades

In order to service the ultimate Bell Road development demands, the Bell Road mains upgrade as recommended in the Te Tumu Structure Plan would be required. The extent of the upgrade is provided in Figure 3 below, with a DN450 watermain connected back to the Te Okuroa/Stevenson Drive network via a DN300 pipeline to provide a double-ended supply to the development area.

Figure 3 shows the network performance of Scenario 3 with the proposed upgrade in place. Headlosses along the upgraded pipeline are brought into an acceptable range (less than 2 m/km) and minimum pressures are maintained above 55m. This indicates the proposed DN450 sizing of the Bell Road upgrade is sufficient to supply the ultimate Bell Road development demands.

From a capacity perspective, the maximum residential lots that could be supplied from the existing single-end DN150 UPVC main is approximately 140 lots, before simulated headlosses exceed 5 m/km, and upgrade of the main is required. Minimum pressures are maintained above TCC LoS of 30m in this instance.

Additionally there is a significant security of supply trigger, ie. what is the maximum number of residential lots that can be supplied from a single-end main, before an alternative pipeline is required to maintain supply in the event of a mains break. Currently TCC has no defined LoS for security of supply, it is recommended this should be limited to no more than 200 lots when supplying from the ageing DN150 asset. It is recommended this standard is better defined by TCC for future greenfields servicing advice.

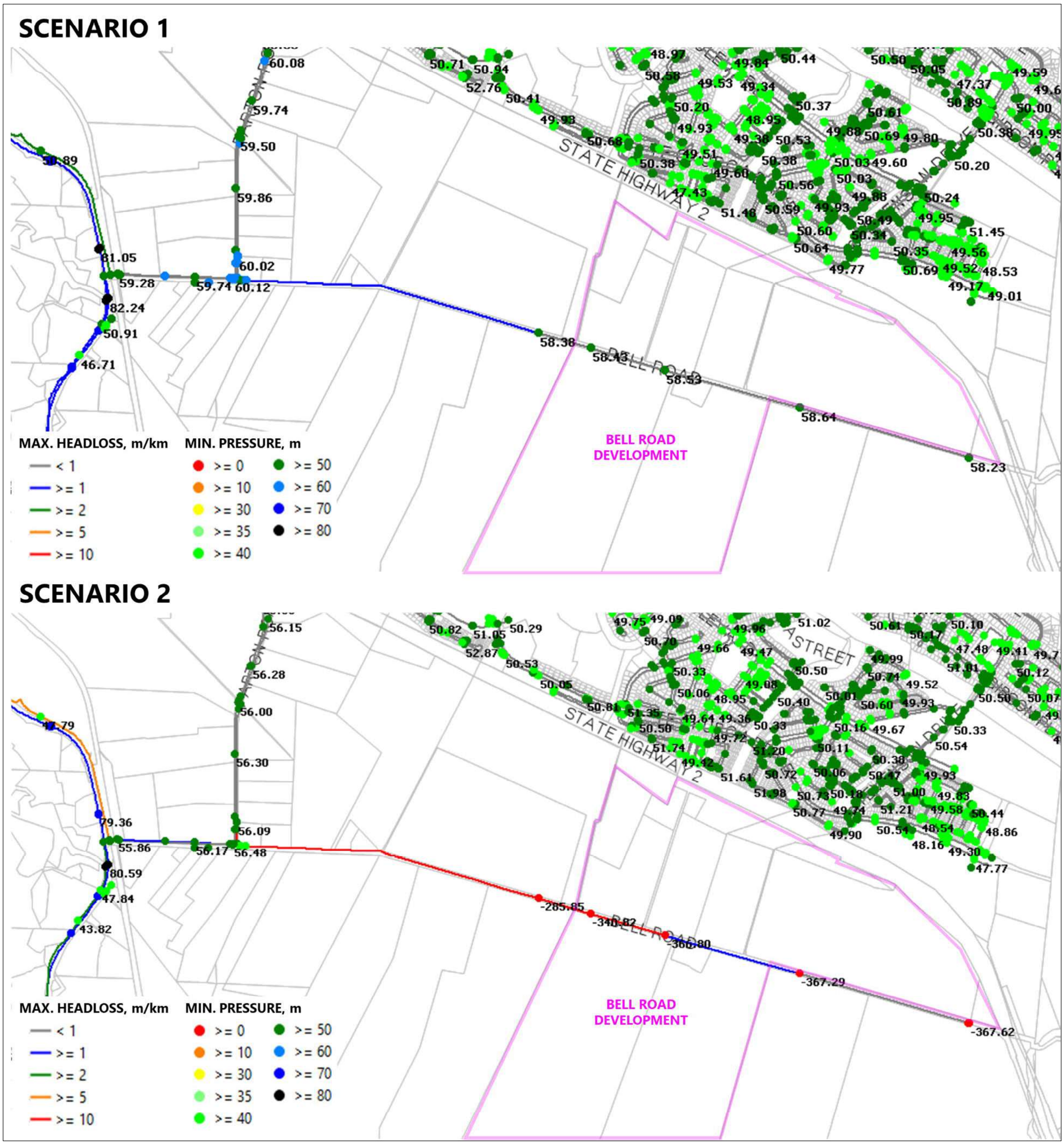


Figure 2: Scenario 1 & 2 - Minimum Pressure & Maximum Headloss

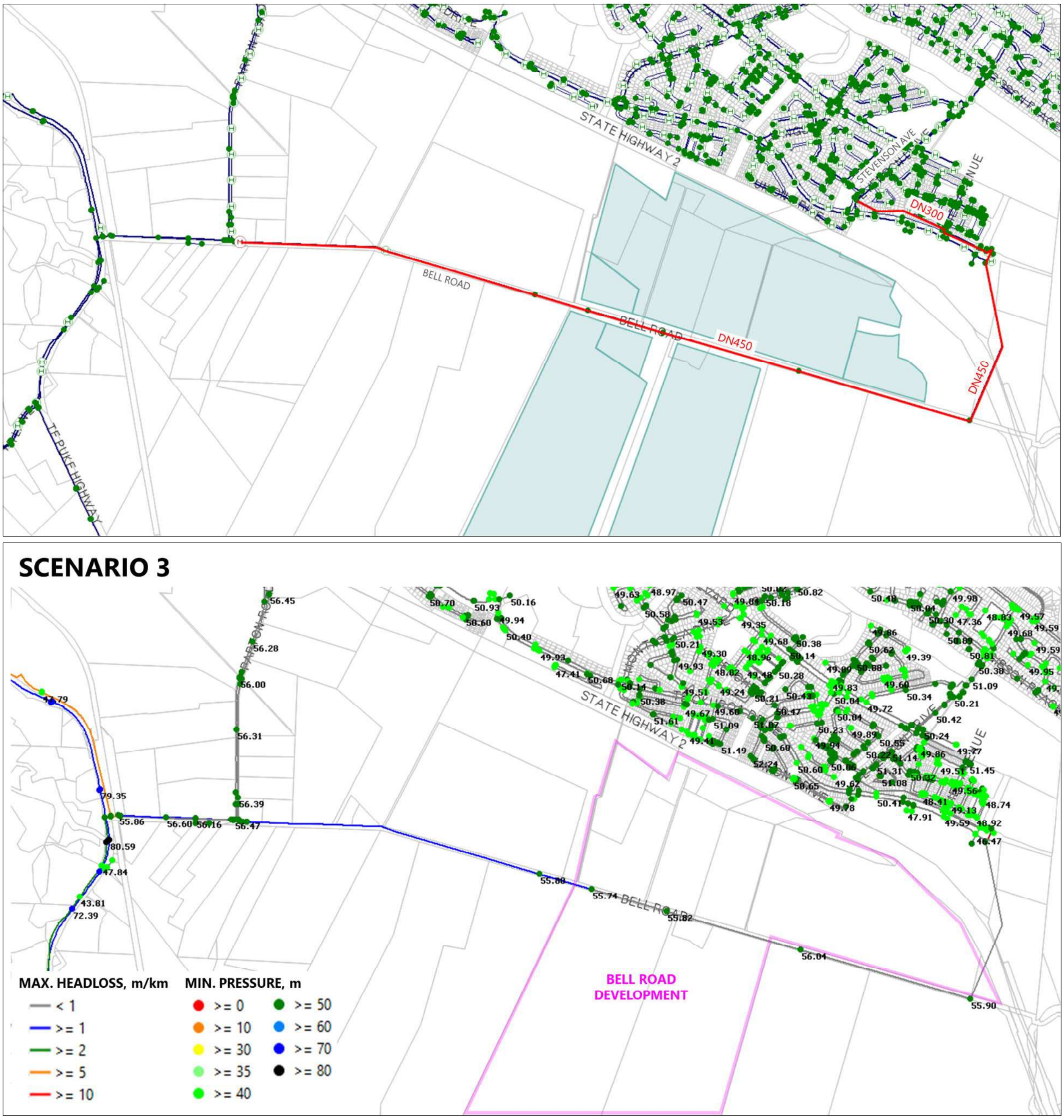


Figure 3: Scenario 3 Bell Road DN450 Upgrade - Minimum Pressure & Maximum Headloss

4.3 Reservoir Performance

Figure 4 below shows the performance of the Eastern & Poplar SRs, in the existing scenario and supplying the Bell Road ultimate development demands. Both reservoirs maintain an acceptable operating range even with the ultimate Bell Road development demands on the network, operating between 70-95% full, with the ability to refill comfortably over a 24-hour peak demand period.

In the existing scenario the inflow to Eastern SR is set to a maximum of 150 l/s and the inflow to Poplar SR is set to a maximum of 60 l/s to balance flows within the transmission network.

There is a known headloss issue on the existing DN250 Poplar SR inlet & outlet mains, with simulated headlosses over 8 m/km. This does not cause a direct downstream pressure level of service issue, however suggests both pipe sections are at capacity and may be considered for upsize if any renewal is required.

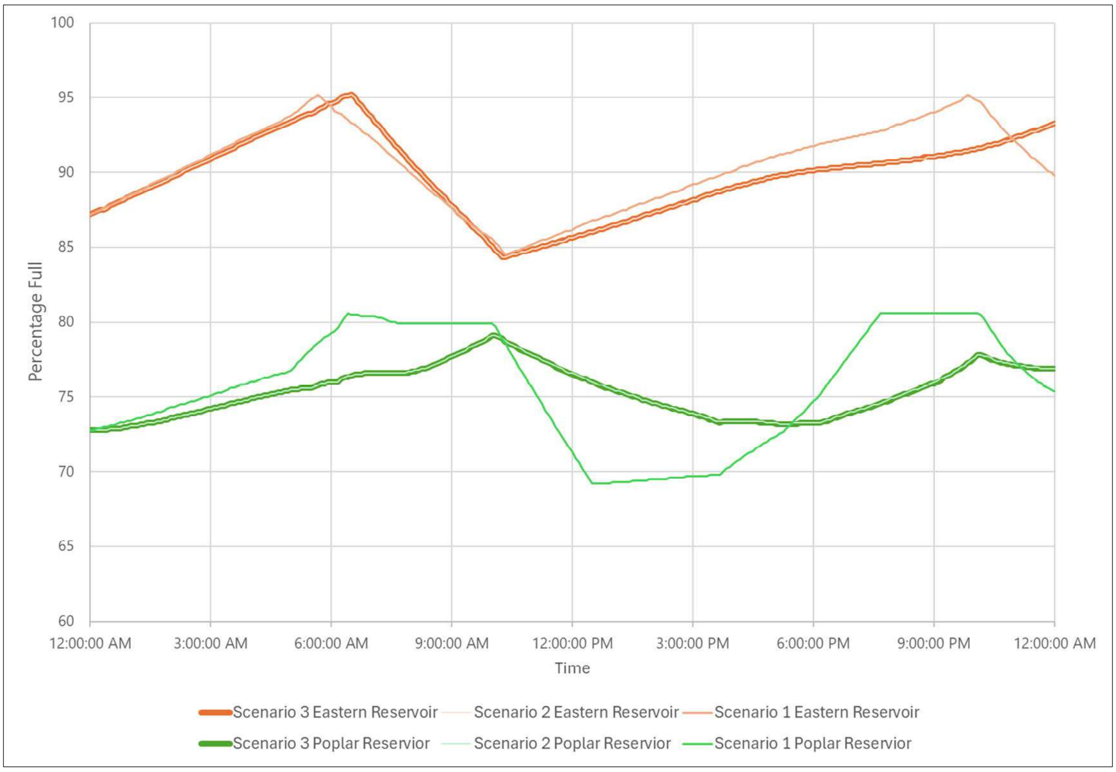


Figure 4: Scenario 1 to 3 – Eastern & Poplar (% Full)

5 10-Year + Bell Road (30%) + Te Tumu (20%)

5.1 10-Year Network Upgrades

The WMPL58 10-Year PDD model (67MLD) was used for the interim buildout scenario runs. In this model, the following upgrades were included as shown below in Figure 5.

- Upgrade of existing Bell Road watermain to DN450
- Addition of new DN300/DN450 water main to connect the new Bell Road main to the existing network at Stevenson Drive
- Addition of new internal network servicing the Te Tumu Development

In the 10-Year scenario the inflow to Eastern SR needs to be increased from 150 l/s to 160 l/s in order to refill the reservoir. The inflow to Poplar SR can be retained at a maximum of 60 l/s to balance flows within the transmission network.

In the 10-Year scenario the Omanu FCV remains closed, with the Mount Maunganui SR supplied via the Joyce WTP network across the Puwhariki FCV, as in the current day scenario. Waiari WTP supplies Poplar SR, Eastern SR & Mangatawa SR via the Seabreeze FCV. The CWTM1 & CWTM2 mains are not included in the 10-Year scenario, and instead the Carlyle FCV is fully open allowing flow to bypass Eastern SR.

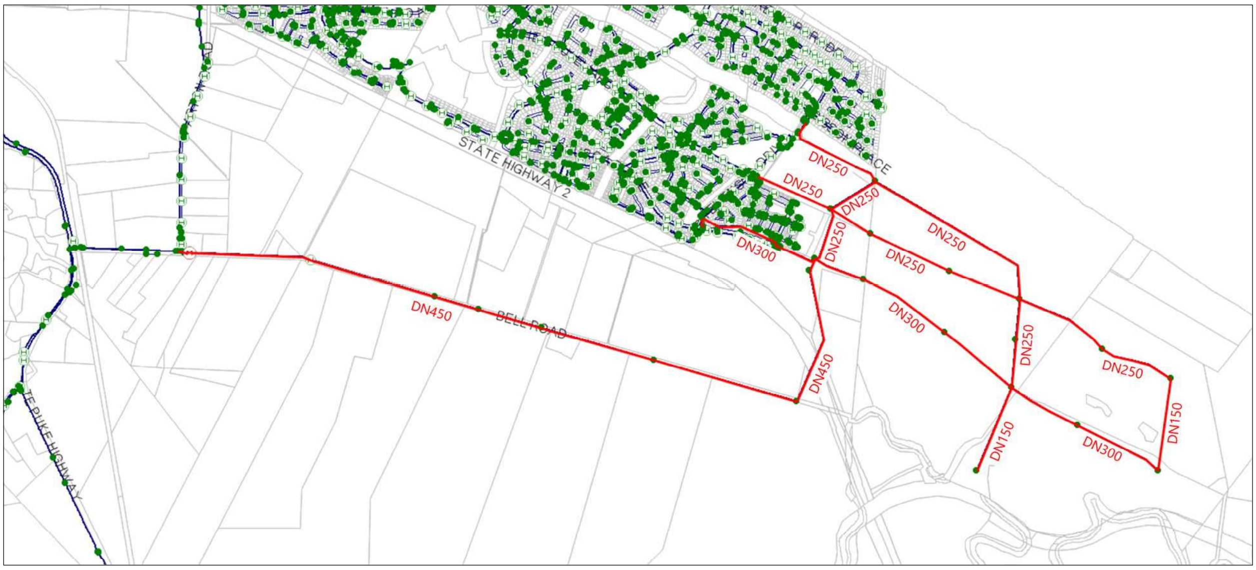


Figure 5: 10-Year Model Upgrades

5.2 Network Performance

Figure 6 below shows a comparison of Scenario 4 & Scenario 5 minimum pressure and maximum headlosses. As shown in Scenario 4, the upgraded DN450 main along Bell Road has sufficient capacity to supply 10-Year (2034) demands, including interim (20%) Te Tumu buildout, with headlosses within 5 m/km and minimum pressures above 30m. In Scenario 5, with the interim (30%) Bell Road buildout added into the model, along with interim (20%) Te Tumu buildout, minimum pressures drop slightly by ~2.5m to ~56m along Bell Road, with headlosses increasing to ~0.6 - 0.7 m/km. *This is well within TCC LoS which suggests the proposed Bell Road DN450 main upgrade is sufficiently sized to service interim buildout of both development areas, while maintaining level of service within the existing Wairakei network.*

Figure 6: Scenario 4 & 5 - Minimum Pressure & Maximum Headloss

5.3 Reservoir Performance

5.3.1 Operational Performance (Peak Demand)

Figure 7 below shows the performance of the Eastern, Poplar & Mangatawa SRs (all supplied from the Waiari WTP), in the 10-Year (2034) scenario when supplying the interim (30%) Bell Road and interim (20%) Te Tumu development demands.

In the 10-Year scenario the inflow to Eastern SR (without upgrade) needs to be increased from 150 l/s to 160 l/s in order to refill the reservoir. The additional headlosses created within the Waiari transmission network when increasing the Eastern SR inflow need to be balanced against the ability of the Seabreeze FCV to supplement flows to the Mangatawa SR and downstream network. The inflow to Poplar SR can be retained at a maximum of 60 l/s to balance flows within the transmission network.

In the 10-Year scenario, Poplar SR (4.5ML) is able to refill sufficiently over a 24-hour demand period, maintaining an operating range between 75-90% full. Eastern SR (10ML) operates similarly, with the increased 160 l/s inflow allowing sufficient refill when supplying downstream demand. Mangatawa SR (9ML) has a bi-directional inlet/outlet with an altitude valve at the reservoir site. Outflow from the Mangatawa SR is supplemented by flow across the Seabreeze FCV during daily demand, which under the 10-Year scenario is still able to refill the reservoir at night.

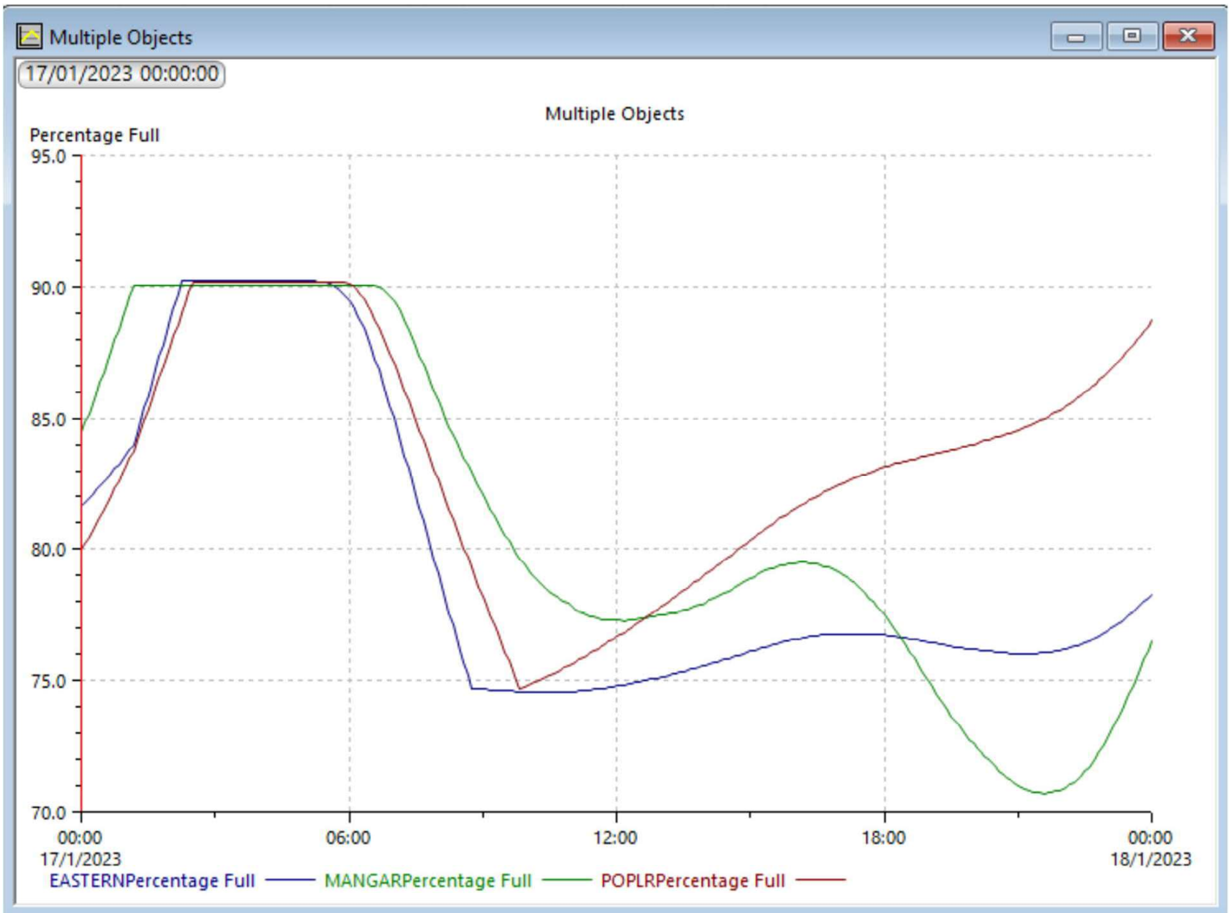


Figure 7: Scenario 4 & 5 – Eastern & Poplar & Mangatawa SRs (% Full)

5.3.2 Reservoir Storage (Eastern & Poplar SRs)

When assessing reservoir storage availability for the Bell Road & Te Tumu future network supply, we can consider storage availability in the Eastern & Poplar SRs, which directly service the downstream Domain, Parton (including Te Tumu) & Poplar/Bell (including Bell Road) DMAs. For this assessment, the following reservoir volumes should be used:

1. Poplar Lane SR – 4.5ML – usable volume at 80% is 3.6ML
2. Eastern No.1 SR - 10ML – usable volume at 80% is 8ML

Table 4 below shows the existing reservoir storage assessment without additional Te Tumu or Bell Road development demands, which indicates the 24-48 hour (ADD) requirement is able to be met in the 10-Year LTP (2034) horizon (67MLD total network demand) with 1.6 days (ADD) storage available.

Table 4: Reservoir Storage for Domain + Poplar + Wairakei +Te Tumu

Scenario	PDD (l/s)	ADD (/s)	Res Storage (ML)	24-hr Require (MLD)	Storage Avail (days)
Existing	72.0	58.0	11.6 ML	5.0 MLD	2.1 days
5-Year (2029)	97.2	78.7	11.6 ML	6.8 MLD	1.7 days
10-Year (2034)	106.5	86.3	11.6 ML	7.5 MLD	1.6 days

Table 5 below shows the reservoir storage assessment with additional Bell Road (30% buildout) and Te Tumu (20% buildout), which suggests the 24-48 hour requirement starts to be exceeded by the 10-Year LTP (2034) horizon (67MLD total network demand) with only 1.2 days (ADD) storage now available.

Table 5: Reservoir Storage for Domain + Poplar + Wairakei + Te Tumu + Bell Road Demand

Scenario	PDD (l/s)	ADD (/s)	Res Storage (ML)	24-hr Require (MLD)	Storage Avail (days)
Existing	72.0	58.0	11.6 ML	5.0 MLD	2.1 days
5-Year (2029)	102.5	83.0	11.6 ML	7.2 MLD	1.6 days
10-Year (2034)	136.0	110.2	11.6 ML	9.5 MLD	**1.2 days**

The only alternative supply mechanism to the Poplar Lane & Eastern SR is via the Water Lane FCV, which supplies from the Joyce WTP and is currently closed. This is opened weekly to encourage network turnover, and could be opened in an emergency, however the condition of the DN375 UPVC main and ability to transfer large amounts of water is not certain.

This suggests that in order to support interim development for the Bell Road and Te Tumu developments, the Eastern No.2 SR (proposed 11.4ML) is required for construction within the 10-Year LTP horizon. This was recommended as part of the Te Tumu Structure plan by the year 2037, hence the timing of the storage requirement would be brought forward with cumulative growth in Bell Road.

6 30-Year + Bell Road (100%) + Te Tumu (100%)

6.1 30-Year Network Upgrades

The WMPL58 30-Year PDD model (86MLD) was used for the ultimate buildout scenario runs. In this model, the following upgrades were included as shown below in Figure 8.

- Upgrade of existing Bell Road watermain to DN450
- Eastern No.2 SR providing an additional 11.4ML at the reservoir site
- Commissioning of the DN375/DN525 CWTM1 & CWTM2 to enable supply to Mount SR
- Mount No.2 SR providing an additional 10ML at the existing Mauao or Hull Road site
- Waiari CWT No.2 providing an additional 10ML at the WTP site

In the 30-Year scenario the inflow to Eastern SR needs to be increased from 160 l/s to 250 l/s in order to refill the reservoir. The additional headlosses created within the Waiari transmission network when increasing the Eastern SR inflow are balanced against the ability of the existing Waiari DN600 trunk network plus CWTM1&2 trunk mains to supply adequate inflow to the Mangatawa & Mount Maunganui SRs. The inflow to Poplar SR can be retained at a maximum of 60 l/s.

In the 30-Year scenario Mount Maunganui SR is now supplied via CWTM2 from the Waiari WTP network, and the Puwhariki FCV is closed. Waiari WTP supplies Poplar SR, Eastern SR, Mangatawa SR via the CWTM1 (dedicated inlet main), and Mount Maunganui SR via the CWTM2 (dedicated inlet main). Seabreeze FCV & Carlyle FCV are both closed with CWTM1 now connected just upstream allowing bypass of the Eastern SR.

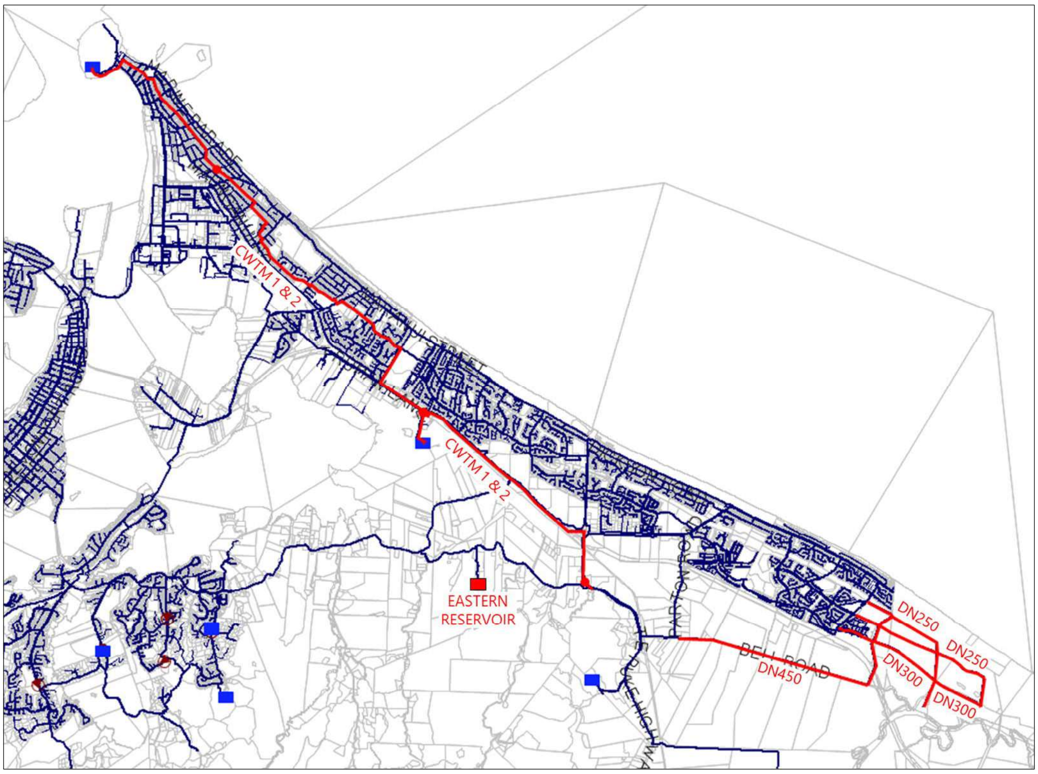


Figure 8: 30-Year Model Upgrades

6.2 Network Performance

Figure 10 below shows a comparison of Scenario 6 & Scenario 7 minimum pressure and maximum headlosses. Scenario 6 under 30-Year demand, with the upgraded Eastern No.2 SR in place and the DN450 Bell Road main shows the network is at capacity when supplying the full Te Tumu buildout (no Bell Road Development). Minimum pressures fall marginally below LoS at the extents of the Te Tumu development area. There are also high headlosses (around 5 m/km) across a number of local and transmission mains in this scenario.

In Scenario 7, with the ultimate Bell Road demands (45.9 l/s) also added into the model, along with ultimate Te Tumu demand (79.9 l/s), the existing Waiari network is unable to maintain supply. Minimum pressures worsen significantly to less than 10m at the extents of the Te Tumu development area which is well below TCC LoS.

In order to supply both the ultimate Bell Road & Te Tumu development buildout, the No.1 Road SR and watermain as recommended in the Te Tumu Structure Plan would be required within the 30-Year planning horizon. The location of the mains upgrade is provided in Figure 9 below. This was identified largely as a resilience requirement in the Te Tumu Structure plan (by 2047), however this becomes a network capacity requirement when servicing both Te Tumu & Bell Road development demands.

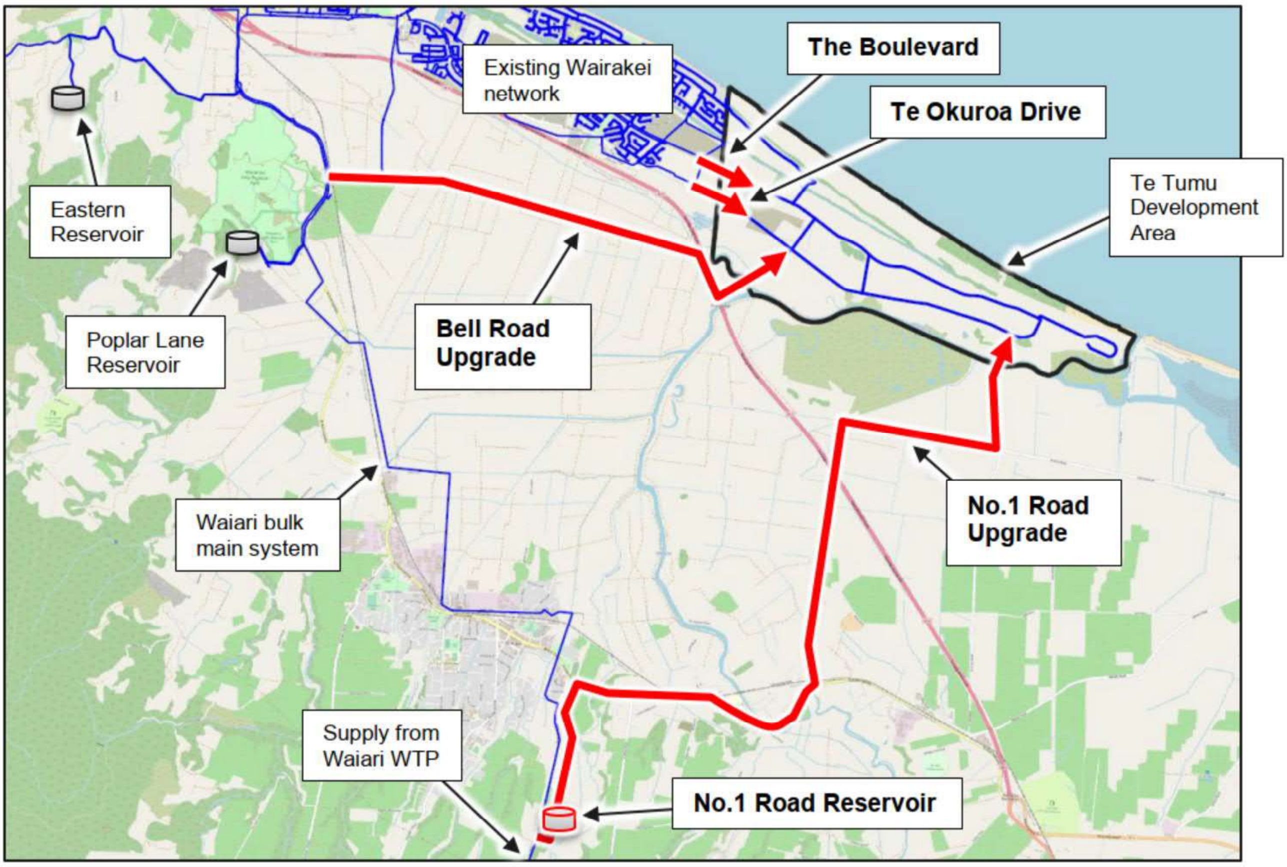


Figure 9: Te Tumu Greenfields Area & Key Supply Routes (taken from Stantec Report)

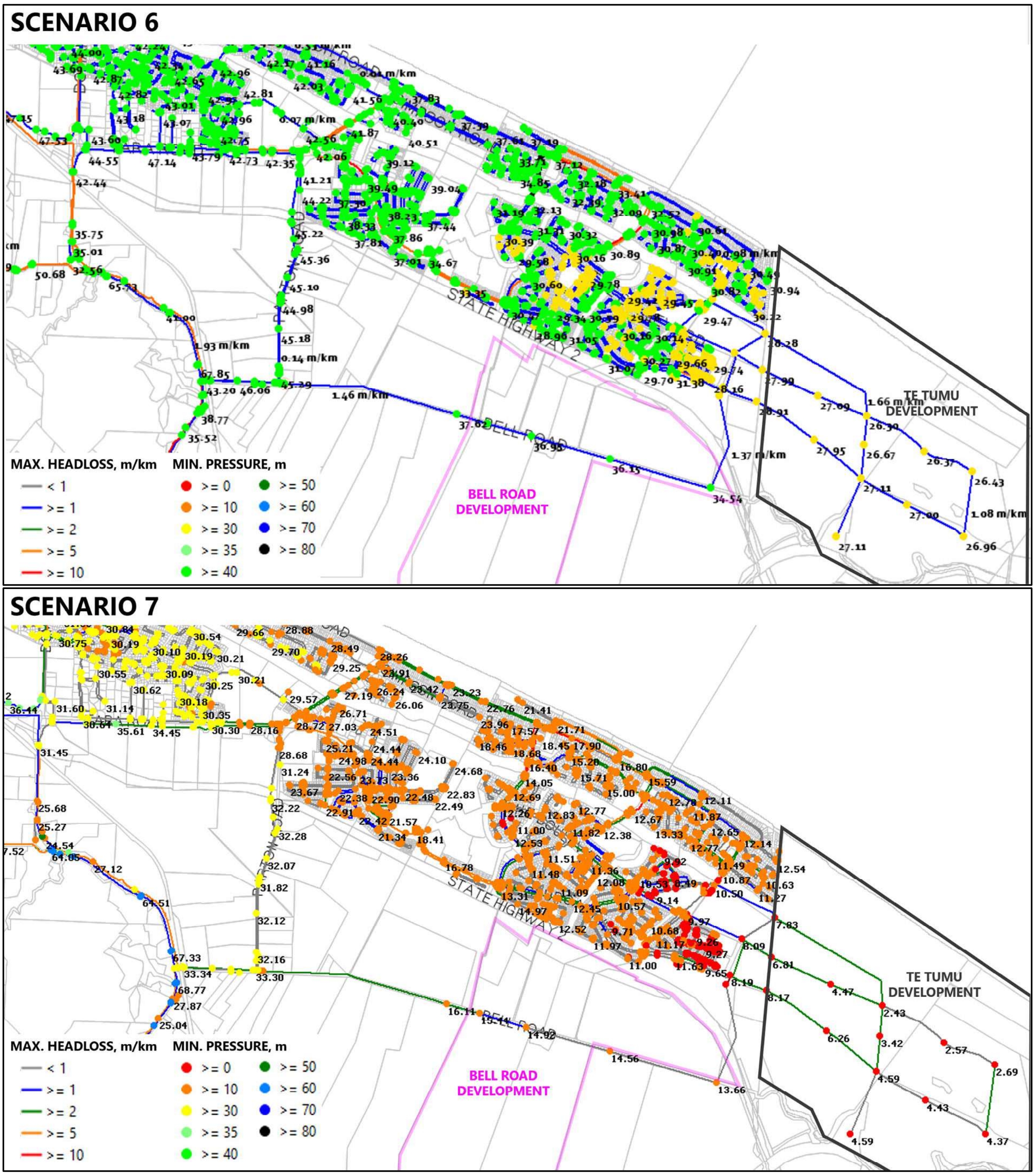


Figure 10: Scenario 6 & 7 - Minimum Pressure & Maximum Headloss

6.3 Reservoir Performance

6.3.1 Operational Performance (Peak Demand)

Figure 7 below shows the performance of the Eastern, Poplar, Mangatawa & Mount Maunganui SRs (all supplied from the Waiari WTP), in the 30-Year (2054) scenario when supplying the ultimate Bell Road and Tumu development demands.

In the 30-Year scenario even with the increased inflow (250 l/s) to the upgraded Eastern SR site (21.4ML), the reservoirs slowly drain to almost 50% over the 24-hour demand period. Similarly, the Poplar SR (4.5ML) drains to almost 50% when supplying ultimate demand. Due to increased headlosses in the Waiari WTP network, the Mount Maunganui SR (14.3ML) also struggles to fill via the new CWTM1 & CWTM2 mains.

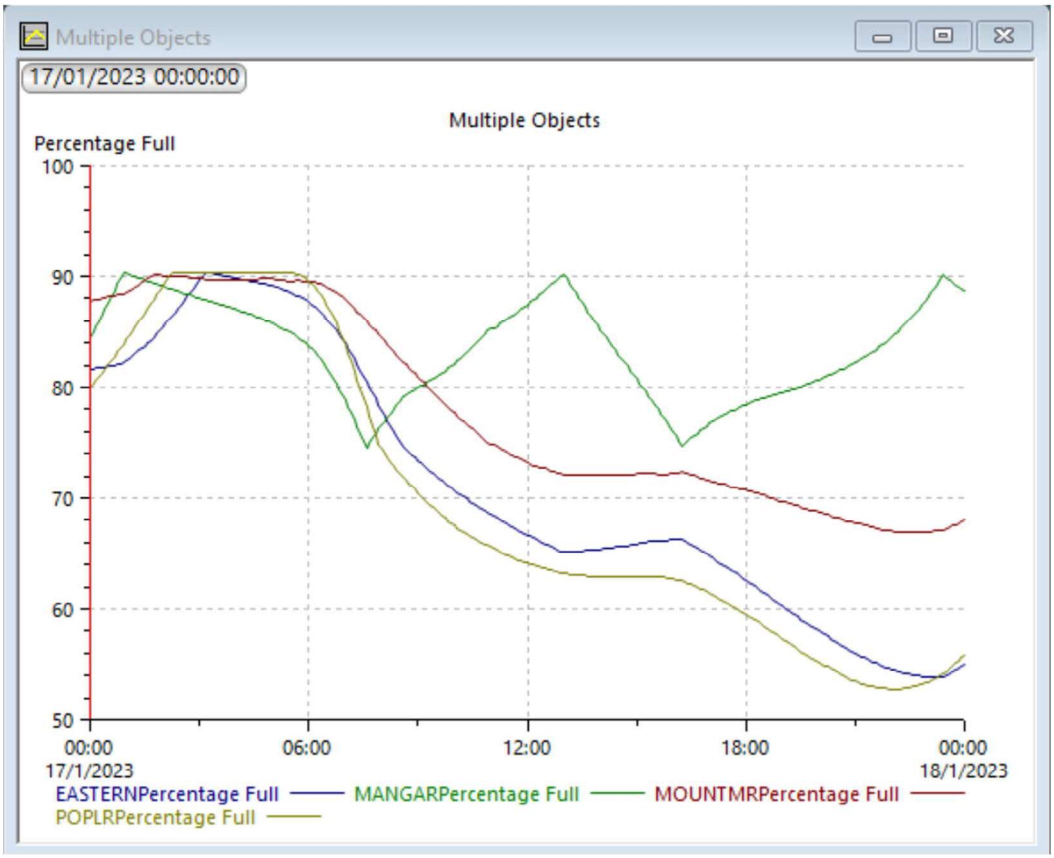


Figure 11: Scenario 7 – Coastal Strip SRs (% Full)

7 30-Year + Bell Road (60%) + Te Tumu (60%)

An assessment was made to determine a feasible trigger for reaching the capacity of the existing Waiari network (including proposed 30-Year upgrades) to supply Bell Road & Te Tumu demands, before the No.1 Road SR & watermain solution is required to service the Eastern expansion of the TCC water supply network.

It should be noted the existing Waiari WTP consent is 45MLD, and the current plant capacity is 30MLD. However, at the time of writing this memo, due to additional chlorine dosing required, the feasible output is between 12-15MLD. Hence upgrade of the WTP is required to service any growth beyond the 10-Year demand horizon.

Several demand scenarios were trialled to determine when the capacity requirement for the No.1 Road SR & watermain is triggered. This is governed by the ability of the upgraded Coastal Strip Reservoirs (as far as Mount Maunganui SR) to refill when servicing peak daily demand, and the ability of the downstream network to supply LoS pressures to the development extents.

The results indicate this is triggered when the Bell Road & Te Tumu combined demand reaches approximately 75 l/s (6.4MLD) along with infill growth in the 30-Year demand scenario. This equates to approximately 60% buildout of both development areas. In this scenario, 27.4MLD is being supplied from the Waiari WTP, which is reaching the current plant capacity. The total Coastal Strip demand is 29.4MLD.

This assessment relies on the following key assumptions:

1. Mount Maunganui SR is supplied from Waiari WTP with supplementary flow across the Harbour Bridge. If the current supply mechanism across Puwhariki FCV is considered feasible into the future (ie. Joyce WTP consent allows), this frees up capacity within the Waiari network for additional growth to the east, and removes the requirement for construction of CWTM2.

2. Assumes no supply to the Welcome Bay network, as considered in previous assessments, via the proposed Water Lane Pump Station. Additionally, does not allow for any resilience or flow transfer scenarios from the Waiari network to either the Joyce or Oropi WTP networks in the future.

The modelling results for this scenario (Scenario 8) are provided below.

7.1 Network Performance

Figure 12 below shows minimum pressure and maximum headlosses under Scenario 8 (60% development buildout) under 30-Year demand, with the upgrades proposed in the 30-Year planning horizon as in the section above. Minimum pressures fall marginally below LoS at the extents of the Te Tumu development area, however this would be considered acceptable. There are also high headlosses (around 5 m/km) across a number of local and transmission mains in this scenario.

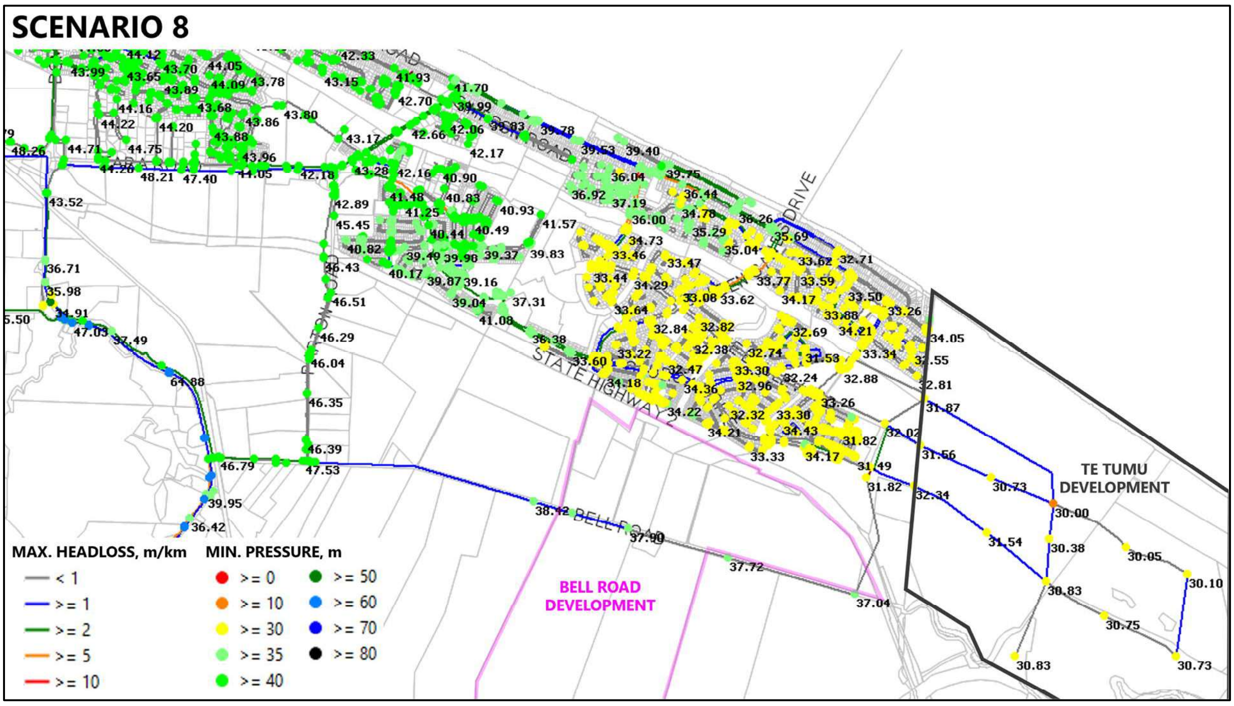


Figure 12: Scenario 8 - Minimum Pressure and Maximum Headloss

7.2 Reservoir Performance

7.2.1 Operational Performance (Peak Demand)

Figure 13 below shows the performance of the Eastern, Poplar, Mangatawa & Mount Maunganui SRs (all supplied from the Waiari WTP) in the 30-Year (2054) scenario when supplying 60% buildout of the Bell Road and Te Tumu development demands.

The inflow to the upgraded Eastern SR site (21.4ML) is increased to its maximum, with approximately 250 l/s peak flow able to be drawn from the Waiari transmission network. While the reservoir dips just below 70% full over the 24-hour simulation, it is able to refill over a 48-hour period, and maintains its level over a 7-day peak demand period.

Similarly, a peak flow of approximately 100 l/s is able to be conveyed to the upgraded Mount Maunganui SR site (14.2ML) along the CWTM2 transmission main. While the reservoir dips just below 70% full over the 24-hour simulation, it is able to refill over a 48-hour period, and maintains its level over a 7-day peak demand period.

Both Poplar SR (4.5ML) with a maximum inflow rate of 60 l/s and Mangatawa SR (9ML) supplied via the CWTM1 transmission main are able to maintain a daily operating depth of 70-90% full.

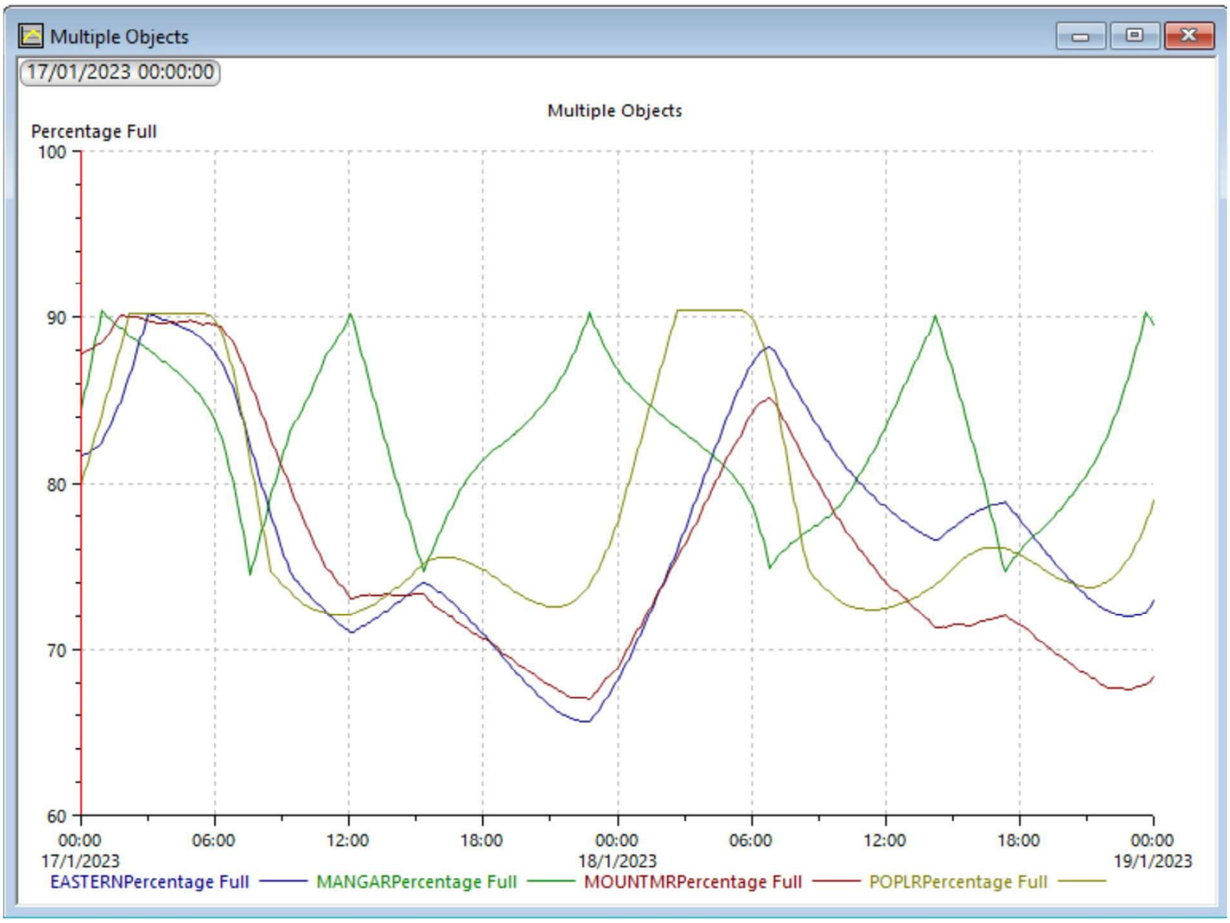


Figure 13: Scenario 8 – Coastal Strip SRs (% Full)

7.2.2 Reservoir Storage (Eastern & Poplar SRs)

When assessing reservoir storage availability for the Bell Road & Te Tumu future network supply, we can consider storage availability in the Eastern & Poplar SRs, which directly service the downstream Domain, Parton (including Te Tumu) & Poplar/Bell (including Bell Road) DMAs. For this assessment, the following reservoir volumes should be used:

1. Poplar Lane SR – 4.5ML – usable volume at 80% is 3.6ML
2. Eastern No.1 SR - 10ML – usable volume at 80% is 8ML
3. Eastern No.2 SR – 11.4ML – usable volume at 80% is 9.1ML

Table 6 below shows a reservoir storage assessment with the additional Eastern No.2 SR upgrade (11.4ML) in the 30-Year demand horizon. For Scenario 8, with assumed 60% buildout of Bell Road & Te Tumu, the 24-48 hour (ADD) requirement is able to be met with 1.5 days (ADD) storage available. This decreases to 1.2 days (ADD) storage when considering 100% buildout of both development areas.

Table 6: Reservoir Storage for Domain + Poplar + Wairakei + Te Tumu + Bell Road Demand

Scenario	PDD (l/s)	ADD (/s)	Res Storage (ML)	24-hr Require (MLD)	Storage Avail (days)
Existing	72.0	58.0	11.6 ML	5.0 MLD	2.1 days
5-Year (2029)	102.5	83.0	11.6 ML	7.2 MLD	1.6 days
10-Year (2034) Te Tumu & Bell Road (30%)	136.0	110.2	11.6 ML	9.5 MLD	**1.2 days**
30-Year (2054) Te Tumu & Bell Road (60%)	196.5	159.2	**20.7 ML**	13.7 MLD	1.5 days
30-Year (2054) Te Tumu & Bell Road (100%)	247.5	200.5	**20.7 ML**	17.3 MLD	**1.2 days**

APPENDIX E – UTILITY CORRESPONDANCE

Matthew Kerse

From: Resource Consents <Resourceconsents@powerco.co.nz>
Sent: Wednesday, 6 August 2025 10:57 am
To: Matthew Kerse
Cc: Bev Higginbotham
Subject: Electricity Supply To: Bell road, Papamoa
Attachments: BM250088_WS_Concept_Framework_Plan_WIP_20250718.pdf; BOP0749-C400.pdf

Hi Matthew,

Electricity Supply To: Bell road, Papamoa

An upgrade will be required to provide a suitable connection point for all units/lots of this development. There will be a cost to complete this work.

Please contact a Powerco Approved Contractor for a price and design. Conditions may apply. These conditions will be advised as part of the quotation from the Contractor.
Standard connection fees will apply once this upgrade work has been completed.

Please be advised the information contained herein is current as of the date of this letter but could be subject to change over time.

Many thanks,

Zoe

www.powerco.co.nz

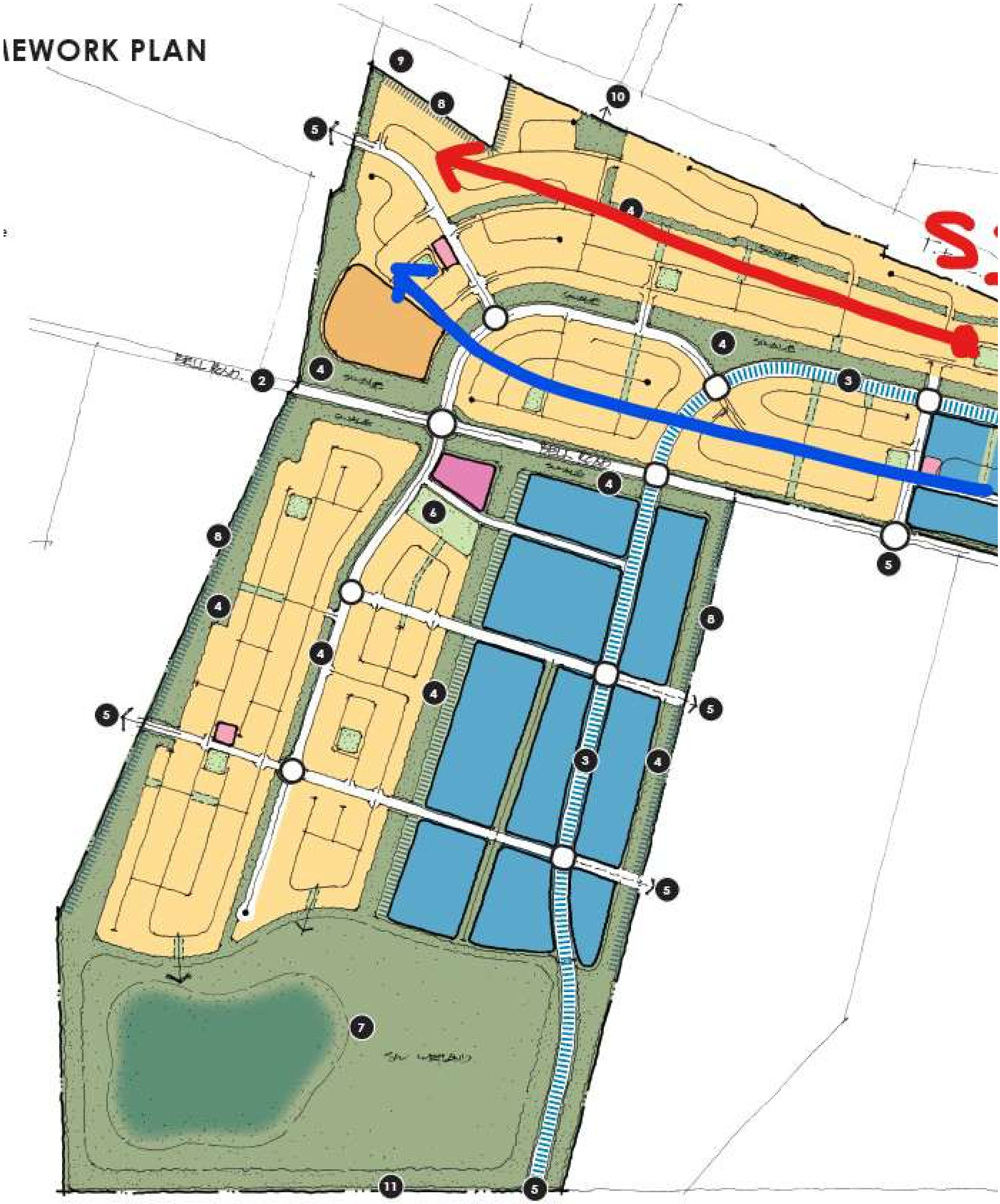
POWERCO

From: Matthew Kerse <MatthewK@maven.co.nz>
Sent: Wednesday, 6 August 2025 10:22 am
To: Resource Consents <Resourceconsents@powerco.co.nz>; Bev Higginbotham <Bev.Higginbotham@powerco.co.nz>
Cc: BOP0749 - Bell Road <BOP0749@maven.co.nz>
Subject: RE: Confirmation of Electricity Supply - Fast-track Development, Bell Road Papamoa

Hi Zoe and Bev, I appreciate the patience on this.

As discussed Bev, I have attached the preliminary concept masterplan that outlines the residential and light commercial/industrial zoning for the fast-track site. This has recently been prepared and presented to BOPRC and WBOPDC for early consultation, so please note the early nature of this and note that this is not public information. At this point we do not have a detailed scheme plan showing the lots. The Developer's intent is standalone housing and likely to be in the order of 3000 Lots to release 200 Lots/year over 20 years beginning in 2028/2029.

The development will be staged from the northeastern extent adjacent the State Highway first, to west (red arrow), then the remaining portion of the north block from east to west (blue arrow). It is envisaged that the north block will take in the realm of 10 years to develop. The land south of Bell Road would commence once the northern block is fully developed



I have also attached the concept stormwater layout plan that shows two stormwater pump locations intended to be implemented to deal with stormwater runoff from the site and catchment. Initial sizing is noted on the plan and early discussion with BOPRC was completed yesterday. These pumps will be primarily electricity powered, with backup diesel generators. These pumps will need to be implemented at the stage that the north block is 50-75% developed

I hope this provides enough context at your end to progress the confirmation letter we require to accompany the substantive application to the EPA.

Please do not hesitate to get in contact to discuss further.

Cheers,

Matthew Kerse
PRINCIPAL – MAVEN BAY OF PLENTY
BSurv, MS+SNZ, Licensed Cadastral Surveyor

MAVEN BOP LIMITED
07 242 4255 | 027 313 3734
MatthewK@maven.co.nz
www.maven.co.nz
116 Cameron Road, Tauranga

From: Resource Consents <Resourceconsents@powerco.co.nz>
Sent: Tuesday, 5 August 2025 1:26 pm
To: Matthew Kerse <MatthewK@maven.co.nz>
Cc: BOP0749 - Bell Road <BOP0749@maven.co.nz>
Subject: RE: Confirmation of Electricity Supply - Fast-track Development, Bell Road Papamoa

Hi Matthew,

Just following up on my below email, so we can issue a resource consent letter, can you please provide the scheme plan that references each lot.

Many thanks,

Zoe
Project Manager Support

Ph: 0800 769 372

www.powerco.co.nz

From: Resource Consents
Sent: Monday, 28 July 2025 8:14 am
To: Matthew Kerse <MatthewK@maven.co.nz>

Cc: BOP0749 - Bell Road <BOP0749@maven.co.nz>
Subject: RE: Confirmation of Electricity Supply - Fast-track Development, Bell Road Papamoa

Hi Matthew,

For us to be able to issue a Resource Consent letter, we do require the scheme plan so we can reference each individual lot. Can you please send this over.

Many thanks,

Zoe
Project Manager Support

Ph: 0800 769 372

www.powerco.co.nz

POWERCO

From: Matthew Kerse <MatthewK@maven.co.nz>
Sent: Thursday, 24 July 2025 10:18 am
To: Resource Consents <Resourceconsents@powerco.co.nz>
Cc: BOP0749 - Bell Road <BOP0749@maven.co.nz>
Subject: Confirmation of Electricity Supply - Fast-track Development, Bell Road Papamoa

To whom in concern,

We are currently preparing a substantive application under the Fast-track Approvals Act 2024 for a large-scale residential development located on Bell Road, Papamoa.

The preliminary concept masterplan estimates up to 3800 residential Lots, with approximately 60 ha of employment zone. Flood pumps will be upgraded and incorporated to manages existing flood effects within the catchment. The overall development is intended to be progressed over a 20 year period, market depending.

The exact site extents are still being finalised however the development will encompass approximately 350 hectares on Bell Road. A masterplan can be shared in due course once this is refined and agreed. The general site location is depicted below:

Can you please provide us a confirmation letter to confirm power can be supplied to service our development area and we will include it as part of our substantive application.

Let me know if you need anything else from me.

Thanks,

Matthew Kerse
PRINCIPAL – MAVEN BAY OF PLENTY
BSurv, MS+SNZ, Licensed Cadastral Surveyor

MAVEN BOP LIMITED
07 242 4255 **|** 027 313 3734
MatthewK@maven.co.nz
www.maven.co.nz
116 Cameron Road, Tauranga

24 October 2025

TELECOMMUNICATIONS SERVICES FOR WAIRAKEI SOUTH
SUPPORTING DETAIL

To Whom It May Concern,

On the 24 July 2025 Tuatahi confirmed that, provided an installation agreement was entered into, Tuatahi would be able to provide telecommunication services to the proposed development.

Further to this, Tuatahi can also share further information on how this development would be served to support planning and due diligence. This is copied below

- Tuatahi owns and operates a central office in Papamoa, this has been installed with capacity to service approximately 7000 connections. Currently utilising <10% this is intended to service most short- and medium-term growth in the area, including Wairakei South
- This central office is currently being upgraded to deliver the latest fibre XGSPON technology serving the community with world leading speeds and reliability
- Tuatahi also worked with Tauranga City Council to install fibre infrastructure across the new "Sands Town Centre Interchange" bridge
    - This is specified to allow for a primary supply of up to 5,400 potential services
- Duct and network capacity has been considered between this interchange, and the Papamoa Tuatahi central office, requiring only trivial augmentation to accommodate the Wairakei South project
- Two secondary routes have also been identified to ensure this community has reliability of supply as it grows and becomes of considerable size. These are;
    - A nearby underpass approx. 1,300m west of its existing SH2 Crossing. And/or;
    - Joining the Papamoa/Wairakei South Network into the Te Puke UFB network in coordination with upgrades to Seddon Road as part of its long-term plan
- Tuatahi also has a long and proven history successfully working on projects of this nature across the Papamoa, Bay of Plenty and North Island. Tuatahi coordinates its infrastructure build with the developer and construction of other services to execute in an efficient manner with minimal disruption
- Tuatahi Fibre infrastructure is 'future proof', supporting connections to all businesses and residential properties as well as being a prerequisite for most technology initiatives

In summary, servicing this area has been included as part of Tuatahi long term planning for some time. Tuatahi foresees no reason that the same level of Fibre connectivity could not be achieved in this growth area, as exists in the rest of Tauranga and Western Bay

Kind Regards,

Tony Seddon
Regional Manager – BOP
Tuatahi First Fibre Ltd

Matthew Kerse

From: Paul Bird <Paul.Bird@firstgas.co.nz>
Sent: Wednesday, 19 November 2025 3:02 pm
To: Matthew Kerse
Cc: BOP0749 - Bell Road
Subject: Confirmation of Gas Supply - Fast-track Development, Bell Road Papamoa

You don't often get email from paul.bird@firstgas.co.nz. Learn why this is important

Matthew,

I refer to your email of 3 October. Please see our response below.

Can you please provide expert input on the following matters:

- Whether gas reticulation is able to be provided to serve the residential lots for this development **YES, but the cost to extend the network and all future reticulation and connection costs would be borne by the end user. Therefore,**
  - If so, should this be considered or is standalone califont gas supply more appropriate? **We believe that an LPG supply (bottles) would be more appropriate for residential users**
- Generally how are commercial/light industrial areas serviced for gas in the BOP region? Is reticulated gas infrastructure appropriate or standalone individual bottle/tanks more appropriate? **Dependent on specific energy needs either natural gas or LPG can be appropriate, however for many users, natural gas will only be used if they border the existing network or existing network is nearby. Otherwise alternative forms of process energy are considered.**
- Depending on the items above whether a confirmation letter to confirm gas can be supplied to service our development area and we will include it as part of our substantive application. **Based on the above we do not think a confirmation letter is warranted.**

Of course, if you have any questions, please let me know.

Paul Bird
Distribution Development Manager
Firstgas
Midland Chambers, Level 9, 45 Johnston Street, Wellington, 6011
04 979 5367 +64 27 531 0060 firstgas.co.nz

From: Matthew Kerse <MatthewK@maven.co.nz>

Sent: Friday, 3 October 2025 9:55 am
To: Connections <connections@firstgas.co.nz>
Cc: BOP0749 - Bell Road <BOP0749@maven.co.nz>
Subject: Confirmation of Gas Supply - Fast-track Development, Bell Road Papamoa

Warning: External email

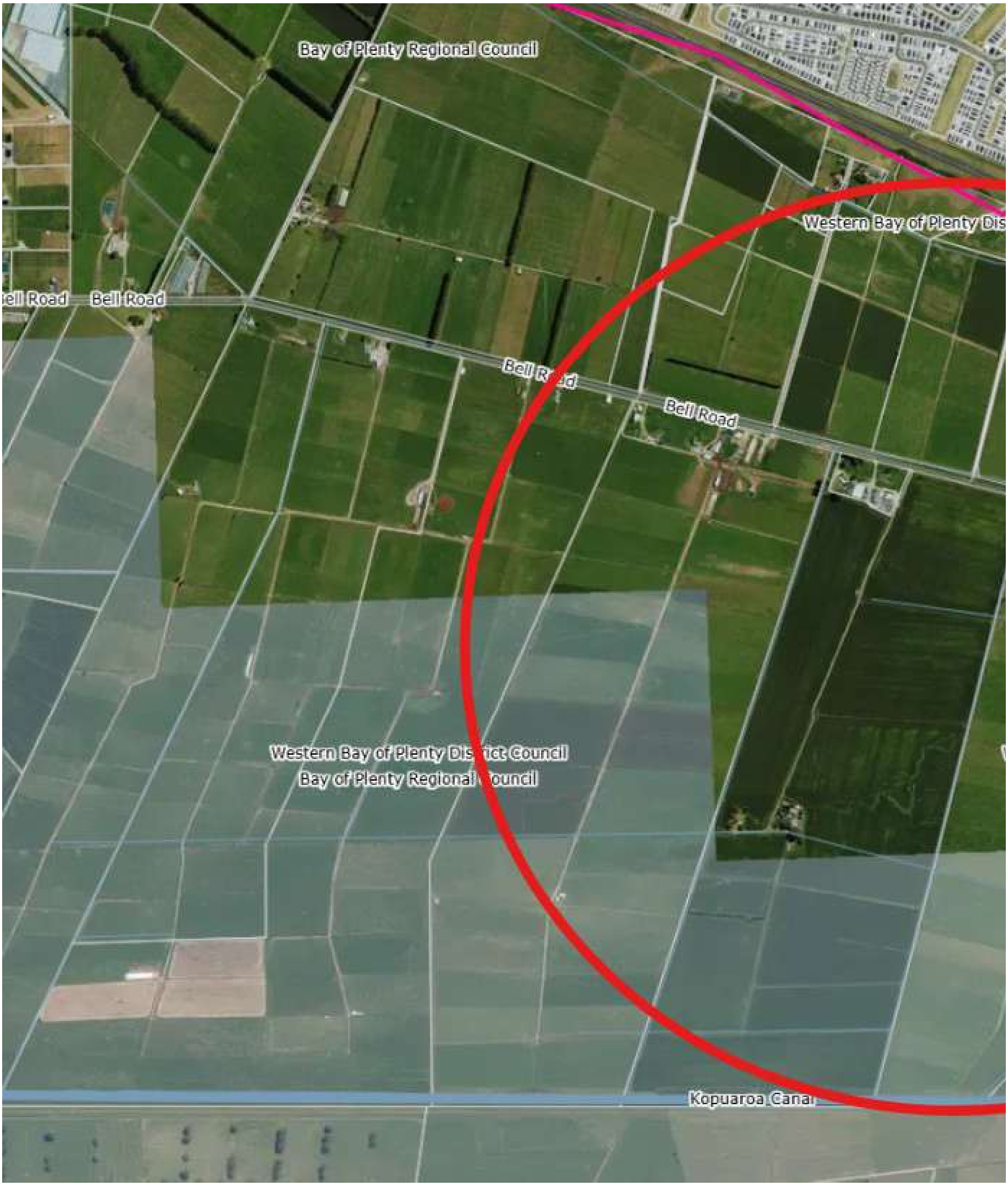
To whom in concern,

We are currently preparing a substantive application under the Fast-track Approvals Act 2024 for a large-scale residential development located on Bell Road, Papamoa.

The concept masterplan is attached and provides for approximately 2700 residential Lots, with approximately 60 ha of employment zone (commercial & light industrial).

development is intended to be progressed over a 20 year period, market depending.

The general site location is depicted below:



Can you please provide expert input on the following matters:

- Whether gas reticulation is able to be provided to serve the residential lots for this development
  - If so, should this be considered or is standalone califont gas supply more appropriate?
- Generally how are commercial/light industrial areas serviced for gas in the BOP region? Is reticulated gas infrastructure appropriate or standalone individual bottle/tanks more appropriate?
- Depending on the items above whether a confirmation letter to confirm gas can be supplied to service our development area and we will include it as part of our substantive application.

Let me know if you need anything else from me.

Thanks,

Matthew Kerse
PRINCIPAL – MAVEN BAY OF PLENTY
BSurv, MS+SNZ, Licensed Cadastral Surveyor

MAVEN BOP LIMITED
07 242 4255 **|** 027 313 3734
MatthewK@maven.co.nz
www.maven.co.nz
116 Cameron Road, Tauranga

Tuatahi
First Fibre

PO Box 27050
Garnett Avenue 3257
0800 Fibre LTD
tuatahifibre.co.nz

24 July 2025

CONDITIONAL ACCEPTANCE BY TUATAHI FIRST FIBRE LIMITED AS TELECOMMUNICATIONS OPERATOR

Development: Wairakei South
TFF ID: PG1000058

1. Tuatahi First Fibre Limited (TFF) confirms that a TFF telecommunications connection will be made available for each site in the development, **providing the developer was to sign a TFF Installation Agreement.** Upon approval of this agreement, TFF will undertake to become the telecommunications operator of the telecommunications reticulation in the proposed development and any proposed public roads at Wairakei South (the "**Subdivision**"), to provide network connections to all lots / units in the Subdivision (the "**Reticulation**").

2. The Reticulation will be installed in accordance with:

   (a) the requirements and standards set by the Western Bay of Plenty District Council and advised to TFF via the Council's website; and

   (b) the requirements of the Telecommunications Act 2001 and all other applicable laws, regulations and codes (as amended).

3. The Reticulation will be installed by our preferred provider to TFF's satisfaction.

4. TFF will be the owner, operator and maintainer of the Reticulation.

5. One or more retail service providers will be available to supply telecommunications services over the completed Reticulation when service is available, provided that TFF shall not be responsible if the retail service provider's offer to supply such telecommunications services or the number of such providers varies from time to time.

SIGNED for and on behalf of **TUATAHI FIRST FIBRE LIMITED** by:

Signature: D J Rugaas

Name: Daniel Rugaas