

SOUTHERN LINKS 1 RESIDENTIAL

INFRASTRUCTURE REPORT

PROJECT INFORMATION

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1. Statement of Experience

Author

I am Min Shon, a Senior Civil Engineer with Maven Waikato Ltd. I hold a Master of Civil Engineering from the University of Auckland and am a Chartered Professional Engineer (CPEng) registered with Engineering New Zealand. I have over six (6) years of professional experience in civil engineering, with particular experience in land development, including earthworks, roading, and three waters infrastructure design.

I confirm that I have read and understood the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023, and agree to comply with its requirements.

I acknowledge that, as an expert, I have an overriding duty to assist the decision-maker impartially on matters within my area of expertise. In preparing this report, I have exercised my independent professional judgement, and the opinions expressed in this report are my own. I understand that my duty as an expert is not to advocate for the interests of the applicant or any other party.

I confirm that the matters addressed in this report are within my area of expertise, except where I expressly identify that I have relied upon information, assessments or opinions provided by others. I have made all reasonable enquiries and have not knowingly omitted any material facts known to me that might alter or detract from the opinions expressed in this report.

Reviewer

My name is Sean McDonald. I am a Senior Engineer and Team Leader at Maven Waikato Ltd ("Maven"), a firm of consulting engineers and surveyors based in Hamilton. I have been employed by Maven since 2025. I hold a Bachelor of Engineering Technology (Highways) which I graduated from in 2006, hold a New Zealand Certificate of Engineering "Civil" (NZCE) and I am a member of Engineering New Zealand.

I have over 29 years' of experience in the field of civil engineering including as a civil engineering technician, New Zealand army engineer, council engineer and consulting engineer, with over 20 years' of experience post degree. Since obtaining my degree I have worked on a variety of civil projects including State Highway works, 3 Waters Infrastructure works, Residential Land Development, Commercial and Industrial Land Development and major Infrastructure projects such as the upgrade of the Port Boteny (Sydney) Naphtha Storage Facilities, the Transpower upgrade and extension of the Whakamuru Substation, the Central Government Rotorua Youth Justice Facility and Contact Energy's new Tauhara Geothermal power station.

I confirm that I have read and understood the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023, and agree to comply with its requirements.

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2. EXECUTIVE SUMMARY

2.1. Purpose and Context

This Infrastructure Report supports the Substantive Application under the Fast-track Approvals Act 2024 for the SL1 Residential Development at 37A Saxbys Road, Deanwell, Hamilton. The report has been prepared in accordance with Hamilton City Council's Regional Infrastructure Technical Specifications (RITS) relevant New Zealand and Austroads standards and the Mangakōtukutuku Integrated Catchment Management Plan (Final Draft 2025) and accompanies the application for a comprehensively master-planned residential community of approximately 938 lots and a neighbourhood commercial node.

The site occupies approximately 46 hectares of gently undulating farmland on the south-western fringe of Hamilton forming the residential heart of the wider 440-hectare Southern Links 1 (SL1) Growth Cell. Currently in single ownership across multiple titles and used for rural pastoral farming the land sits within the Mangakōtukutuku Stream catchment and is bounded by Saxbys Road to the south with frontages to Macmurdo Avenue and Forth Crescent to the west. The site is underlain predominantly by Hinuera Formation interbedded silt and sands with peat deposits identified further to the south-west, outside the development footprint. These ground conditions in particular the low-lying topography that currently generates widespread shallow flooding and poorly defined overland flow paths during significant rainfall events are the defining constraint that has shaped the infrastructure strategy.

2.2. Design Philosophy and Statutory Framework

The infrastructure design adopts an integrated, multi-disciplinary approach covering earthworks, roading, stormwater, wastewater, water supply and utility servicing. The design incorporates Water Sensitive Urban Design (WSUD) principles and has been developed in accordance with the Waikato Regional Policy Statement, Waikato Regional Plan, National Environmental Standards for Freshwater, Hamilton City Council's Regional Infrastructure Technical Specifications (RITS), relevant New Zealand and Austroads standards, and applicable erosion and sediment control requirements.

Key design outcomes include balanced earthworks with a net surplus of approximately 17,160 m³, a connected and multimodal road network, integrated stormwater treatment and attenuation, wastewater servicing through two pump stations, and a water supply network achieving the RITS minimum pressure requirement of 200 kPa (20 m head).

2.3. Earthworks

Bulk earthworks across the approximately 43.3-hectare disturbance area comprise approximately 290,000 m³ of cut and 273,000 m³ of compacted fill, resulting in a net surplus of approximately 17,160 m³. Approximately 86,690 m³ of topsoil will also be stripped, stockpiled and reused.

Earthworks will be undertaken progressively across three work sections and managed in accordance with the Waikato Regional Council Guidelines for Soil Disturbing Activities (TR 2009/02). Comprehensive erosion and sediment controls will be implemented throughout construction, including sediment retention ponds, chemically treated decanting earth bunds, silt fences, stabilised entrances and clean water diversion drains.

2.4. Roothing and Access

The development will be accessed from Saxbys Road, Macmurdo Avenue and Forth Crescent, with a potential future connection to Houchens Road as the wider SL1 Growth Cell develops. The internal network provides a hierarchy of arterial, collector and local roads designed in accordance with RITS and Austroads requirements, together with walking and cycling facilities and on-street parking.

An Integrated Transportation Assessment confirms that the surrounding transport network can accommodate the anticipated traffic generated by the development, with no engineering exceptions proposed.

2.5. Stormwater

Stormwater management is a key component of the infrastructure strategy and adopts an integrated treatment-train and WSUD approach. The system comprises on-lot detention/retention, piped primary conveyance and swales, six artificial wetlands, and controlled discharge to the Mangakōtukutuku Stream.

The stormwater system is designed to provide water quality treatment and attenuation for events up to the 100-year ARI, including climate change allowances, with post-development discharge controlled to 80% of pre-development flows. Overland flow paths are incorporated within the road network to safely convey flows exceeding the primary piped system capacity.

Comprehensive 2D HEC-RAS modelling confirms that the development maintains flood immunity during the 100-year ARI event and that downstream flood impacts are negligible. The assessment also considers a blocked-device sensitivity scenario and confirms that the proposed overland flow paths provide a safe and resilient secondary conveyance system. The stormwater strategy aligns with the Mangakōtukutuku ICMP, Hamilton City Council Stormwater Guidelines and RITS requirements.

2.6. Wastewater — Interim and Ultimate Solutions

Wastewater servicing will be provided through two new pump stations, supported by gravity reticulation across all five development stages. The proposed interim connection to the Peacocke wastewater network has been assessed by WSP and has sufficient available capacity to accommodate the proposed development flows, including the assessed peak wet weather flow of 17.54 L/s.

The Peacocke network's ultimate capacity is allocated to the wider Peacocke development; therefore, the proposed connection represents an interim servicing solution. The permanent solution will depend on the delivery of the Southern Wastewater Treatment Plant and associated conveyance infrastructure. A decentralised membrane bioreactor (MBR) has also been identified as an alternative servicing pathway should the reticulated connection become impracticable.

Both pump stations provide emergency storage consistent with RITS requirements and will be located above the 100-year flood level with appropriate freeboard.

2.6.1. Wastewater Pipe Construction Methodology

Open Trench Construction: Open trench construction involves excavating a continuous trench along the pipeline alignment, installing the pipe and associated fittings, and then backfilling and reinstating the surface. The construction duration will depend on the length of pipe, ground conditions, access, and the extent of required reinstatement works. Construction is expected to progress progressively along the alignment, with temporary impacts including excavation, stockpiling of spoil, construction traffic, noise, dust, and localised disruption to access. Where required, trenches will be managed through appropriate temporary works, dewatering, traffic management, and trench safety measures.

Drill Shot Construction (Trenchless): Drill shot construction is a trenchless installation method where the pipeline is installed underground using directional drilling, with excavation generally limited to entry and exit locations. Each drill shot is approximately 120m long and is anticipated to take an average of three days to complete, followed by an additional day to switch over lot connections and install pipe fittings. For the proposed approximately 3km pipeline, the overall construction programme is estimated at approximately 16 weeks (around four months), including testing and commissioning (livening). The

method will minimise surface disturbance along the alignment; however, temporary impacts may include drilling noise, construction traffic, management of drilling fluids and spoil, and localised disturbance at the launch and receiving pits.

2.7. Water Supply

Water supply will be provided through connections to existing mains on Saxbys Road, Macmurdo Avenue and Forth Crescent, supplemented by a connection to the Dixon Road bulk main for later development stages. Three servicing options have been assessed, with a fully reticulated network identified as the preferred option.

EPANET modelling confirms that the proposed network achieves the RITS minimum pressure requirement of 200 kPa (20 m head) across all stages. Firefighting supply also meets the applicable FW2 residential and FW3 commercial requirements. Existing pressure deficiencies within the wider Hamilton South network have been identified as pre-existing constraints and are not materially worsened by the proposed development.

2.8. Power and Communications

Reticulated power and fibre communications will be provided by the respective network utility operators and have been incorporated into the typical service cross-section per provider agreements.

2.9. Conclusion

The Infrastructure Report demonstrates that the proposed SL1 Residential Development can be adequately serviced through an integrated and staged infrastructure strategy that responds to the site's existing ground, drainage and flooding constraints.

The proposed earthworks, roading, stormwater, wastewater, water supply and utility infrastructure have been designed to meet the relevant technical requirements. In particular, the stormwater strategy provides an integrated approach incorporating six artificial wetlands, formalised overland flow paths and controlled discharge at 80% of pre-development flows, while hydraulic modelling confirms that flood risk and downstream impacts are appropriately managed.

Wastewater servicing is viable on an interim basis through the Peacocke network, with an ultimate servicing pathway identified through the Southern Wastewater Treatment Plant. Water supply achieves the required pressure and firefighting standards across all stages. Remaining matters relate principally to detailed design, implementation and confirmation of infrastructure delivery programmes and do not represent impediments to the overall feasibility of the infrastructure strategy.

2.10. Staging and Delivery

The proposed development is delivered in five stages with each stage incorporating the infrastructure required to service its catchment independently prior to the commencement of subsequent stages:

Stage	Lots	Stormwater	Wastewater	Water Supply
Stage 1	321	Wetland A & F, Catchment A (13.0 ha)	WWPS A, gravity + rising main to 144 Hall Rd	DN450 PE mains, connect to Saxbys Rd + Dixon Rd
Stage 2	222 + 1 commercial	Wetland B, Catchment B (7.6 ha)	WWPS B, gravity + rising main to WWPS A	DN63–DN180 PE local mains

Stage	Lots	Stormwater	Wastewater	Water Supply
Stage 3	Combined: 394	Wetland C & F, Catchment C (8.5 ha) + F (4.0 ha)	Gravity to WWPS A	DN63–DN180 PE local mains
Stage 4		Wetland D, Catchment D (5.3 ha)	Gravity via pipe bridge to Stage 3 network	DN63–DN180 PE local mains
Stage 5		Wetland E, Catchment E (5.9 ha)	Gravity to Stage 1 network	DN63–DN180 PE local mains

The development will be staged, with each stage designed to operate independently while maintaining consistency with the overall infrastructure strategy. Interim measures during construction are addressed through the Construction Management Plan, including temporary erosion and sediment controls, haul roads, and staged commissioning of stormwater devices.

3. Introduction

3.1. Background

Maven Waikato Ltd have been engaged b to undertake Infrastructure Design including earthworks, roadings, and 3 waters in support of the Residential Development at 37A Saxbys Road, Deanwell, Hamilton.

The proposal seeks approval for a Substantive Application under the Fast-track Approvals Act 2024 for a comprehensively master planned and staged residential development. This includes all necessary resource consents under the Resource Management Act 1991, including regional, district approvals where required.

This Infrastructure Report (IR) relates to the residential component (referred to as the Residential Development and Residential Area) of the wider SL1 Project, a listed project, which includes both residential and industrial components and together comprises circa 106ha of the overall SL1 Growth Cell.

The Residential Development forms part of the residential component of the wider Southern Links 1 (SL1) Growth Cell, a circa 440ha contiguous land area that stretches the south-western edge of Hamilton that includes the Hamilton Southern Links (RoNS) designation.

3.2. Purpose of this Report

The information provided in this IR outlines the methodology associated with the proposed infrastructures onsite. This IR is to be read in conjunction with the engineering drawings and is to accompany the Substantive Application for the SL1 Project under the Fast-track Approvals Act 2024.

3.3. Site Description

The Residential Development comprises circa 46ha in single ownership and is currently used for rural farming activities. The landholding includes three land parcels legally described as Lot 2 DP 589463 (22.21 ha); Lot 1 DPS 51518 (7.58 ha); and Part Lot 2 DP 25668 (33.64 ha).

The Residential Development provides for the establishment of circa 938 residential units, together with a neighbourhood commercial node, open spaces, waterbodies, and infrastructure devices including wetlands and roading. The proposed Residential Development is underpinned by a series of design principles, with a focus on creating a well-connected, legible, and diverse community on Hamilton's urban fringe. This is supported via a coordinated neighbourhood structure with a connected roading and pedestrian/cycle network, integrated open space and stormwater outcomes as well as varying housing typologies and densities (including single detached, duplex, and terraced apartments) which have been proposed to meet the growing and changing needs of the housing market to ensure there are options for future residents and thoughtfully located based on opportunities and constraints, with density ranging from terraced, duplex and detached dwellings to ensure integration with the adjoining urban footprint.

Located centrally within the Residential Development is a local neighbourhood commercial node that will provide a small-scale range of amenities, four to five small retail and food and beverage tenancies designed for convenience and support immediate local needs. This local node adjoins a neighbourhood reserve, adjacent to the north/south ecological corridor, providing neighbourhood park amenities to the Residential Development.

The proposal includes substantial enabling works to establish developable land, including bulk earthworks across the site. An integrated stormwater management system including artificial wetlands, detention/attenuation devices and treatment ponds are designed with the intent to discharge to

ground water as relevant. Ecological restoration is integrated via riparian and corridor planting with appropriate design measures being adopted to enhance and protect key features including the upper tributaries of the Mangakōtukutuku Stream and associated drains.

Access and integration with the surrounding Hamilton area is provided through connected transport framework, including the establishment of intersections, roading, and walking and cycle networks, along with upgrades to existing transport infrastructure. The Residential Development is proposed to be serviced via a coordinated strategy, including the extension of public networks, upgrades, and installation of appropriate infrastructure.



Figure 1: Site Locality

3.4. Legal Descriptions

This development site is currently split into three major parcels of land, which are summarized in Table 1 below:

Lot Description	Area (m ²)
Lot 1 DPS 51518	75,769
Part Lot 2 DP 25668	336,403
Lot 2 DP 589463	222,086

Table 1: Legal Descriptions

4. Earthworks

Earthworks will include re-contouring, excavations for drainage reticulation, formation of building platforms, roading and where applicable the construction of retaining walls. The site will contain specific erosion and sediment control measures suitable to control the earthworks area.

4.1. Geotechnical Investigation

Various site-specific geotechnical investigations have been conducted and a geotechnical investigation report has been prepared by CMW 2026, to support the application¹.

The report identifies the approximate distribution of prevailing landforms and geologies for the local area. The site is partially underlain by Holocene Swamp deposits and partially by Hinuera Formation interbedded silt and sand soils. Walton Subgroup forms the base of the hills to the east and is expected to underlie the Hinuera Formation.

However, based on CMW's observations and 3D Leapfrog modelling of subsurface soil conditions, the site is completely underlain by Hinuera Formation soils and the Peat (swamp deposits) soils are located further to the south-west, outside the Residential Development area.

From the ground investigations undertaken by CMW, CMW summarise the site geology results in Table 2 below.

Geological Unit	Depth to top of soil unit (m)		Thickness (m)
	Min	Max	
Topsoil	0		0.1 to 0.5
Interbedded loose to dense Sands and firm to very stiff Silts (Hinuera Formation)	0.1	0.5	1.9 to 18.0
Stiff to very stiff Clayey Silt (Hamilton Ash/Walton Subgroup)	1.9	18.0	*
*NOTE: base of unit not encountered			

Table 2: Summary of Strata Encountered

Upon completion of the proposed earthworks onsite, the geotechnical engineer will be required to prepare an Earthworks Completion Report. This report will certify the adequacy of the earthworks, and it will also provide recommendations for the foundation designs for the proposed lots within this development.

¹ Refer to Geotechnical Investigation Report (HAM2025-0056AD Rev 4) by CMW

4.2. Bulk Earthworks

The total bulk earthworks for whole site is summarised in table 3 below:

Bulk Subgrade Earthworks (topsoil stripping exclusive)	
Total area of ground disturbance	433,460 m ² (43.34ha)
Total volume of CUT	290,010 m ³
Total volume of FILL	227,375 m ³
Total Volume of FILL with Compaction Factor (1.2)	272,850 m ³
Maximum CUT and FILL depth	2.36m FILL / 5.34m CUT
Total Volume (surplus of CUT)	- 17,160 m ³
Others	
Topsoil stripping (200 mm)	86,690 m ³

Table 3: Summary of Bulk Earthworks

4.3. Erosion and Sediment Control

Prior to commencing earthwork operations, it is anticipated that a pre-construction meeting with the WRC monitor team will take place. During this meeting, the erosion and sediment control measures will be discussed and confirmed to ensure that works are to be undertaken in accordance with relevant conditions of consent and the Construction Management Plan (CMP) to ensure earthworks and erosion are effectively mitigated.

Erosion and sediment control measures will be implemented in accordance with TR2009/09 – Guidelines for Soil Disturbing Activities in the Waikato Region. The proposed controls will include clean water diversion drains to prevent runoff entering disturbed areas, sediment retention devices to capture sediment-laden runoff, stabilised construction entrances to minimise sediment tracking onto public roads.

Together, these measures are intended to minimise sediment discharge to downstream receiving environments and ensure earthworks are undertaken in accordance with the relevant resource consent conditions. For a comprehensive understanding of the specific application of sediment and erosion control measures for each area of earthworks, please consult the CMP which provides detailed guidance on these measures.

5. Rooding

5.1. Design Standards

The proposed roads have been designed in accordance with Austroads and Waikato's Regional Infrastructure Technical Specifications (RITS). BBO is the lead transport engineers for this project and have been provided the technical support with the rooding design. The design provided is for resource consent purpose only and further design details for engineering approval stage will be necessary.

5.1.1. Engineering Exception Decisions

- No engineering exceptions are proposed for this project.

5.2. Integrated Transportation Assessment

Integrated Transportation Assessment (ITA) has been carried out by BBO which considers the traffic and transportation effects of the proposed residential development. Please refer to the appended Engineering Plans (Appendix A) and ITA (Appendix C) for further details.

5.3. Temporary Access

The Residential Development will gain vehicle access connections via Saxbys Road, Macmurdo Avenue, and Forth Crescent. It might gain the temporary access through the eastern side of subject site connecting to Houchens Road depending on future developments in the SL1 Growth Cell.

5.4. Road Typology and Design

Minor Arterial Roads are contained within 30m corridors and include a carriageway width of 18m and design of:

- 40mm DG10 asphaltic concrete
- 375mm granular pavement of 125mm AP40 / 250mm GAP 65
- Subgrade improvement layer of 600mm brown rock If required
- To a design subgrade of CBR 3

Collector Roads are contained within 23m corridors and include a carriageway width of 11.3m and design of:

- 40mm DG10 asphaltic concrete
- 475mm granular pavement of 175mm AP40 / 300mm GAP 65
- Subgrade improvement layer of 600mm brown rock If required
- To a design subgrade of CBR 3

Local Roads are contained within 18m and 16.8m corridor and include a carriageway width of 10.2m and design of:

- 40mm DG 10 asphaltic concrete
- 375mm granular pavement of 125mm AP40 / 250mm Gap 65
- Subgrade improvement layer of 600mm brown rock if required
- To a design subgrade of CBR 3

5.5. Parking

Dedicated on-street parallel parking lanes are to be provided within carriageway throughout to ensure that the requirements of the HCC District Plan can be complied with.

5.6. Walking and Cycling

The 30m wide roads will provide 3m wide cyclepath and 1.8m wide footpaths for pedestrian. For the 23m wide roads and 16.8m wide roads, 1.8m wide footpath will be provided on both sides.

6. Stormwater

The Residential Development proposal has been developed in consultation with Hamilton City Council, and other/external technical consultants. The Residential Development consists of 5 main stages, that informs the post development catchment.

This section of the report provides further details of the Residential Development, its stormwater strategies and options to meet regulatory requirements, RITS and ICMP as specified throughout the report and the attached Stormwater Management Plan.

Spanning approximately 46.2ha the development includes approximately 938 units across the site, designed with mix of housing typologies and densities.

The key feature of the development is integrated stormwater treatment utilising wetlands, forebays, high flow bypass designed to convey and attenuate overflows from the road and lot areas releasing at 80% of pre-development flows into the Mangakōtukutuku stream. Lot Areas will be treated at source while road impervious areas via artificial stormwater wetlands.

6.1. Design Standards

The Hamilton City Council and Waikato Regional Council sets out design and construction standards for stormwater and requires all land development projects to be provided with a means of stormwater disposal.

Integrated stormwater treatment has been designed in accordance with Design guidelines and standards in the list below;

- Mangakōtukutuku Integrated Catchment Management Plan – Final Draft 2025
- Hamilton City Council Stormwater Guidelines and standards
- Waikato Regional Council Guidelines and standards
- RITS guidelines and specifications

6.1.1. Engineering Exception Decisions

- No engineering exceptions are proposed for this application.

6.2. Stormwater Management Plan (SMP)

Stormwater Management Plan (SMP), has been prepared to support a stormwater discharge consent application for the 5 stages of the Residential Development, as outlined below in the table 4 below:

Stage	Wetland	Catchment	Area (Ha)
1	Wetland A	A	13
2	Wetland B	B	7.6
3	Wetland C	C	8.5
4	Wetland D	D	5.3
5	Wetland E	E	5.9
3	Wetland F	F	4.0

Table 4: SW Wetland Catchments

Each site has been assessed through hydrological and hydraulic modelling, incorporating the adopted 4°C climate-change scenario. The relevant design parameters, climate-change assumptions and modelling methodology are detailed in Section 6.1 of the Stormwater Assessment Report (SAR).

The proposed stormwater management system has been designed to provide the following:

- Water Quality Volume treatment and retention of the 10mm of new road seal runoff to maintain water naturality.
- Conveyance of flows up to the 100YR ARI storm events through proposed networks and overland flows within the road corridors. these will be directed to the downstream wetlands, for each of the stormwater catchments. Limit post-development peak discharges to no more than 80% of pre- development flows to the Mangakōtukutuku Stream.
- Preserve existing flow paths and discharge locations to avoid introducing new hydrological impacts.
- Account for external inflows and upstream catchments to ensure downstream impacts are not worsened under post-development conditions.
- Support future maintenance, accessibility, and ecological enhancement through features such as maintenance tracks and planting around the wetland areas.

A flood model for the 2, 10 and 100-year ARI events has been developed to assess existing and post-development conditions upstream and downstream of the Residential Development. The modelling has informed the stormwater design, including artificial wetland storage and attenuation, controlled discharge, and defined overland flow paths to manage peak flows and flood levels.

The 100-year ARI modelling indicates a localised increase in flood depth of approximately 10-15 m upstream of the southern site boundary, with a maximum increase in water depth of approximately 70 mm. This effect is confined to the immediate upstream area and does not result in a material increase in flood risk to adjacent properties. Within and around the development, localised increases in water surface levels of approximately 10–50 mm occur; however, there is no material change in downstream water levels or flows. The wider downstream catchment assessment, including the modelling undertaken for the draft Mangakōtukutuku Integrated Catchment Management Plan, identified potential increases in downstream flooding under development scenarios without mitigation. The proposed stormwater management strategy addresses these effects through wetland storage, attenuation and controlled discharge, with the assessment confirming no adverse downstream flooding effects from the Residential Development.

In addition, the model has been used to test a sensitivity scenario in which all primary stormwater devices are blocked during a 100-year event. Even under this worst-case condition the model demonstrates that the development maintains flood immunity with only minor exceedances and expected to be mitigated through detailed design refinements. These areas will be addressed during detailed design by refining finished ground and road levels, improving secondary overland flow paths, and optimising the stormwater drainage layout to safely convey exceedance flows while maintaining flood immunity for building platforms.

The SAR aligns with the requirements of both the ICMP, Hamilton City Council and Waikato Regional Council.

6.3. Stormwater System

The Residential Development will be serviced by the following stormwater infrastructures.

1. Detention/Retention Tanks
2. Primary Network – Pipe System

3. Swales
4. Artificial Stormwater Wetlands

The proposed stormwater management system for the residential development incorporates an integrated approach comprising on-lot stormwater controls, a piped drainage network, and surface conveyance and treatment systems. On-lot detention tanks are provided to attenuate runoff from individual properties, reducing post-development peak flows and maintaining discharge rates consistent with the Hamilton City Council Stormwater Guidelines and RITS requirements. The piped network has been designed to convey runoff from frequent storm events, while larger exceedance events are managed via defined overland flow paths to maintain flood resilience. Stormwater quality treatment and initial abstraction are achieved through the use of treatment devices, including swales and artificial stormwater wetlands, which provide sediment removal, pollutant capture, and flow attenuation prior to discharge.

Due to low soakage results from site testing, tanks are proposed for lot areas to provide for initial abstraction and water quality mitigation requirements. Flows surcharge into the proposed stormwater connection or discharge via overland flow to the road corridor. Proposed Swales and Primary network provides conveyance of these flows including flows from road catchment areas to the Artificial Wetlands.

The downstream proposed artificial wetlands will function to treat road runoffs, extended detention and provide full detention for events up to the 100-year CC.

Please refer to the Appended Engineering Plans (Appendix A) for further details.

6.3.1. Existing Reticulation

Existing stormwater infrastructure is limited to farm/roadside drains and streams that forms part of the Mangakōtukutuku Stream catchment. Multiple culverts along the stream were encountered/surveyed and have been incorporated in the stormwater design and modelling. There is an existing bridge located downstream of the site on Saxbys Road and is one of existing site constraints and that has been surveyed and incorporated in modelling.

6.3.2. Lot Connections

All lots are serviced with lot connections as per RITS guidelines and specifications.

6.4. Overland Flow Paths (OLFPs)

Additional branches of OLFPs will be created as roading corridors are formed. The following measures will be adopted to mitigate their effects of these overland flowpaths on the proposed development:

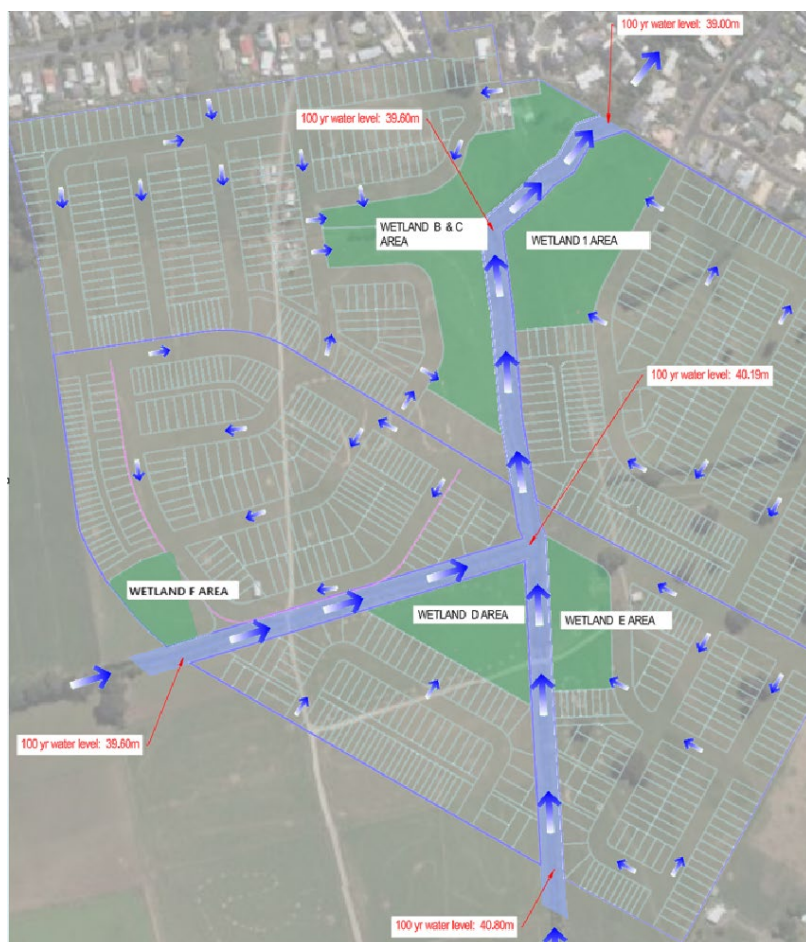


Figure 2: Proposed Overland Flow path

- Identify and maintain existing natural overland flow paths and watercourse alignments to convey concentrated stormwater runoff from the site. Existing culverts will be retained and utilised where practicable to maintain existing discharge locations; however, additional culverts are proposed where required to provide hydraulic connectivity and accommodate the proposed development layout.
The arch culverts will be supplier-designed to satisfy the required hydraulic and structural performance criteria, with fish passage provisions and any associated stream works designed.
- Identify and retain any upstream OLFPs and/or watercourses to avoid any upstream flooding.
- Ensure OLFPs are to be designed where possible within the roading network and discharge into watercourses.

The preliminary OLFP design is provided in the Stormwater Assessment Report (SAR) and is summarised below.

An assessment of the post development overland flow paths (OLFPs) has been carried out to evaluate the behaviour of surface runoff in the road carriageway under the proposed stormwater management system. The design scenario is based on the 2081-2100 RCP8.5 climate change scenario, incorporating all proposed devices and the assessment is done through HEC-RAS 2D. The OLFPs represents the conveyance of surface runoff because of the proposed system during the 100-year storm event.

Flow depths and velocities were assessed at key locations throughout the development covering all the various road/accessway typologies ensuring and confirming conveyance of the OLFP is viable through proposed carriageway. See below showing results at the key locations.

More than 80% of the road network complies with the standard design threshold of 150 mm maximum flood depth. However, isolated areas have been identified where maximum flood depths exceed the 150 mm guideline.

- Catchment A: max depth = 220mm
- Catchment B: max depth = 280mm
- Catchment E: max depth = 320mm

Note these depths are likely to be reduced at further refined modelling at detailed design stage via applying some of the options below:

- Advance the flood model by including catchpits and roading stormwater network
- Provide sensitivity analysis assuming catchpits are fully blocked
- Provide proprietary Megapits if required to alleviate ponding
- Increase vertical curvature length of the roading corridor to increase the spill weir and minimise ponding depth
- Mono camber transition in the carriageway and/or footpath berms to reduce the depth of spilling headwaters
- Or a combination of the solutions above

The detailed design will be required to demonstrate compliance with the applicable RITS flood-depth criterion, or an alternative design accepted through the engineering approval process, while maintaining the intended secondary-flow-path function.

Highest velocity depth of 0.14 (m²/s) values remain below critical safety thresholds defined in Austroads 2012 Part 5, which specify:

- < 0.4m²/s for pedestrian safety
- < 0.6m²/s for vehicle safety

The highest recorded value was 0.14m²/s confirming safe flow conveyance for both pedestrians and vehicles under design conditions. Flow is primarily routed along proposed roads conveyed into roadside primary networks for the 10-year conveyance to the proposed wetlands.

It is noted that a separate flood sensitivity analysis has been completed using HEC-RAS 2D modelling assuming all stormwater devices are fully blocked. The SMP evaluates overland flow behaviour under worst case flooding conditions within and surrounding the site.

6.5. Capacity and Quality

Stormwater Strategy for Lot Areas

Roof runoff is managed using inert roofing materials, while driveway runoff is directed through a catch pit with a sump for pre-treatment before disposal underground stormwater tank. Overflow is located in the catchpit system for flows surpassing the designed event within the lot areas. Excess flows will be diverted into the downstream system via the road carriageway.

Stormwater Strategy for Road Carriageway

The Water Quality volume (WQV) will be provided through the proposed wetland system with the initial abstraction is to be provided within lot areas.

Stormwater Strategy for proposed SW Wetlands

The proposed wetlands forms critical part of the overall stormwater mitigation system. They have been sized to accommodate the 100-year event or excess flows from both the road carriageway and on lot flows exceeding the 10-year event. Additionally, these are also designed to provide treatment and attenuation of lower flow events. Please refer to SAR Section 7.4 Artificial Wetlands and CMP Section 4 Construction Methodology and Sequence of Works for more information.

6.6. Flooding

A 2D flood model has been developed for the site using HEC-RAS. The model has been used to assess existing, design and sensitivity scenarios.

The figure below shows the contributing catchment of the site during the 100year event, delineated through QGIS/HEC HMS based on a 10m grid externally. Data used is comprised of localised site survey and LINZ data capturing the wider extent of the catchment.

The catchment extent is generally consistent with the ICMP catchment framework, however project specific catchment delineation has been undertaken as part of this assessment to refine upstream contributing areas based on current information for data and modelling.

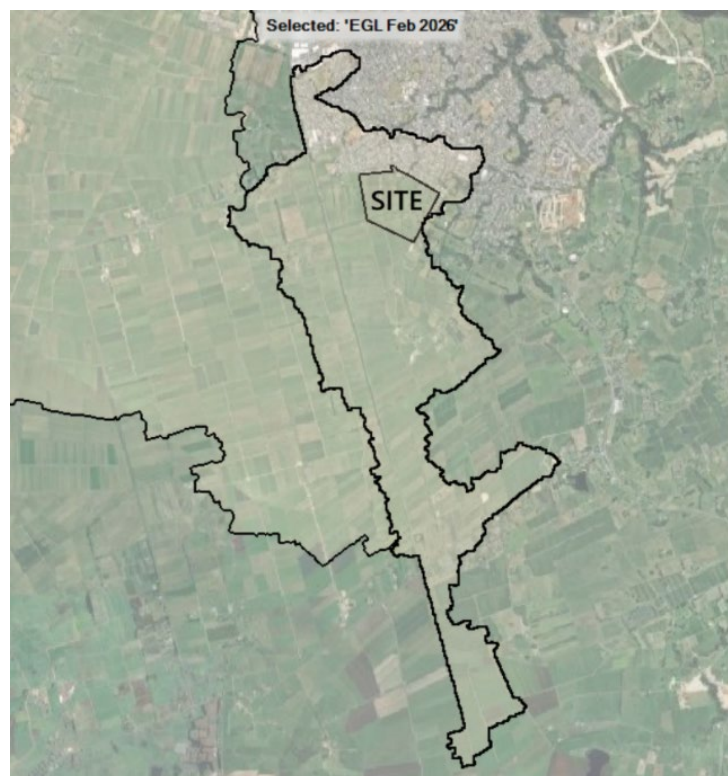


Figure 3: Existing 100YR Catchment

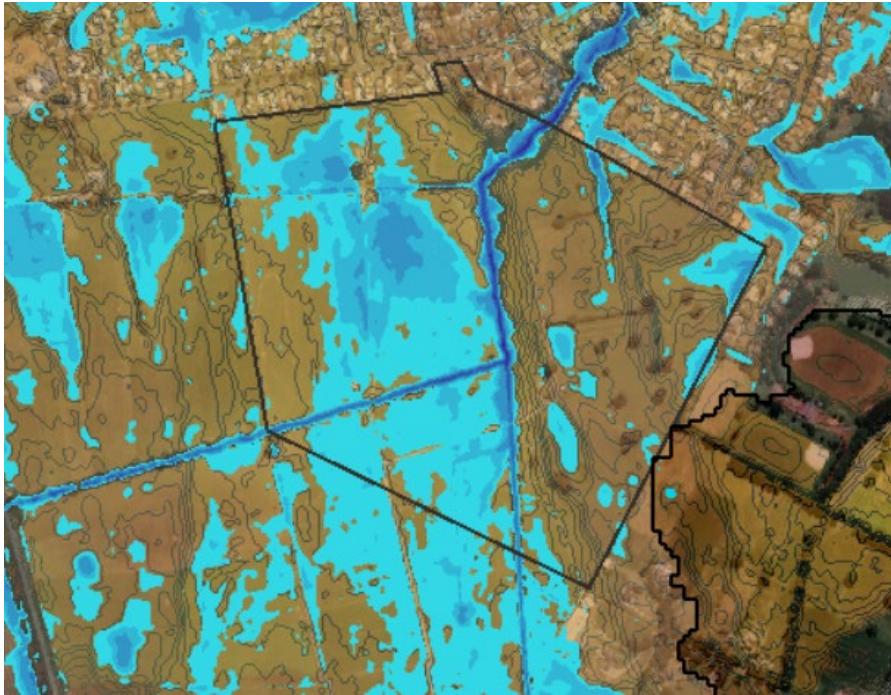


Figure 4: Existing Flood Extent in the 1% AEP Event (100mm)

The existing 100-year catchment (Figure 3) and existing flood extent in the 100-year event (Figure 4) demonstrates that the site is currently subject to widespread shallow flooding and poorly defined flow paths. This has informed the proposed design approach, which focuses on conveyance through diversion channels, retaining drainage corridors, while incorporating artificial stormwater wetlands and storage to manage stormwater events up to the 100YR ARI within the site in line with RITS. The proposed approach is consistent with the objectives and recommendations of the Mangakōtukutuku Integrated Catchment Management Plan (ICMP), including managing stormwater at a catchment scale, maintaining and enhancing existing flow paths, providing stormwater treatment and attenuation, and avoiding adverse increases in downstream flood risk.

The Sensitivity assessment assumed that all stormwater soakage attenuation devices have already reached their capacity. Even under this worst-case condition, the model demonstrates that the development maintains flood immunity, with only minor exceedances expected to be mitigated through detailed design refinements as mentioned above in Section 4.4 Overland Flow Paths (OLFPs).

6.7. Connection Points and Staging

The proposed development will be delivered in five stages, with each stage incorporating the stormwater infrastructure required to service its respective catchment. Stormwater management facilities, including artificial stormwater wetlands and piped drainage networks, will be commissioned progressively to ensure that each stage operates independently and complies with the required quantity and quality performance criteria prior to the commencement of subsequent stages. The staging and corresponding stormwater connections are summarised below.

- Stage 1 – This stage corresponds to catchment A, which is serviced by artificial stormwater wetland A. Stormwater discharge up to the 100 year at 80% pre development into Mangakōtukutuku Stream.
- Stage 2 – This stage corresponds to catchment B, which is serviced by artificial stormwater wetland B. Stormwater discharge up to the 100 year at 80% pre development Mangakōtukutuku Stream.

- Stage 3 – This stage corresponds to catchment C, which is serviced by artificial stormwater wetland C and F. Stormwater discharge up to the 100 year at 80% pre development Mangakōtutuku Stream.
- Stage 4 – This stage corresponds to catchment D, which is serviced by artificial stormwater wetland D. Stormwater discharge up to the 100 year at 80% pre development Mangakōtutuku Stream.
- Stage 5 – This stage corresponds to catchment E, which is serviced by artificial stormwater wetland E. Stormwater discharge up to the 100 year at 80% pre development Mangakōtutuku Stream.

7. Wastewater

7.1. Design Standards

Wastewater systems have been designed in accordance with Regional Infrastructure Technical Specifications (RITS).

7.1.1. Engineering Exception Decisions

No engineering exceptions are proposed for this application.

7.2. Catchment Area

The proposed development consists of approximately 938 lots and a neighbourhood commercial centre. The total wastewater catchment area, excluding reserves, is 33.80 ha, comprising 11.0 ha (Stage 1), 8.43 ha (Stage 2), 6.73 ha (Stage 3), 3.20 ha (Stage 4), and 4.42 ha (Stage 5). The wastewater design has been based on 3 persons per residential unit in accordance with Hamilton City Council's feedback.

7.3. Design Flows

Calculations for wastewater demand indicate a calculated peak sewer discharge to the existing DN150 uPVC wastewater main of 14.94l/s (Stage 1), 10.4l/s (Stage 2), 8.65l/s (Stage 3), 4.51l/s (Stage 4), and 5.16l/s (Stage 5). Please refer to the Appended Engineering Calculations (Appendix B) for further details.

7.4. Reticulation

WSP has undertaken a wastewater capacity assessment for the proposed interim connection of the SL1 Residential to the Peacocke wastewater network via the N4 Transfer Pump Station (N4 TPS). Please refer to the Appendix D – WSP WWPS Capacity Assessment for more information.

The assessment concluded that the N4 TPS currently has sufficient interim capacity to accommodate the combined attenuated peak wet weather flow (PWWF) of 17.54 L/s from the SL1 Residential catchment at the discharge point, including the additional discharge associated with the proposed development. This flow represents the attenuated peak flow at the discharge point and should not be interpreted as the sum of the individual peak flows from each development stage.

WSP also noted³ that the proposed discharge would contribute approximately 16% of the estimated flow and around 9% of the available capacity within the lowest-capacity downstream pipe section (GG3) between the discharge point and the N4 TPS.

However, WSP advised that the full ultimate capacity of the N4 TPS has already been allocated to the wider Peacocke development and other confirmed diversions, and therefore the proposed connection cannot be relied upon as a permanent wastewater servicing solution. The duration of the interim servicing arrangement will depend on the implementation of the Southern Wastewater Treatment Plant (WWTP) and associated conveyance infrastructure, as well as the timing and extent of future development within the SL1 area requiring the ultimate servicing solution.

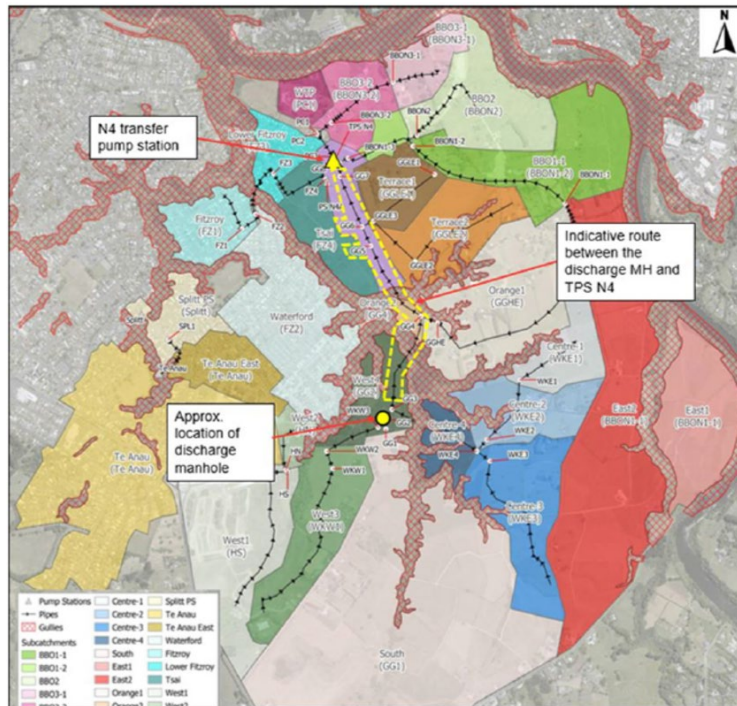


Figure 5: Pipe Sections between the Discharge Manhole and the N4 TPS (WSP)

7.4.1. Existing Reticulation

The proposed discharge point is located at the newly constructed pump station on 144 Hall Road as part of the Peacocke development, as advised by Hamilton City Council (HCC).

7.4.2. Proposed Reticulation

The internal wastewater reticulation for the Residential Development will be provided via new 150 mm, 225 mm, and 300mm diameter uPVC SN16 pipelines. A gravity wastewater reticulation network will be implemented across Stages 1 to 5. A wastewater pump station will be constructed in Stage 1, with an additional pump station to be installed in Stage 2 to provide internal conveyance.

For Stage 1, wastewater will discharge to a proposed wastewater pumpstation located at wastewater reserve (Lot 5001). From this wastewater pumpstation, wastewater will discharge to the newly constructed pump station located on 144 Hall Road in accordance with engagement with Hamilton City Council (HCC).

For Stage 2, gravity pipelines are proposed within the catchment, with a new wastewater pump station to be constructed within the local purpose reserve (Lot 5000). Wastewater from this pump station will be discharged to the nearest wastewater manhole on collector road 2 in stage 3.

For Stages 3 to 5, wastewater will be conveyed by gravity to the wastewater pump station located within the reserve (Lot 5001).

Please refer to the Appended Engineering Plans (Appendix A) for further details.

7.5. Lot Connections

All lots are serviced with lot connections as per RITS guidelines and specifications.

7.6. Connection Points and Staging

- Stage 1 – Wastewater will discharge to a proposed wastewater pump station located within the reserve (Lot 5001). From this pump station, flows will be conveyed to the newly constructed pump station at 144 Hall Road via rising main.
- Stage 2 - A gravity reticulation network is proposed within the catchment, discharging to a new wastewater pump station to be constructed within the reserve (Lot 5000). Wastewater from this facility will be pumped to the nearest wastewater manhole on Collector Road 2 in Stage 3.
- Stage 3 – Wastewater will be conveyed via gravity to the wastewater pump station located within the reserve (Lot 5001).
- Stage 4 – A new gravity wastewater reticulation network will be constructed to service Stage 4 utilising 150 mm diameter uPVC SN16 pipelines. Wastewater from this stage will be conveyed via gravity to a connection manhole located within the Stage 3 wastewater reticulation network.

The proposed Stage 4 gravity pipeline alignment requires a crossing of an existing drain prior to connecting into the Stage 3 network. At this location, a stainless steel wastewater pipe crossing will be installed to ensure structural integrity, durability, and protection of the pipework within the watercourse environment. The stream crossing will be provided by a pipe bridge spanning the drain, maintaining the existing channel and hydraulic conveyance while avoiding permanent structures within the stream bed.

The pipe bridge will be supplier-designed to meet the required structural loading and span requirements. Construction will minimise disturbance to the stream banks and bed, with appropriate erosion and sediment controls implemented. Any works within or adjacent to the watercourse will be undertaken in accordance with the applicable Waikato Regional Council consent requirements.

- Stage 5 – Similar to Stage 4 new gravity reticulation network will be constructed to service this stage. It will be directly connected to Stage 1 wastewater pipe network on Collector Road 2.

Please refer to Table 5 below for further detail on the proposed servicing arrangements and wastewater pump station (WWPS) details.

Stage	Lots	Proposed Servicing	General Comment
Stage 1	321	Construct WWPS A centrally within the development and a new 250 OD risingmain to 144 Hall Road.	Total emergency storage in wet well and emergency storage tank is 164.25m ³ so 9.1 hours storage to be provided.
Stage 2	222 residential lot + 1 Commercial lot	Construct WWPS B within the reserve (Lot 5000) and a new 160 OD rising main to the WWPS A.	Total emergency storage in wet well and emergency storage tank is 49.5m ³ so 9 hours storage to be provided.
Stage 3 – 5	394	Construct a gravity pipeline for each stage and wastewater will be conveyed to a connection manhole.	The proposed Stage 4 gravity pipeline alignment requires a crossing of an existing drain prior to connecting into the Stage 3 network. At this location, a stainless steel

			wastewater pipe crossing will be installed to ensure structural integrity, durability, and protection of the pipework within the watercourse environment.
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Table 5: Wastewater Staging

7.7. Wastewater Pump Station

7.7.1. RITS Wastewater Pump Station Requirements

This section of the report relates to the proposed Wastewater Pump Stations within Stage 1 and 2. The specification and design of the new wastewater pump station has been developed with Peter Carroll (Aquate, BE Civil, CPEng). The proposed pump station will comprise of a collection manhole, inlet pipes, a wet well, control cabinet, odour biofilter and emergency storage tanks. Detailed descriptions of the pump station and compliance check in accordance with RITS is presented in Table 6 below.

Requirements	Requirements check
a) Area around the pump station shall be graded to prevent surface water flowing onto or over the pump station cover slabs.	The pump station areas have been elevated above the nearby roads, and they will grade back to the road areas.
b) Free of secondary flow paths for 1% AEP flood level, and the pump station lid levels shall be provided with a minimum freeboard of 300mm above the estimated flood level.	As the pump station will be sitting at a higher elevation than the nearby existing stream, this will ensure that the minimum freeboard will be achieved. The pump station lid level will be at least 300mm above the overland flow path on the road and 300mm above the 100yr flood level in the existing stream.
c) Pumping systems shall • Have a pumping capacity of N+1 with a minimum of two identical pedestal mounted submersible sewage pumps. • Each pump shall be capable of discharging the design peak wet weather flow rate from the catchment. • Include sufficient well volume to operate under normal conditions without surcharge to the incoming wastewater network.	The pumpstation is compliant with these conditions referring to the Aquate Pump Station for technical specifications for further details. (Appendix D – Wastewater Pumpstation Technical Specifications)
d) The station shall be located to ensure that the entire design catchment can be serviced.	Northern wastewater pumpstation (WWPS B) will manage all of Stage 2. The central wastewater pumpstation (WWPS A) will manage pumped flows in Stage 1, ,3, 4, and 5. The pump stations have been strategically placed in the catchment low points.
e) All stations shall be contained within a separate local purpose reserve - drainage title set out to provide safe and easy operation and maintenance of the site without impacting on public activities surrounding the site and is designated in	A designated local purpose reserve for each pump station has been proposed to allow for the operation and maintenance of the pump station.

accordance with the relevant district plan or vested as part of a subdivision.	
f) The station shall be designed to service the entire catchment area of land beyond the reach of the existing gravity system. Refer to Clause 5.1.6.	The wastewater pump stations have been designed to account for the whole Residential Development proposed in the project.
g) In staged construction, guidance from the Council is required to ensure the correct sizing of the pump station and associated rising mains and storage facilities meet the short and long-term requirements of the catchment.	The pumpstations have been designed to cater for the short term and long-term requirements. There is allocated space to expand the underground wastewater storage if required to do so in the future.
h) A minimum emergency storage capacity of nine hours average dry weather flow, measured between the high-level alarm and the point of overflow.	The pump station has been designed to account for a minimum emergency storage capacity of 9 hours.

Table 6: WWPS RITS Requirements

Please refer to C530 and C540 Engineering Plans (Appendix A), and Wastewater Pump Station Technical Specifications (Appendix E) for further details.

7.7.2. Emergency Storage

The proposed pump station will be provided with emergency storage tanks to store wastewater in the event of pump failure. A minimum 9-hour emergency storage based on average daily flow will be provided prior to emergency overflow occurring in accordance with RITS. This equates to a total volume of 49.5m³ for the northern wastewater pumpstation and 164.25m³ for the central wastewater pump station which will be stored across the wet well, additional ancillary storage chambers, and pipelines including the upstream network. The ancillary storage chambers will be connected to the collection manhole via pipes which will be laid at a gradient of 1% towards the manhole to allow self-draining.

7.7.3. External Services

The successful operation of the wastewater pump station is reliant on the provision of adequate external services including:

- Wash Water
- Power
- Stormwater / Overland Flow
- Telemetry wireless pathways

Wash Water

The proposed pump stations will be provided with a DN50 PE rider main from the proposed 63mm OD water main in the proposed adjacent roads. They will provide the water supply required for wash down purpose (self-cleansing) for the pump stations.

Power

A reticulated power network will be designed and installed in the proposed adjacent roads to provide a point of connection for power for the proposed pump stations.

Stormwater / Overland Flow

The proposed pump stations will be elevated from the ground and situated away from the overland flow paths and flood plain.

Electrical and Telemetry

The electrical and telemetry requirements for the proposed pump station will be confirmed with HCC. The alarm and operational data control system will be installed by the developer, or by HCC at the developer's cost.

7.8. Alternative Solution (Decentralised System – MBR Package Plant)

A decentralised wastewater servicing solution may also be considered if connection to the existing reticulated wastewater network is demonstrated to be impractical or unable to provide the required level of service. This could comprise a packaged wastewater treatment plant, such as a membrane bioreactor (MBR) system, with treated effluent managed and discharged in accordance with the requirements of the relevant authorities.

Any decentralised wastewater solution would be subject to further technical assessment and confirmation of its suitability for the development, including treatment capacity, treatment performance and reliability, effluent discharge requirements, operational and maintenance requirements, land and infrastructure requirements, and integration with the proposed development and other servicing infrastructure. Implementation would also be subject to obtaining all necessary approvals and consents from the relevant authorities.

The identification of a decentralised wastewater solution does not constitute a commitment to implement an MBR or any other specific treatment technology. Rather, it provides an alternative servicing pathway should the preferred connection to the existing reticulated wastewater network not be confirmed as feasible.

7.9. Potential Benefit

The proposed wastewater infrastructure has the potential to provide a strategic servicing opportunity for future development beyond the current development area, including the potential future Houchens development. The proposed wastewater network has been designed to accommodate possible future connections, subject to confirmation of downstream network capacity, hydraulic requirements, and the relevant approvals from Hamilton City Council (HCC) and other infrastructure authorities.

In particular, the Local Purpose Reserve (Lot 3 DPS 47058) on John Webb Drive, which is owned by HCC, provides a potential location for an additional wastewater pump station to support future network expansion. Provision of a pump station at this location could facilitate the collection and conveyance of wastewater from future development areas and provide a logical connection point to the wider wastewater network. This approach may enable infrastructure to be progressively developed in response to growth, reduce the need for separate standalone wastewater solutions for future developments, and improve the overall efficiency and integration of the wastewater network. Any future servicing capacity, pump station location, pipeline alignment, and connection arrangements would need to be confirmed through detailed design stage and consultation with HCC.

8. Water

8.1. Design Standards

The RITS sets out design and construction standards for water reticulation, potable water supply and firefighting supply in accordance with SNZPAS 4509:2008 (NZ Fire Service Fire Fighting Water Supply Code of Practice).

8.1.1. Engineering Exception Decisions

There are no engineering exception decisions.

8.2. Design Flows

Calculations for water demand indicate a calculated peak demand of 42.97l/s. Please refer to Engineering Calculations (Appendix B) for further details.

An EPANET model for the Residential Development has been designed and it is concluded that the design nodes will achieve the required 200kPa (20m head pressure) as required by RITS 6.1.3.1 On Demand Water Supply Area, assuming 250 kPa of supply pressure at the connection points from existing networks. The EPANET modelling report is provided in Appendix F for further information.

8.3. Reticulation

Mott MacDonald has undertaken water supply modelling for the Residential Development. The modelling results indicate that the existing Hamilton South network does not currently achieve the minimum pressure criterion of 20m, nor does it satisfy the required head loss performance criteria, including under the baseline scenario without the proposed SL1 Residential Development. This demonstrates that the identified network constraints are existing deficiencies within the wider Hamilton South system and are not solely attributable to the proposed development. Please refer to the Appendix G – Mott Macdonald Water Supply Modelling for more information.

For the areas of the existing network directly affected by the proposed development, the modelling indicates that minimum pressures are maintained at or above 20m under the assessed development scenarios. The proposed connections therefore do not result in an unacceptable deterioration in pressure performance within the affected existing network. In some scenarios, the additional network connections associated with the development provide localised improvements in pressure performance within parts of the existing network.

Head loss constraints remain within parts of the existing network, particularly in the vicinity of Sunnyhills Avenue and Fourth Crescent. These constraints are evident under the existing baseline conditions and persist under the development scenarios. While the proposed development introduces additional demand to the network, the modelling confirms that the existing network constraints do not prevent the proposed development stages from meeting the applicable water supply servicing requirements. Any future upgrades required to address head loss constraints on Sunnyhills Avenue (40mmØ uPVC rider main) and Fourth Crescent (100mmØ AC Main) would therefore be subject to separate network planning, assessment and agreement with Hamilton City Council (HCC).

Overall, the modelling demonstrates that all stages of the proposed SL1 Residential Development can be serviced through the proposed water supply connections and meet the assessed servicing requirements. The modelling also demonstrates that the proposed development does not result in an unacceptable deterioration in the performance of the existing network directly affected by the development. Ongoing coordination with HCC will be required to confirm the final connection arrangements and identify any network upgrades or other requirements to be addressed through detailed design.

8.3.1. Existing Reticulation

There are existing DN50 UPVC rider main and DN150 UPVC water mains on MacMurdo Avenue and Forth Crescent, and DN150 AC water main on Saxbys Road.

8.3.2. Proposed Reticulation

The proposed reticulation network comprises DN450 PE and DN250 PE mains along the main central collector road, with sluice valves and hydrants provided at appropriate locations throughout. The majority of local roads are serviced by a combination of DN63 PE, DN125 PE, and DN180 PE mains. Road 5, which connects Saxbys Road to the main central collector road, is serviced by DN450 PE and DN63 PE mains.

Please refer to Engineering Plans - Appendix A (C600-Water Supply) for further details.

8.4. Lot Connections

All lots will be serviced with lot connections as per RITS guidelines and specifications.

8.5. Connection Points and Staging

Please refer to Table 7 below for further detail on the proposed servicing arrangements and Water Supply EPANET Modelling details.

Stage	Lots	Proposed Servicing	General Comment
Stage 1	321	Construct DN450 PE mains along the main central collector road and connect to the existing 150mm AC watermain in Saxbys Road, and the existing 750mm Bulk Main on Dixon Road.	An EPANET model for the SL1 - Residential 1 has been designed and it is concluded that the design nodes on Residential 1 will achieve the required 200kPa (20m head pressure) as required by RITS 6.1.3.1 On Demand Water Supply Area.
Stage 2- 5	616	A combination of DN63 PE, DN125 PE, and DN180 PE mains to be constructed as per Maven Drawing (C600-Water Supply).	Peak Demand: S1 – 14.49l/s S2 – 10.7l/s S3 – 8.4l/s S4 – 4.38l/s S5 – 5.01l/s

Table 7: Water Supply Connection Points and Staging

8.6. Possible Connection Options

Three potential water supply servicing options have been identified for the proposed development.

Option 1 involves a fully reticulated water supply network providing individual water connections to all lots. The network is designed to meet both domestic and firefighting water demand requirements. This is the preferred servicing option and forms the basis of the EPANET modelling assessment.

Option 2 involves a staged development approach. Stage 1 is supplied through the existing water supply network via connection points located on MacMurdo Avenue and Fourth Crescent. To accommodate future growth, an additional bulk water supply connection is proposed between Dixon Road and Saxbys Road for Stages 2 to 5. Under this option, all lots receive full water supply connections, and firefighting water demand requirements are maintained throughout the development.

Option 3 involves servicing the full development using trickle-feed connections to each lot, with a maximum flow rate of 1.3 L/min per connection. Under this arrangement, each property would be supplied via a restricted flow connection and would typically require on-site water storage to meet peak domestic demand. Firefighting water supply requirements would continue to be provided through the reticulated network.

8.7. Firefighting Supply

A principal main and associated hydrant is provided internal to the development to comply with the Regional Infrastructure Technical Specification (RITS) and associated firefighting standards.

The minimum firefighting water supply classification for development in urban areas is FW2 and FW3 for the proposed commercial hub. The development meets the following water supply requirements based on Option 1:

- A primary water flow of 12.5 litres/sec within a radial distance of 135m.
- An additional secondary flow of 12.5 litres/sec within a radial distance of 270m.
- The required flow can be achieved from a maximum of one or two hydrants operating simultaneously.
- A minimum running pressure of 100kPa.

8.8. Future Strategic Water Reservoir

In the longer term, an additional South Water Reservoir, located adjacent to the existing reservoir within the SL1 Growth Cell, is identified as a potential strategic infrastructure requirement to support the resilience and capacity of Hamilton's water supply network. While the additional reservoir is not required to service the proposed Residential South development, it would provide additional storage to support future residential and business growth, strengthen the reliability and resilience of the water supply, and provide critical capacity for firefighting and essential services, including the hospital. Current strategic planning anticipates that the first of two new reservoirs will commence construction in the near term, with a second reservoir potentially required from approximately 2040, subject to future demand and network requirements.

9. Services

9.1. Power

Power will be provided by a service provider and has been incorporated into the typical service cross section per agreement with the service provider.

9.2. Communications

Communications will be provided by a service provider and has been incorporated into the typical service cross section per agreement with the service provider.

10. Conclusions

Based on this engineering report it is considered that the proposed development can be accommodated at the subject site, without generating any adverse effects to the existing infrastructure and the receiving environment.

Stormwater drainage can be provided for the proposed development. Various options have been considered, and the best practicable option is proposed. The treatment and disposal methods both offer a high amenity value consistent with the urban design ideals.

Wastewater drainage can be provided for the proposed development.

There is public water supply infrastructure surrounding the site, which can provide potable water and firefighting supply for this proposed development of option 1 is advanced.

Utility providers have been engaged to discuss the servicing requirements for the proposed development and confirm the capacity of the surrounding networks. The outcomes of these discussions have informed the proposed servicing strategy, with any required upgrades to be progressed in accordance with the providers' requirements and delivery timeframes.

Therefore, information gathered to-date confirms the site is suitable for the proposed development.

Appendix A – Engineering Plans (Bound Separately)

Appendix B – Engineering Calculations



Maven Associates

Job Number

298001

Sheets

1

Rev

A

Job Title

SL1 - RESIDENTIAL

Calc Title

SEDIMENT YIELD - PHASE 1A

Author

MKS

Date

11/12/2025

Checked

DJM

Design Spreadsheet for USLE

Calc 1: Estimate of Sediment Generation (A), tonnes/ha/yr

$$A = R \times K \times LS \times C \times P$$

Where

- A = Sediment Generation (tonnes/ha/yr)
- R = Rainfall Erosion Index (J/hectare)
- K = Soil Erodibility Factor (tonnes/unit of R)
- LS = Slope Length and steepness Factor
- C = Ground Cover Factor
- P = Roughness Factor

Rainfall Erosion Index

$$R = 0.008828 \times P^{2.2 \times 1.7}$$

$$P = 66.568$$

P is the 2yr 24 hour rainfall from ARC Figure A.1 for a 6 hour duration period

$$2\text{yr} = 106 \text{ mm/hr}$$

$$\text{Therefore } R = 154 \text{ J/ha}$$

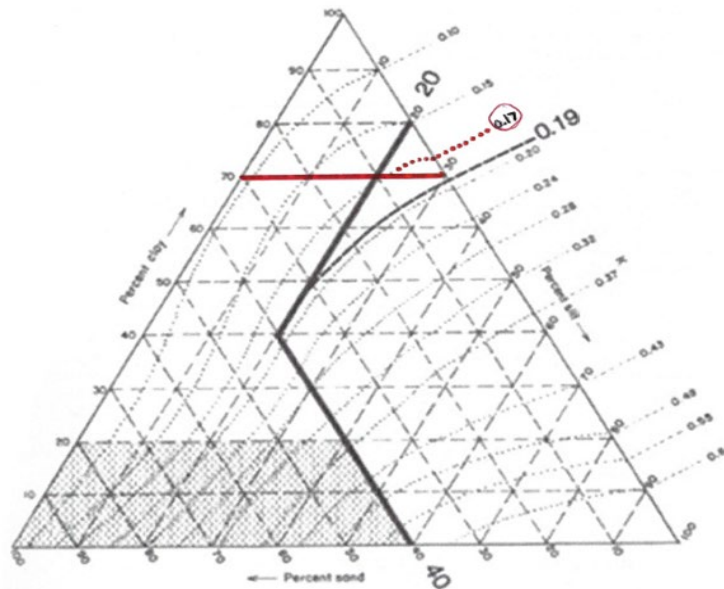


Figure 1: USLE Nomograph for Estimating k value

Soil Erodibility Factor

$$K = k \times \text{Organic \% Factor} \times \text{M-I Factor}$$

The K factor can be determined by using the nomograph method, which requires that a particle size analysis be done to determine the percentages of sand, very fine sand, silt and clay. Use the figure above to determine appropriate K value.

Site Geology

sand	%	60
silt	%	30
clay	%	10

Therefore from Figure 1 of USLE, k value unfactored =

$$k = 0.3$$

$$\text{Organic \%} = 4$$

Therefore from Table 1 of USLE, Organic % Factor =

$$\text{O\%F} = -0.1$$

Metric To Imperial Factor

$$\text{M-I Factor} = 1.32$$

$$\text{Therefore } K = 0.264 \text{ tonnes/unit of R}$$

Correct for organic content using Table 1 (the nomograph assumes 2% organic matter).

Table 1

K Value	Correction factor when percent organic matter is				
	0% (clay)	1%	2%	3%	4% (topsoil)
Greater than 0.40	+ 0.14	+ 0.07	0	- 0.07	- 0.14
0.20 – 0.40	+ 0.10	+ 0.05	0	- 0.05	- 0.10
Less than 0.20	+ 0.06	+ 0.03	0	- 0.03	- 0.06

In this table, exposed clay is considered 0% organic; topsoil 4% organic. In our example, if the surface is clay, the value would be corrected by adding 0.06 to the K value of 0.19 i.e. K = 0.25

Multiply the corrected K value by 1.32 to convert from imperial to metric
i.e. K = 0.33 (tonnes/unit of R)

Table 1: USLE Organic % Correction Factor

Slope Length and Steepness Factor

$$LS = \text{From Appendix 1 equation}$$

$$\text{Slope Length} = 350$$

$$\text{Maximum Elevation} = 70.2$$

$$\text{Minimum Elevation} = 66.8$$

$$\text{Slope As a \%} = 0.97$$

$$\text{Therefore } m = 0.2$$

$$\text{Therefore } LS = 0.16$$

Ground Cover Factor

C = 1 Assumed site as **Bare Soil**
and taking value from Table 2

Roughness Factor

P = 1.32 Assumed site as **Bare Soil**
and taking value from Table 2

Ground Cover Factor

This is the ratio of soil loss from an actual site (or parts of a site) with specific ground cover (e.g. clay, topsoil, grass) compared to a bare site (i.e. no vegetation or topsoil). The bare site is given a value of 1.0.

Roughness Factor

The P factor provides adjustment for the degree to which surface roughness affects the erosion of sediment from a site (or part of a site).

As a standard practice, it is appropriate to use the range of C and P values given in Table 2 below.

Table 2

Treatment	C factor	P factor
Bare Soil		
- compacted and smooth	1.0	1.32
- track walked on contour	1.0	1.2
- rough irregular surface	1.0	0.9
- disked to 250 mm depth	1.0	0.8
Native vegetation (undisturbed)	0.01	1.0
Pasture (undisturbed)	0.02	1.0
Establishing grass	0.1	1.0
Mulch – on subsoil ²	0.15 (3 month period only)	1.0
Mulch – on topsoil ³	0.05 (3 month period only)	1.0

Table 2: USLE Organic % Correction Factor

Therefore A = 8.49 tonnes/ha/yr

Estimate of Sediment yield

S (Yield) = A x Area x SDR x SCM x Duration

where A = 8.49 tonnes/ha/yr
 Area = 4.91 ha
 SDR = 0.5
 SCM = 0.5 %
 Duration = 0.5 yrs

SDR Sediment Delivery Ratio, 0.5 for slopes < 10%, 0.7 for slopes > 10%

SCM Sediment Control Measures (%) 50% is considered conservative

Therefore S (Yield) = 5.210 tonnes / per 6 months

M M A E N Maven Associates		Job Number 298001	Sheets 2	Rev A
Job Title Calc Title	SL1 - RESIDENTIAL Earthworks Pond - Phase 1A	Author MKS	Date 11/12/2025	Checked DJM
Catchment Area50000 m² Pond Volume 3% of Area1500 m³ Dead Storage 30% of volume450 m³ Live Storage 70% of volume1050 m³ Decant Dewatering (3.2l/s/ha)16.0 l/s				
Size Decant Standard decent4.5 l/s = 200 holes Therefore16.00 l/s = 711 holes Use4decants				
Pond Dimensions v = 1500 m³ d = 1.5 m x = width of pond base Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.				
Calc 2: Calculate width and length of base, Quadratic Equation 3:1 ratio $v = (((3x^2) + ((x + 4d)(3x + 5d)))) / 2)d$ $\Rightarrow v = 3x^2d + 8.5xd^2 + 10d^3$ quadratic equation to find "x" a b c 0 = 4.5 x² + 19.125 x + -1466.25 x = 16.05 width of pond base or = -20.30 Check = 1500 m³ 5:1 ratio $v = (((5x^2) + ((x + 4d)(5x + 5d)))) / 2)d$ $\Rightarrow v = 5x^2d + 12.5xd^2 + 10d^3$ quadratic equation to find "x" a b c 0 = 7.5 x² + 28.125 x + -1466.25 x = 12.23 width of pond base or = -15.98 Check = 1500 m³ Width = 16.05 m Length = 48.15 m				

Dead Storage Depth

Pond Dimensions

x = 16.05 m
v = 450.0 m³
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$$v = (((3x^2) + ((x+4d)(3x+5d)))/2)d$$

=> $v = 10d^3 + 8.5xd^2 + 3x^2d$ cubic equation to find "d"

		a		b		c
0	=	d ³ + 13.6429287	d ² + 77.28561	+d	-45	
e	=	5.08				
f	=	104.18				
g	=	5.93				
h	=	-0.86				
d	=	0.531	depth of dead storage			
Check v	=	450.0	m ³			

Spillway Dimensions

Side Slope horizontal 3 vertical 1
Gradient 1 %
Base Width 16.05 m

Calc 3: Calculate spillway flow (Q) Rational Formula

$$Q = CIA \quad 1\% \text{ AEP}$$

where C = 0.85
I = 0.000065 m/s 234 0.234
A = 50000 m²

Therefore Q = 2.76 m³/sec

Calc 4: Calculate spillway depth (H) Mannings Formula

$$V = (1/n)R^{2/3}S^{1/2} \quad R = A/P \quad Q = AV$$

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter
A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.13	16.8727	2.137266	0.01	0.12667	1.401232	2.994805

Therefore H = 0.13 m OK



Maven Associates

Job Number

298001

Sheets

1

Rev

A

Job Title

SL1 - RESIDENTIAL

Calc Title

SEDIMENT YIELD - PHASE 1B

Author

MKS

Date

11/12/2025

Checked

DJM

Design Spreadsheet for USLE

Calc 1: Estimate of Sediment Generation (A), tonnes/ha/yr

$$A = R \times K \times LS \times C \times P$$

Where

- A = Sediment Generation (tonnes/ha/yr)
- R = Rainfall Erosion Index (J/hectare)
- K = Soil Erodibility Factor (tonnes/unit of R)
- LS = Slope Length and steepness Factor
- C = Ground Cover Factor
- P = Roughness Factor

Rainfall Erosion Index

$$R = 0.008828 \times P^{2.2 \times 1.7}$$

$$P = 66.568$$

P is the 2yr 24 hour rainfall from ARC Figure A.1 for a 6 hour duration period

$$2\text{yr} = 106 \text{ mm/hr}$$

$$\text{Therefore } R = 154 \text{ J/ha}$$

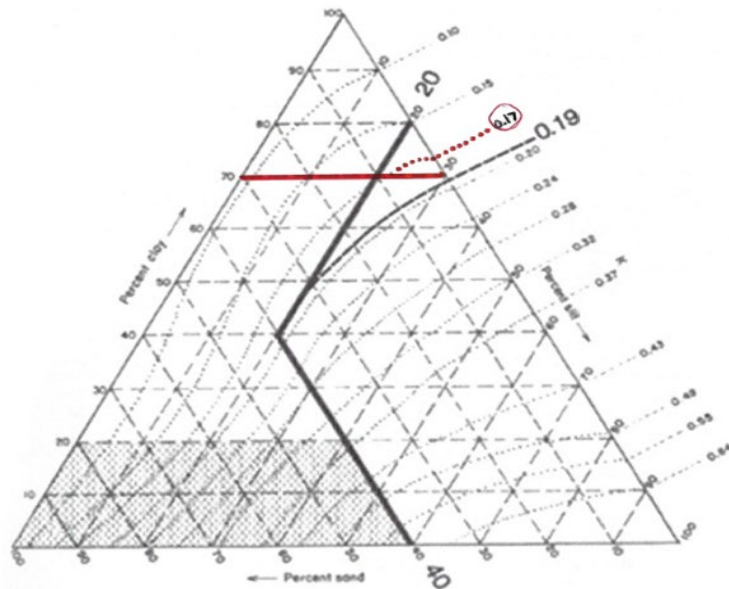


Figure 1: USLE Nomograph for Estimating k value

Soil Erodibility Factor

$$K = k \times \text{Organic \% Factor} \times \text{M-I Factor}$$

The K factor can be determined by using the nomograph method, which requires that a particle size analysis be done to determine the percentages of sand, very fine sand, silt and clay. Use the figure above to determine appropriate K value.

Site Geology

sand	%	60
silt	%	30
clay	%	10

Therefore from Figure 1 of USLE, k value unfactored =

$$k = 0.3$$

$$\text{Organic \%} = 4$$

Therefore from Table 1 of USLE, Organic % Factor =

$$\text{O\%F} = -0.1$$

Metric To Imperial Factor

$$\text{M-I Factor} = 1.32$$

$$\text{Therefore } K = 0.264 \text{ tonnes/unit of R}$$

Correct for organic content using Table 1 (the nomograph assumes 2% organic matter).

Table 1

K Value	Correction factor when percent organic matter is				
	0% (clay)	1%	2%	3%	4% (topsoil)
Greater than 0.40	+ 0.14	+ 0.07	0	- 0.07	- 0.14
0.20 – 0.40	+ 0.10	+ 0.05	0	- 0.05	- 0.10
Less than 0.20	+ 0.06	+ 0.03	0	- 0.03	- 0.06

In this table, exposed clay is considered 0% organic; topsoil 4% organic. In our example, if the surface is clay, the value would be corrected by adding 0.06 to the K value of 0.19 i.e. K = 0.25

Multiply the corrected K value by 1.32 to convert from imperial to metric
i.e. K = 0.33 (tonnes/unit of R)

Table 1: USLE Organic % Correction Factor

Slope Length and Steepness Factor

$$LS = \text{From Appendix 1 equation}$$

Slope Length =	310
Maximum Elevation =	71
Minimum Elevation =	68.5
Slope As a %	0.81
Therefore m =	0.2

$$\text{Therefore } LS = 0.14$$

Ground Cover Factor

C = 1 Assumed site as **Bare Soil**
and taking value from Table 2

Roughness Factor

P = 1.32 Assumed site as **Bare Soil**
and taking value from Table 2

Ground Cover Factor

This is the ratio of soil loss from an actual site (or parts of a site) with specific ground cover (e.g. clay, topsoil, grass) compared to a bare site (i.e. no vegetation or topsoil). The bare site is given a value of 1.0.

Roughness Factor

The P factor provides adjustment for the degree to which surface roughness affects the erosion of sediment from a site (or part of a site).

As a standard practice, it is appropriate to use the range of C and P values given in Table 2 below.

Table 2

Treatment	C factor	P factor
Bare Soil		
- compacted and smooth	1.0	1.32
- track walked on contour	1.0	1.2
- rough irregular surface	1.0	0.9
- disked to 250 mm depth	1.0	0.8
Native vegetation (undisturbed)	0.01	1.0
Pasture (undisturbed)	0.02	1.0
Establishing grass	0.1	1.0
Mulch – on subsoil ²	0.15 (3 month period only)	1.0
Mulch – on topsoil ³	0.05 (3 month period only)	1.0

Table 2: USLE Organic % Correction Factor

Therefore A = 7.61 tonnes/ha/yr

Estimate of Sediment yield

S (Yield) = A x Area x SDR x SCM x Duration

where A = 7.61 tonnes/ha/yr
 Area = 4.99 ha
 SDR = 0.5
 SCM = 0.5 %
 Duration = 0.5 yrs

SDR Sediment Delivery Ratio, 0.5 for slopes < 10%, 0.7 for slopes > 10%

SCM Sediment Control Measures (%) 50% is considered conservative

Therefore S (Yield) = 4.746 tonnes / per 6 months

M M A E N Maven Associates		Job Number 298001	Sheets 2	Rev A
Job Title Calc Title	SL1 - RESIDENTIAL Earthworks Pond - Phase 1B	Author MKS	Date 11/12/2025	Checked DJM
Catchment Area40000 m² Pond Volume 3% of Area1200 m³ Dead Storage 30% of volume360 m³ Live Storage 70% of volume840 m³ Decant Dewatering (3.2l/s/ha)12.8 l/s				
Size Decant Standard decent4.5 l/s = 200 holes Therefore12.80 l/s = 569 holes Use4decants				
Pond Dimensions v = 1200 m³ d = 1.5 m x = width of pond base Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope. Calc 2: Calculate width and length of base, Quadratic Equation 3:1 ratio v = (((3x²)+(x+4d)(3x+5d)))/2)d => v = 3x²d+8.5xd²+10d³ quadratic equation to find "x" a b c 0 = 4.5 x²+ 19.125 x+ -1166.25 x = 14.11 width of pond base or = -18.36 Check = 1200 m³ 5:1 ratio v = (((5x²)+(x+4d)(5x+5d)))/2)d => v = 5x²d+12.5xd²+10d³ quadratic equation to find "x" a b c 0 = 7.5 x²+ 28.125 x+ -1166.25 x = 10.74 width of pond base or = -14.49 Check = 1200 m³ Width = 14.11 m Length = 42.34 m				

Dead Storage Depth

Pond Dimensions

x = 14.11 m
v = 360.0 m³
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$$v = (((3x^2) + ((x+4d)(3x+5d)))/2)d$$

=> $v = 10d^3 + 8.5xd^2 + 3x^2d$ cubic equation to find "d"

		a		b		c
0	=	d ³ +	11.99630251	d ² +	59.75555	+d -36
e	=		3.93			
f	=		73.53			
g	=		5.28			
h	=		-0.74			
d	=		0.541			depth of dead storage
Check v	=		360.0			m ³

Spillway Dimensions

Side Slope horizontal 3 vertical 1
Gradient 1 %
Base Width 14.11 m

Calc 3: Calculate spillway flow (Q) Rational Formula

$$Q = CIA \quad 1\% \text{ AEP}$$

where C = 0.85
I = 0.000065 m/s 234 0.234
A = 40000 m²

Therefore Q = 2.21 m³/sec

Calc 4: Calculate spillway depth (H) Mannings Formula

$$V = (1/n)R^{2/3}S^{1/2} \quad R = A/P \quad Q = AV$$

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter
A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.13	14.93549	1.885429	0.01	0.126238	1.398045	2.635915

Therefore H = 0.13 m OK



Maven Associates

Job Number

298001

Sheets

1

Rev

A

Job Title

SL1 - RESIDENTIAL

Calc Title

SEDIMENT YIELD - PHASE 2A

Author

MKS

Date

11/12/2025

Checked

DJM

Design Spreadsheet for USLE

Calc 1: Estimate of Sediment Generation (A), tonnes/ha/yr

$$A = R \times K \times LS \times C \times P$$

Where

- A = Sediment Generation (tonnes/ha/yr)
- R = Rainfall Erosion Index (J/hectare)
- K = Soil Erodibility Factor (tonnes/unit of R)
- LS = Slope Length and steepness Factor
- C = Ground Cover Factor
- P = Roughness Factor

Rainfall Erosion Index

$$R = 0.008828 \times P^{2.2 \times 1.7}$$

$$P = 66.568$$

P is the 2yr 24 hour rainfall from ARC Figure A.1 for a 6 hour duration period

$$2\text{yr} = 106 \text{ mm/hr}$$

$$\text{Therefore } R = 154 \text{ J/ha}$$

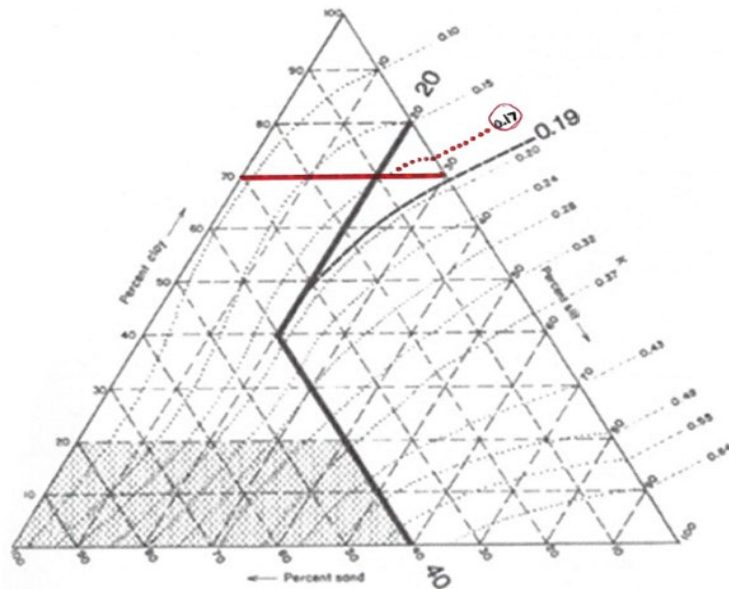


Figure 1: USLE Nomograph for Estimating k value

Soil Erodibility Factor

$$K = k \times \text{Organic \% Factor} \times \text{M-I Factor}$$

The K factor can be determined by using the nomograph method, which requires that a particle size analysis be done to determine the percentages of sand, very fine sand, silt and clay. Use the figure above to determine appropriate K value.

Site Geology

sand	%	60
silt	%	30
clay	%	10

Therefore from Figure 1 of USLE, k value unfactored =

$$k = 0.3$$

$$\text{Organic \%} = 4$$

Therefore from Table 1 of USLE, Organic % Factor =

$$\text{O\%F} = -0.1$$

Metric To Imperial Factor

$$\text{M-I Factor} = 1.32$$

$$\text{Therefore } K = 0.264 \text{ tonnes/unit of R}$$

Correct for organic content using Table 1 (the nomograph assumes 2% organic matter).

Table 1

K Value	Correction factor when percent organic matter is				
	0% (clay)	1%	2%	3%	4% (topsoil)
Greater than 0.40	+ 0.14	+ 0.07	0	- 0.07	- 0.14
0.20 – 0.40	+ 0.10	+ 0.05	0	- 0.05	- 0.10
Less than 0.20	+ 0.06	+ 0.03	0	- 0.03	- 0.06

In this table, exposed clay is considered 0% organic; topsoil 4% organic. In our example, if the surface is clay, the value would be corrected by adding 0.06 to the K value of 0.19 i.e. K = 0.25

Multiply the corrected K value by 1.32 to convert from imperial to metric
i.e. K = 0.33 (tonnes/unit of R)

Table 1: USLE Organic % Correction Factor

Slope Length and Steepness Factor

$$LS = \text{From Appendix 1 equation}$$

$$\text{Slope Length} = 224.1$$

$$\text{Maximum Elevation} = 72.02$$

$$\text{Minimum Elevation} = 69.3$$

$$\text{Slope As a \%} = 1.21$$

$$\text{Therefore } m = 0.3$$

$$\text{Therefore } LS = 0.18$$

Ground Cover Factor

C = 1 Assumed site as **Bare Soil**
and taking value from Table 2

Roughness Factor

P = 1.32 Assumed site as **Bare Soil**
and taking value from Table 2

Ground Cover Factor

This is the ratio of soil loss from an actual site (or parts of a site) with specific ground cover (e.g. clay, topsoil, grass) compared to a bare site (i.e. no vegetation or topsoil). The bare site is given a value of 1.0.

Roughness Factor

The P factor provides adjustment for the degree to which surface roughness affects the erosion of sediment from a site (or part of a site).

As a standard practice, it is appropriate to use the range of C and P values given in Table 2 below.

Table 2

Treatment	C factor	P factor
Bare Soil		
- compacted and smooth	1.0	1.32
- track walked on contour	1.0	1.2
- rough irregular surface	1.0	0.9
- disked to 250 mm depth	1.0	0.8
Native vegetation (undisturbed)	0.01	1.0
Pasture (undisturbed)	0.02	1.0
Establishing grass	0.1	1.0
Mulch – on subsoil ²	0.15 (3 month period only)	1.0
Mulch – on topsoil ³	0.05 (3 month period only)	1.0

Table 2: USLE Organic % Correction Factor

Therefore A = 9.79 tonnes/ha/yr

Estimate of Sediment yield

S (Yield) = A x Area x SDR x SCM x Duration

where A = 9.79 tonnes/ha/yr
 Area = 4.88 ha
 SDR = 0.5
 SCM = 0.5 %
 Duration = 0.5 yrs

SDR Sediment Delivery Ratio, 0.5 for slopes < 10%, 0.7 for slopes > 10%
 SCM Sediment Control Measures (%) 50% is considered conservative

Therefore S (Yield) = 5.969 tonnes / per 6 months

Dead Storage Depth

Pond Dimensions

x = 10.67 m
v = 225.0 m³
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$$v = (((3x^2) + ((x+4d)(3x+5d)))/2)d$$

=> $v = 10d^3 + 8.5xd^2 + 3x^2d$ cubic equation to find "d"

		a		b		c
0	=	d ³ +	9.06851233	d ² +	34.14723	+d -22.5
e	=		2.24			
f	=		35.24			
g	=		4.13			
h	=		-0.54			
d	=		0.568			depth of dead storage
Check v	=		225.0			m ³

Spillway Dimensions

Side Slope horizontal 3 vertical 1
Gradient 1 %
Base Width 10.67 m

Calc 3: Calculate spillway flow (Q) Rational Formula

$$Q = CIA \quad 1\% \text{ AEP}$$

where C = 0.85
I = 0.000065 m/s 234 0.234
A = 25000 m²

Therefore Q = 1.38 m³/sec

Calc 4: Calculate spillway depth (H) Mannings Formula

$$V = (1/n)R^{2/3}S^{1/2} \quad R = A/P \quad Q = AV$$

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter
A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.13	11.49103	1.437649	0.01	0.125111	1.389707	1.997911

Therefore H = 0.13 m OK



Maven Associates

Job Number

298001

Sheets

1

Rev

A

Job Title

SL1 - RESIDENTIAL

Calc Title

SEDIMENT YIELD - PHASE 2B

Author

MKS

Date

11/12/2025

Checked

DJM

Design Spreadsheet for USLE

Calc 1: Estimate of Sediment Generation (A), tonnes/ha/yr

$$A = R \times K \times LS \times C \times P$$

Where

- A = Sediment Generation (tonnes/ha/yr)
- R = Rainfall Erosion Index (J/hectare)
- K = Soil Erodibility Factor (tonnes/unit of R)
- LS = Slope Length and steepness Factor
- C = Ground Cover Factor
- P = Roughness Factor

Rainfall Erosion Index

$$R = 0.008828 \times P^{2.2 \times 1.7}$$

$$P = 66.568$$

P is the 2yr 24 hour rainfall from ARC Figure A.1 for a 6 hour duration period

$$2\text{yr} = 106 \text{ mm/hr}$$

$$\text{Therefore } R = 154 \text{ J/ha}$$

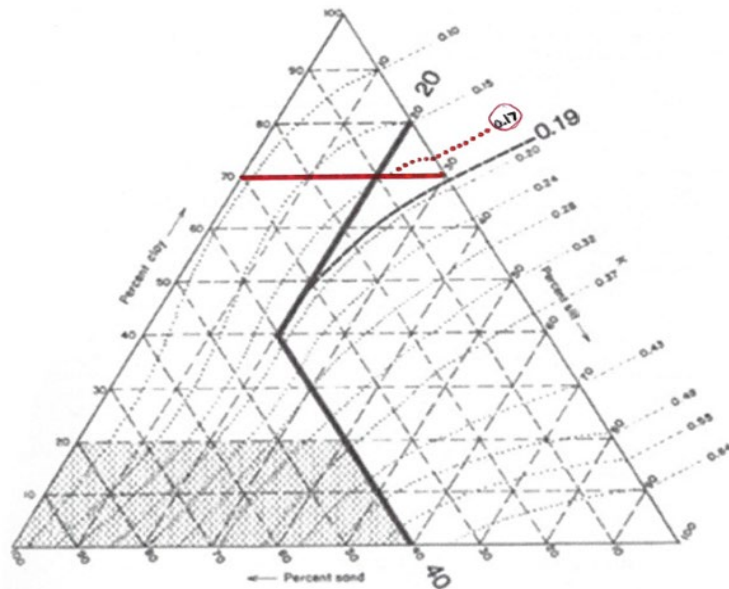


Figure 1: USLE Nomograph for Estimating k value

Soil Erodibility Factor

$$K = k \times \text{Organic \% Factor} \times \text{M-I Factor}$$

The K factor can be determined by using the nomograph method, which requires that a particle size analysis be done to determine the percentages of sand, very fine sand, silt and clay. Use the figure above to determine appropriate K value.

Site Geology

sand	%	60
silt	%	30
clay	%	10

Therefore from Figure 1 of USLE, k value unfactored =

$$k = 0.3$$

$$\text{Organic \%} = 4$$

Therefore from Table 1 of USLE, Organic % Factor =

$$\text{O\%F} = -0.1$$

Metric To Imperial Factor

$$\text{M-I Factor} = 1.32$$

$$\text{Therefore } K = 0.264 \text{ tonnes/unit of R}$$

Correct for organic content using Table 1 (the nomograph assumes 2% organic matter).

Table 1

K Value	Correction factor when percent organic matter is				
	0% (clay)	1%	2%	3%	4% (topsoil)
Greater than 0.40	+ 0.14	+ 0.07	0	- 0.07	- 0.14
0.20 – 0.40	+ 0.10	+ 0.05	0	- 0.05	- 0.10
Less than 0.20	+ 0.06	+ 0.03	0	- 0.03	- 0.06

In this table, exposed clay is considered 0% organic; topsoil 4% organic. In our example, if the surface is clay, the value would be corrected by adding 0.06 to the K value of 0.19 i.e. K = 0.25

Multiply the corrected K value by 1.32 to convert from imperial to metric
i.e. K = 0.33 (tonnes/unit of R)

Table 1: USLE Organic % Correction Factor

Slope Length and Steepness Factor

$$LS = \text{From Appendix 1 equation}$$

$$\text{Slope Length} = 341.36$$

$$\text{Maximum Elevation} = 71.25$$

$$\text{Minimum Elevation} = 67.7$$

$$\text{Slope As a \%} = 1.04$$

$$\text{Therefore } m = 0.3$$

$$\text{Therefore } LS = 0.19$$

Ground Cover Factor

C = 1 Assumed site as **Bare Soil**
and taking value from Table 2

Roughness Factor

P = 1.32 Assumed site as **Bare Soil**
and taking value from Table 2

Ground Cover Factor

This is the ratio of soil loss from an actual site (or parts of a site) with specific ground cover (e.g. clay, topsoil, grass) compared to a bare site (i.e. no vegetation or topsoil). The bare site is given a value of 1.0.

Roughness Factor

The P factor provides adjustment for the degree to which surface roughness affects the erosion of sediment from a site (or part of a site).

As a standard practice, it is appropriate to use the range of C and P values given in Table 2 below.

Table 2

Treatment	C factor	P factor
Bare Soil		
- compacted and smooth	1.0	1.32
- track walked on contour	1.0	1.2
- rough irregular surface	1.0	0.9
- disked to 250 mm depth	1.0	0.8
Native vegetation (undisturbed)	0.01	1.0
Pasture (undisturbed)	0.02	1.0
Establishing grass	0.1	1.0
Mulch – on subsoil ²	0.15 (3 month period only)	1.0
Mulch – on topsoil ³	0.05 (3 month period only)	1.0

Table 2: USLE Organic % Correction Factor

Therefore A = 10.21 tonnes/ha/yr

Estimate of Sediment yield

S (Yield) = A x Area x SDR x SCM x Duration

where A = 10.21 tonnes/ha/yr
 Area = 4.99 ha
 SDR = 0.5
 SCM = 0.5 %
 Duration = 0.5 yrs

SDR Sediment Delivery Ratio, 0.5 for slopes < 10%, 0.7 for slopes > 10%

SCM Sediment Control Measures (%) 50% is considered conservative

Therefore S (Yield) = 6.366 tonnes / per 6 months

M M A E N Maven Associates		Job Number 298001	Sheets 2	Rev A
Job Title Calc Title	SL1 - RESIDENTIAL Earthworks Pond - Phase 2B	Author MKS	Date 11/12/2025	Checked DJM
Catchment Area 36000 m² Pond Volume 3% of Area 1080 m³ Dead Storage 30% of volume 324 m³ Live Storage 70% of volume 756 m³ Decant Dewatering (3.2l/s/ha) 11.5 l/s				
Size Decant Standard decent 4.5 l/s = 200 holes Therefore 11.52 l/s = 512 holes Use 4 decants				
Pond Dimensions v = 1080 m³ d = 1.5 m x = width of pond base Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.				
Calc 2: Calculate width and length of base, Quadratic Equation 3:1 ratio v = (((3x²)+(x+4d)(3x+5d)))/2)d =>v = 3x²d+8.5xd²+10d³ quadratic equation to find "x" a b c 0 = 4.5 x²+ 19.125 x+ -1046.25 x = 13.27 width of pond base or = -17.52 Check = 1080 m³ 5:1 ratio v = (((5x²)+(x+4d)(5x+5d)))/2)d =>v = 5x²d+12.5xd²+10d³ quadratic equation to find "x" a b c 0 = 7.5 x²+ 28.125 x+ -1046.25 x = 10.08 width of pond base or = -13.83 Check = 1080 m³ Width = 13.27 m Length = 39.81 m				

Dead Storage Depth

Pond Dimensions

x = 13.27 m
v = 324.0 m³
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$$v = (((3x^2) + ((x+4d)(3x+5d)))/2)d$$

=> $v = 10d^3 + 8.5xd^2 + 3x^2d$ cubic equation to find "d"

		a	b	c
0	=	d ³ + 11.27976502	d ² + 52.83035	+d -32.4
e	=	3.47		
f	=	62.36		
g	=	5.00		
h	=	-0.69		
d	=	0.546	depth of dead storage	
Check v	=	324.0	m ³	

Spillway Dimensions

Side Slope horizontal 3 vertical 1
Gradient 1 %
Base Width 13.27 m

Calc 3: Calculate spillway flow (Q) Rational Formula

$$Q = CIA \quad 1\% \text{ AEP}$$

where C = 0.85
I = 0.000065 m/s 234 0.234
A = 36000 m²

Therefore Q = 1.99 m³/sec

Calc 4: Calculate spillway depth (H) Mannings Formula

$$V = (1/n)R^{2/3}S^{1/2} \quad R = A/P \quad Q = AV$$

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter
A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.13	14.0925	1.775841	0.01	0.126013	1.396383	2.479754

Therefore H = 0.13 m OK

M MAVEN	Maven Waikato Ltd		Job Number	Author	Date
			298001	MKS/MA	10/04/2026
	Job Title	SL1-RESIDENTIAL 1	Sheet Number	Revision	Checked
	Calculation Title	Pavement Design	1	A	DJM

Flexible Pavement Design for Moderate-Heavy Design Traffic Loading Using AUSTRROADS "Guide to Pavement Technology - Part 2 Pavement Structural Design" (AGPT02-17)

Parameter	Symbol	Reference
Annual Average Daily Traffic:	AADT	Estimated as 10 movements per day per lot within the subdivision ~ 1006 lots currently
Design Period:	P	Section 7.4.2, Table 7.2
Lane Distribution Factor:	LDF	Section 7.4.3, Table 7.3
Direction Factor:	DF	Section 7.4.4, Equation 30
Average Percentage of Heavy Vehicles:	%HV	Section 7.4.4, Equation 30
Initial Daily Heavy Vehicles in Design Lane	N _i	Section 7.4.4, Equation 30
Annual Growth Rate	R	Section 7.4.5, Table 7.4
Cumulative Growth Factor	CGF	Section 7.4.5, Equation 31
Design Traffic in Cumulative Heavy Vehicles	N _{HV}	Section 7.4.5, Equation 32
Average Number of Axle Groups per Heavy Vehicle	N _{HVAG}	Section 7.4.7, Equation 35, Table 7.6
Heavy Vehicle Axle Groups in Design Lane Over Design Period	N _{DT}	Section 7.4.7, Equation 35
Equivalent Single Axles per Heavy Vehicle Axle Group	ESA/HVAG	Section 12.7.1, Table 12.2
Design Equivalent Single Axle Groups	DESA	Section 7.6.2, Equation 37
Thickness of Base Material	-	Section 8.3.1, Figure 8.4
Thickness of Basecourse	-	Section 8.3.1, Figure 8.4 with CBR set to 30

Equations Used

Equation 30:

$$N_i = AADT \times DF \times \%HV / 100 \times LDF$$

Equation 31:

$$CGF = \frac{(1+0.01R)^P - 1}{0.01R} \text{ for } R > 0, \text{ CGF} = P \text{ for } R = 0$$

Equation 32:

$$N_{HV} = 365 \times CGF \times N_i$$

Equation 35:

$$N_{DT} = N_{HV} \times N_{HVAG}$$

Equation 37:

$$DESA = ESA / HVAG \times N_{DT}$$

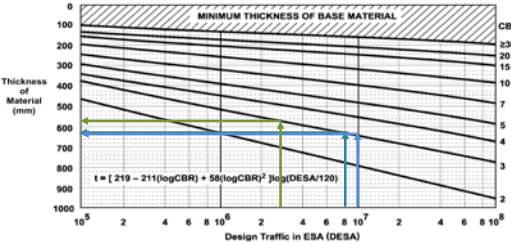
Thickness of Base Material:

$$t = [219 - 211(\log CBR) + 58(\log CBR)^2] \times \log^{(DESA/120)}$$

Thickness of Basecourse:

$$t = [219 - 211(\log 30) + 58(\log 30)^2] \times \log^{(DESA/120)}$$

Figure 8.4: Design chart for granular pavements with thin bituminous surfacing



AADT				
Description	Street Type	Lots	Movements	Contingency
Road Description	Classification	Total Lots entering Road Lanes	Total Vehicle Movements Per Day for all Lanes	10% Contingency
Road 3 (16.8m)	Local	109	1090	1199
Road 4 (16.8m)	Local	35	350	385
Road 5 (18m)	Local	43	430	473
Road6 (16.8m)	Local	59	590	649
Road7 (16.8)	Local	54	540	594
Road8(16.8)	Local	70	700	770
Road16(16.8)	Local	47	470	517
Road9(16.8)	Local	96	960	1056
Road13(16.8)	Local	86	860	946
Road15(16.8)	Local	24	240	264
Road14(16.8)	Local	40	400	440
Road12(18)	Local	135	1350	1485
Road10(16.8)	Local	141	1410	1551
Road10(16.8) - Construction Traffic	Local	141	3384	3722.4
Road10(16.8)+Road10(16.8) - Construction Traffic	Local			
Road11(18)	Local	6	60	66
Road2(23)	Collector	1006	10060	11066
Road2(23) - Construction Traffic	Collector	1006	24144	26558.4
Road2(23)+Road2(123) - Construction Traffic				
Road1(30)	Collector	96	960	1056

Design Traffic (AustRoads Pavement Design Manual - Chapter 7 & Chapter 12)																
Lanes	Design Period	LDF	AADT/Lane	DF	%HV	N _i	R	CGF	Days	N _{HV}	Design Check	N _{HVAG}	N _{DT}	ESA/HVAG	Design ESA	Design Check
No of Lanes	Design Period	Lane Distribution Factor	Average Annual Daily Traffic two-way	Direction Factor ¹	Average Percentage of Heavy Vehicles ²	Initial Daily Heavy Vehicles	Annual Growth Rate % ³	Cumulative Growth Factor	Days per Year of Traffic	Cumulative Heavy Vehicles	Check Design Lane Operating Below Capacity Over Design Life	No of Axle Groups per Heavy Vehicle ⁶	Cumulative HVAG in Design Lane over Design Period	Equivalent Single Axles per Heavy Vehicle Axle Group ⁷	Design Equivalent Single Axles	Design Traffic Loading Check
1	25	1	1199	1	1.5	18	3	36.5	365	2.39E+05	YES	2.40	5.74E+05	0.600	3.45E+05	OK
1	25	1	385	1	1.5	6	3	36.5	365	7.69E+04	YES	2.40	1.84E+05	0.600	1.11E+05	OK
1	25	1	473	1	1.5	7	3	36.5	365	9.44E+04	YES	2.40	2.27E+05	0.600	1.36E+05	OK
1	25	1	649	1	1.5	10	3	36.5	365	1.30E+05	YES	2.40	3.11E+05	0.600	1.87E+05	OK
1	25	1	594	1	1.5	9	3	36.5	365	1.19E+05	YES	2.40	2.85E+05	0.600	1.71E+05	OK
1	25	1	770	1	1.5	12	3	36.5	365	1.54E+05	YES	2.40	3.69E+05	0.600	2.21E+05	OK
1	25	1	517	1	1.5	8	3	36.5	365	1.03E+05	YES	2.40	2.48E+05	0.600	1.49E+05	OK
1	25	1	1056	1	1.5	16	3	36.5	365	2.11E+05	YES	2.40	5.06E+05	0.600	3.04E+05	OK
1	25	1	946	1	1.5	14	3	36.5	365	1.89E+05	YES	2.40	4.53E+05	0.600	2.72E+05	OK
1	25	1	264	1	1.5	4	3	36.5	365	5.27E+04	YES	2.40	1.26E+05	0.600	7.59E+04	Low DESA, see AGPT02-17 Sec. 12.8
1	25	1	440	1	1.5	7	3	36.5	365	8.78E+04	YES	2.40	2.11E+05	0.600	1.26E+05	OK
1	25	1	1485	1	1.5	22	3	36.5	365	2.96E+05	YES	2.40	7.11E+05	0.600	4.27E+05	OK
1	25	1	1551	1	1.5	23	3	36.5	365	3.10E+05	YES	2.40	7.43E+05	0.600	4.46E+05	OK
1	1	1	3722	1	100	3722	0	1.0	1	3.72E+03	YES	2.40	8.93E+03	0.600	5.36E+03	Low DESA, see AGPT02-17 Sec. 12.8
															4.51E+05	OK
1	25	1	66	1	1.5	1	3	36.5	365	1.32E+04	YES	2.40	3.16E+04	0.600	1.90E+04	Low DESA, see AGPT02-17 Sec. 12.8
1	25	1	11066	0.5	3.5	194	3	36.5	365	2.58E+06	YES	2.40	6.19E+06	0.600	3.71E+06	High DESA, see AGPT02-17 Sec. 9.0
1	1	1	26558	1	100	26558	0	1.0	1	2.66E+04	YES	2.40	6.37E+04	0.600	3.82E+04	
															3.75E+06	High DESA, see AGPT02-17 Sec. 9.0
1	25	1	1056	0.5	3.5	18	3	36.5	365	2.46E+05	YES	2.40	5.90E+05	0.600	3.54E+05	OK

Pavement Design (AustRoads Pavement Design Manual - Chapter 8)				Adopted Design		
CBR	Granular Material	Basecourse	Sub-base	Base	Basecourse	Sub-base
Design Subgrade CBR ⁴	Thickness of Material (mm) see Figure 8.4 above	AP40 Basecourse (mm)	GAP65 Sub-base (mm)	Thickness of Granular material (mm)	AP40 Basecourse (mm)	GAP65 Sub-base (mm)
5	345	117	228			
5	296	100	196			
5	305	103	202			
5	319	108	211			
5	315	107	208			
5	326	111	215			
5	309	105	204			
5	340	115	225			
5	335	114	221			
5	280	95	185			
5	302	102	199			
5	355	120	234			
5	356	121	236			
5	165	56	109			
5	357	121	236	375	125	250
5	220	74	145			
5	448	152	296			
5						
5	449	152	297	475	175	300
5	346	118	229	375	125	250

	MAVEN ASSOCIATES				Job Number	Sheet	Rev	Calc Title			Author	Date	Checked							
					298001	1	A	SW Pipe Capacity Check			MJRA	14/03/2026								
To be read in conjunction with 119010 - C451 - Catchment Plan																				
<table border="1"><tr><td>Rainfall Depth</td><td>ARI 10YR (mm)</td></tr><tr><td>NIWA rainfall data RCP 8.5 (2YR - 24HR)</td><td>84</td></tr><tr><td>NIWA rainfall data RCP 8.5 (10YR)</td><td>130</td></tr></table>					Rainfall Depth	ARI 10YR (mm)	NIWA rainfall data RCP 8.5 (2YR - 24HR)	84	NIWA rainfall data RCP 8.5 (10YR)	130	2081-2100	Pipe ks factor = 0.6		mm (pipes up to 1.0m dia)						
Rainfall Depth	ARI 10YR (mm)																			
NIWA rainfall data RCP 8.5 (2YR - 24HR)	84																			
NIWA rainfall data RCP 8.5 (10YR)	130																			
					2081-2100	as built grade and pipe size														
<table border="1"><tr><td colspan="2">CN Number</td></tr><tr><td>Impervious area</td><td>98</td></tr><tr><td>Pervious (Post Development)</td><td>74</td></tr></table>					CN Number		Impervious area	98	Pervious (Post Development)	74	Proposed Roads	CN Number								
CN Number																				
Impervious area	98																			
Pervious (Post Development)	74																			
					Residential Lots	94.4	Equivalent CN - (85% impervious coverage, 15% pervious coverage)													
						92	Equivalent CN - (70% impervious coverage, 30% pervious coverage)													
Line No.	MH to MH		Catchment letter	Catchment Area m2	CN	Peak Flow rate - 10YR ARI l/s	Cum. Flow l/s	Pipe dia m	No. of Barrels	Gradient %	Capacity l/s	Percent Capacity %	Remaining l/s	Velocity m/s	Check OK					
Line 1A	1A-8	1A-7	Lots Road	6019 1673	94.4 98	125.0 36.0	125.0 160.9	0.450	1	0.50	229.87	70.0%	68.92	1.4	OK					
Line 1A	1A-7	1A-6	Lots Road	0 0	94.4 98	0.0 0.0	160.9 160.9									0.450	1	0.50	229.87	70.0%
Line 1A	1A-6B	1A-6A	Lots Road	1315 0	94.4 98	27.3 0.0	27.3	0.225	1	0.50	37.06	73.7%	9.74	0.9	OK					
Line 1A	1A-6A	1A-6	Lots Road	0 0	94.4 98	0.0 0.0	27.3 27.3									0.225	1	0.50	37.06	73.7%
Line 1A	1A-6	1A-5	Lots Road	1658 901	94.4 98	34.4 19.4	222.7 242.1	0.525	1	0.50	344.54	70.3%	102.48	1.6	OK					
Line 1A	1A-5B	1A-5	Lots Road	778 622	94.4 98	16.2 13.4	16.2 29.5									0.225	1	0.50	37.06	79.7%
Line 1A	1A-5A	1A-5	Lots Road	5466 1900	94.4 98	113.5 40.8	113.5 154.3	0.450	1	0.50	229.87	67.1%	75.52	1.4	OK					
Line 1A	1A-5	1A-4	Lots Road	928 1063	94.4 98	19.3 22.8	445.2 468.1									0.600	1	0.50	489.07	95.7%
Line 1A	1A-4A	1A-4	Lots Road	5447 1739	94.4 98	113.1 37.4	113.1 150.5	0.450	1	0.50	229.87	65.5%	79.38	1.4	OK					
Line 1A	1A-4	1A-3	Lots Road	2304 1083	94.4 98	47.9 23.3	666.4 689.7									0.750	1	0.50	877.66	78.6%
Line 1A	1A-3A	1A-3	Lots Road	6581 1992	94.4 98	136.7 42.8	136.7 179.5	0.450	1	0.50	229.87	78.1%	50.38	1.4	OK					

Stage 1 -
Wetland A

Line 1A	1A-3	1A-2	Lots Road	1763 984	94.4 98	36.6 21.1	905.8 926.9	0.900	1	0.50	1414.46	65.5%	487.55	2.2	OK
Line 1A	1A-2A	1A-2	Lots Road	1103 808	94.4 98	22.9 17.4	22.9 40.3	0.300	1	0.50	79.13	50.9%	38.85	1.1	OK
Line 1A	1A-2	1A-1 Outlet	Lots Road	0 0	94.4 98	0.0 0.0	967.2 967.2	0.900	1	0.50	1414.46	68.4%	447.27	2.2	OK
Line 1B	1B-11B	1B-11	Lots Road	3975 1661	94.4 98	82.5 35.7	82.5 118.3	0.375	1	0.50	142.35	83.1%	24.10	1.3	OK
Line 1B	1B-11A	1B-11	Lots Road	6085 2112	94.4 98	126.4 45.4	126.4 171.7	0.450	1	0.50	229.87	74.7%	58.12	1.4	OK
Line 1B	1B-11	1B-10	Lots Walkway	0 528	94.4 98	0.0 11.3	290.0 301.3	0.525	1	0.50	344.54	87.5%	43.20	1.6	OK
Line 1B	1B-10A	1B-10	Lots Road	5897 1855	94.4 98	122.5 39.9	122.5 162.3	0.450	1	0.50	229.87	70.6%	67.54	1.4	OK
Line 1B	1B-10	1B-9	Lots Road	0 0	94.4 98	0.0 0.0	463.7 463.7	0.675	1	0.50	665.97	69.6%	202.30	1.9	OK
Line 1B	1B-9A	1B-9	Lots Road	1937 2105	94.4 98	40.2 45.3	40.2 85.5	0.375	1	0.50	142.35	60.0%	56.88	1.3	OK
Line 1B	1B-9	1B-8	Lots Road	0 1026	94.4 98	0.0 22.1	549.1 571.2	0.675	1	0.50	665.97	85.8%	94.77	1.9	OK
Line 1B	1B-8	1B-7	Lots Road	0 1326	94.4 98	0.0 28.5	571.2 599.7	0.675	1	0.50	665.97	90.0%	66.28	1.9	OK
Line 1B	1B-8A	1B-8	Lots Road	5902 1723	94.4 98	122.6 37.0	122.6 159.6	0.450	1	0.50	229.87	69.4%	70.28	1.4	OK
Line 1B	1B-8	1B-7	Lots Road	0 813	94.4 98	0.0 17.5	759.3 776.7	0.750	1	0.50	877.66	88.5%	100.91	2.0	OK
Line 1B	1B-7	1B-6	Lots Road	789 513	94.4 98	16.4 11.0	793.1 804.2	0.750	1	0.50	877.66	91.6%	73.49	2.0	OK
Line 1B	1B-6C	1B-6B	Lots JOAL	3703 490	94.4 98	76.9 10.5	76.9 87.4	0.375	1	0.50	142.35	61.4%	54.92	1.3	OK
Line 1B	1B-6B	1B-6A	Lots JOAL	3560 466	94.4 98	73.9 10.0	161.4 171.4	0.450	1	0.50	229.87	74.6%	58.47	1.4	OK
Line 1B	1B-6A	1B-6	Lots Walkway	0 545	94.4 98	0.0 11.7	171.4 183.1	0.450	1	0.50	229.87	79.7%	46.76	1.4	OK

Line 1B	1B-6	1B-5	Lots Road	0 0	94.4 98	0.0 0.0	987.3 987.3	0.825	1	0.50	1126.42	87.6%	139.15	2.1	OK
Line 1B	1B-5B	1B-5A	Lots JOAL	1270 0	94.4 98	26.4 0.0	26.4 26.4	0.225	1	0.50	37.06	71.2%	10.69	0.9	OK
Line 1B	1B-5A	1B-5	Lots JOAL	789 0	94.4 98	16.4 0.0	42.8 42.8	0.300	1	0.50	79.13	54.0%	36.37	1.1	OK
Line 1B	1B-5	1B-4	Lots Road	623 673	94.4 98	12.9 14.5	1043.0 1057.4	0.825	1	0.50	1126.42	93.9%	68.98	2.1	OK
Line 1B	1B-4A	1B-4	Lots Road	1110 673	94.4 98	23.1 14.5	23.1 37.5	0.300	1	0.50	79.13	47.4%	41.60	1.1	OK
Line 1B	1B-4	1B-3	Lots Road	0 652	94.4 98	0.0 14.0	1095.0 1109.0	0.825	1	0.50	1126.42	98.5%	17.43	2.1	OK
Line 1B	1B-3D	1B-3C	Lots Road	2422 4078	94.4 98	50.3 87.6	50.3 137.9	0.375	1	0.50	142.35	96.9%	4.43	1.3	OK
Line 1B	1B-3B	1B-3A	Lots JOAL	5576 878	94.4 98	115.8 18.9	253.7 272.6	0.525	1	0.50	344.54	79.1%	71.97	1.6	OK
Line 1B	1B-3E	1B-3A	Lots JOAL	870 231	94.4 98	18.1 5.0	18.1 23.0	0.225	1	0.50	37.06	62.2%	14.02	0.9	OK
Line 1B	1B-3A	1B-3	Lots JOAL	894 266	94.4 98	18.6 5.7	314.2 319.9	0.525	1	0.50	344.54	92.8%	24.66	1.6	OK
Line 1B	1B-3	1B-2	Lots JOAL	520 513	94.4 98	10.8 11.0	1439.7 1450.7	0.975	1	0.50	1743.91	83.2%	293.21	2.3	OK
Line 1B	1B-2B	1B-2A	Lots Road	2727 1741	94.4 98	56.6 37.4	56.6 94.0	0.375	1	0.50	142.35	66.1%	48.30	1.3	OK
Line 1B	1B-2A	1B-2A	Lots Road	0 0	94.4 98	0.0 0.0	94.0 94.0	0.375	1	0.50	142.35	66.1%	48.30	1.3	OK
Line 1B	1B-2	1B-1 Outlet	Lots Road	0 0	94.4 98	0.0 0.0	1544.7 1544.7	0.975	1	0.50	1743.91	88.6%	199.16	2.3	OK

Line 2A	2A-4A	2A-4	Lots JOAL	967 222	94.4 98	20.1 4.8	20.1 24.9	0.225	1	0.50	37.06	67.1%	12.21	0.9	OK
Line 2A	2A-4	2A-3	Lots Road	0 554	94.4 98	0.0 11.9	24.9 36.8	0.225	1	0.50	37.06	99.2%	0.31	0.9	OK
Line 2A	2A-3	2A-2	Lots	904	94.4	18.8	55.5								

Stage 2 - Wetland B			Road	1084	98	23.3	78.8	0.300	1	0.50	79.13	99.6%	0.31	1.1	OK
	Line 2A	2A-2A	2A-2	Lots	2856	94.4	59.3	96.1							
			Road	1770	98	38.0	134.1	0.375	1	0.50	142.35	94.2%	8.24	1.3	OK
	Line 2A	2A-2	2A-1 Outlet	Lots	0	94.4	0.0	212.9							
			Road	0	98	0.0	212.9	0.450	1	0.50	229.87	92.6%	16.93	1.4	OK
	Line 2B	2B-2G	2B-2F	Lots	2416	94.4	50.2	50.2							
			Road	1299	98	27.9	78.1	0.300	1	0.50	79.13	98.7%	1.04	1.1	OK
	Line 2B	2B-2F	2B-2A	Lots	2075	94.4	43.1	121.2							
			Road	1233	98	26.5	147.7	0.450	1	0.50	229.87	64.3%	82.17	1.4	OK
	Line 2B	2B-2E	2B-2D	Lots	1192	94.4	24.8	24.8							
			JOAL	106	98	2.3	27.0	0.225	1	0.50	37.06	73.0%	10.02	0.9	OK
	Line 2B	2B-2D	2B-2C	Lots	1184	94.4	24.6	51.6							
			Road	784	98	16.8	68.5	0.300	1	0.50	79.13	86.5%	10.65	1.1	OK
	Line 2B	2B-2C	2B-2B	Lots	4160	94.4	86.4	154.9							
			Road	1496	98	32.2	187.0	0.450	1	0.50	229.87	81.4%	42.85	1.4	OK
	Line 2B	2B-2B	2B-2A	Lots	3681	94.4	76.4	263.5							
			Road	1491	98	32.0	295.5	0.525	1	0.50	344.54	85.8%	49.04	1.6	OK
	Line 2B	2B-6	2B-5	Lots	4128	94.4	85.7	85.7							
			Road	1440	98	30.9	116.7	0.375	1	0.50	142.35	82.0%	25.68	1.3	OK
	Line 2B	2B-5	2B-4	Lots	0	94.4	0.0	116.7							
			Walkway	504	98	10.8	127.5	0.375	1	0.50	142.35	89.6%	14.86	1.3	OK
	Line 2B	2B-4A	2B-4	Lots	3622	94.4	75.2	75.2							
			Road	1470	98	31.6	106.8	0.375	1	0.50	142.35	75.0%	35.56	1.3	OK
	Line 2B	2B-4	2B-3	Lots	0	94.4	0.0	234.3							
			Walkway	499	98	10.7	245.0	0.525	1	0.50	344.54	71.1%	99.52	1.6	OK
	Line 2B	2B-3A	2B-3	Lots	2879	94.4	59.8	59.8							
			Road	1562	98	33.6	93.4	0.375	1	0.50	142.35	65.6%	49.00	1.3	OK
	Line 2B	2B-3	2B-2	Lots	0	94.4	0.0	338.4							
			Walkway	1239	98	26.6	365.0	0.600	1	0.50	489.07	74.6%	124.06	1.7	OK
	Line 2B	2B-2A	2B-2	Lots	1467	94.4	30.5	473.7							
			Road	1484	98	31.9	505.6	0.675	1	0.50	665.97	75.9%	160.42	1.9	OK

Stage 3 - Wetland C	Line 2B	2B-2	2B-1 Outlet	Lots Road	0 0	94.4 98	0.0 0.0	870.6 870.6	0.750	1	0.50	877.66	99.2%	7.10	2.0	OK
	Line 2D	2D-8A	2D-8	Lots Road	2076 831	94.4 98	43.1 17.9	43.1 61.0	0.300	1	0.50	79.13	77.1%	18.14	1.1	OK
	Line 2D	2D-8B	2D-8	Lots Road	491 463	94.4 98	10.2 10.0	10.2 20.2	0.225	1	0.50	37.06	54.4%	16.90	0.9	OK
	Line 2D	2D-8	2D-7	Lots Walkway	1567 392	94.4 98	32.5 8.4	113.7 122.1	0.375	1	0.50	142.35	85.8%	20.24	1.3	OK
	Line 2D	2D-7A	2D-7	Lots Road	2365 1302	94.4 98	49.1 28.0	49.1 77.1	0.300	1	0.50	79.13	97.4%	2.03	1.1	OK
	Line 2D	2D-7	2D-6	Lots Walkway	1586 388	94.4 98	32.9 8.3	232.2 240.5	0.525	1	0.50	344.54	69.8%	104.06	1.6	OK
	Line 2D	2D-6A	2D-6	Lots Road	2642 937	94.4 98	54.9 20.1	54.9 75.0	0.300	1	0.50	79.13	94.8%	4.13	1.1	OK
	Line 2D	2D-6	2D-5	Lots Walkway	0 0	94.4 98	0.0 0.0	315.5 315.5	0.525	1	0.50	344.54	91.6%	29.06	1.6	OK
	Line 2D	2D-5	2D-4	Lots Walkway	2157 472	94.4 98	44.8 10.1	360.3 370.4	0.600	1	0.50	489.07	75.7%	118.65	1.7	OK
	Line 2D	2D-4	2D-3	Lots Road	683 1476	94.4 98	14.2 31.7	384.6 416.3	0.600	1	0.50	489.07	85.1%	72.74	1.7	OK
	Line 2D	2D-3A	2D-3	Lots Road	1685 1133	94.4 98	35.0 24.4	35.0 59.3	0.300	1	0.50	79.13	75.0%	19.79	1.1	OK
	Line 2D	2D-3	2D-2	Lots Road	1235 667	94.4 98	25.6 14.3	501.3 515.6	0.675	1	0.50	665.97	77.4%	150.34	1.9	OK
	Line 2D	2D-2	2D-1 Outlet	Lots Road	0 0	94.4 98	0.0 0.0	515.6 515.6	0.675	1	0.50	665.97	77.4%	150.34	1.9	OK
	Line 3A	3A-5B	3A-5A	Lots Road	2044 467	94.4 98	42.5 10.0	42.5 52.5	0.300	1	0.50	79.13	66.3%	26.64	1.1	OK
	Line 3A	3A-5A	3A-5	Lots Road+JOAL	662 1114	94.4 98	13.7 23.9	66.2 90.2	0.375	1	0.50	142.35	63.4%	52.16	1.3	OK
	Line 3A	3A-6	3A-5	Lots Road	1172 1709	94.4 98	24.3 36.7	24.3 61.1	0.300	1	0.50	79.13	77.2%	18.04	1.1	OK

Line 3A	3A-5	3A-4	Lots Road	1680 1365	94.4 98	34.9 29.3	186.2 215.5	0.450	1	0.50	229.87	93.7%	14.37	1.4	OK
Line 3B	3B-2	3B-1	Lots Road	2440 644	94.4 98	50.7 13.8	50.7 64.5	0.300	1	0.50	79.13	81.5%	14.61	1.1	OK
Line 3B	3B-1	3A-4	Lots Road+JOAL	3177 1800	94.4 98	66.0 38.7	130.5 169.2	0.450	1	0.50	229.87	73.6%	60.67	1.4	OK
Line 3B	3A-4	3A-3	Lots Road	0 877	94.4 98	0.0 18.9	384.7 403.5	0.600	1	0.50	489.07	82.5%	85.53	1.7	OK
Line 3C	3C-2A	3C-2	Lots JOAL	1454 244	94.4 98	30.2 5.2	30.2 35.4	0.225	1	0.50	37.06	95.6%	1.62	0.9	OK
Line 3C	3C-2	3C-1	Lots Road	0 2306	94.4 98	0.0 49.6	35.4 85.0	0.375	1	0.50	142.35	59.7%	57.36	1.3	OK
Line 3C	3C-1A	3C-1	Lots Road	4969 2264	94.4 98	103.2 48.7	103.2 151.9	0.450	1	0.50	229.87	66.1%	78.00	1.4	OK
Line 3C	3C-1	3A-3	Lots Road	1913 1090	94.4 98	39.7 23.4	276.6 300.0	0.525	1	0.50	344.54	87.1%	44.52	1.6	OK
Line 3A	3A-3	3A-2	Lots Road	0 478	94.4 98	0.0 10.3	703.6 713.8	0.750	1	0.50	877.66	81.3%	163.82	2.0	OK
Line 2C	2C-3	3A-2	Lots JOAL	1895 518	94.4 98	39.4 11.1	39.4 50.5	0.300	1	0.50	79.13	63.8%	28.65	1.1	OK
Line 2C	2C-2	2C-1	Lots Road	1329 1408	94.4 98	27.6 30.3	27.6 57.8	0.300	1	0.50	79.13	73.1%	21.28	1.1	OK
Line 2C	2C-1	3A-2	Lots Road	766 583	94.4 98	15.9 12.5	73.8 86.3	0.375	1	0.50	142.35	60.6%	56.07	1.3	OK
Line 3A	3A-2	3A-1 Outlet	Lots Road	0 0	94.4 98	0.0 0.0	800.1 800.1	0.750	1	0.50	877.66	91.2%	77.54	2.0	OK
Line 3E	3E-7	3E-6	Lots Road	0 4146	94.4 98	0.0 89.1	0.0 89.1	0.375	1	0.50	142.35	62.6%	53.25	1.3	OK
Line 3E	3E-6A	3E-6	Lots JOAL	4311 626	94.4 98	89.5 13.4	89.5 103.0	0.450	1	0.50	229.87	44.8%	126.89	1.4	OK
Line 3E	3E-6	3E-5	Lots Road	0 750	94.4 98	0.0 16.1	192.1 208.2	0.450	1	0.50	229.87	90.6%	21.67	1.4	OK

Line 4B	4B-4	4B-3	Lots	959	94.4	19.9	19.9								
			Road	5650	98	121.4	141.3	0.375	1	0.50	142.35	99.3%	1.01	1.3	OK
Line 4B	4B-3B	4B-3	Lots	1300	94.4	27.0	27.0								
			JOAL	193	98	4.1	31.1	0.225	1	0.50	37.06	84.0%	5.92	0.9	OK
Line 4B	4B-3A	4B-3	Lots	2457	94.4	51.0	51.0								
			JOAL	559	98	12.0	63.0	0.300	1	0.50	79.13	79.7%	16.09	1.1	OK
Line 4B	4B-3	4B-2	Lots	1196	94.4	24.8	260.4								
			Road	642	98	13.8	274.2	0.525	1	0.50	344.54	79.6%	70.38	1.6	OK
Line 4B	4B-2	4B-1	Lots	1008	94.4	20.9	295.1								
			Road	255	98	5.5	300.6	0.525	1	0.50	344.54	87.2%	43.99	1.6	OK
Line 4B	4B-1	4A-2	Lots	4602	94.4	95.6	396.1								
			Road	1165	98	25.0	421.2	0.600	1	0.50	489.07	86.1%	67.90	1.7	OK
Line 4A	4A-2	4A-1 Outlet	Lots	0	94.4	0.0	916.6								
			Road	0	98	0.0	916.6	0.825	1	0.50	1126.42	81.4%	209.78	2.1	OK

Line 5A	5A-5	5A-4	Lots	1075	94.4	22.3	22.3								
			Road	0	98	0.0	22.3	0.225	1	1.40	62.06	36.0%	39.73	1.6	OK
Line 5A	5A-4	5A-3	Lots	480	94.4	10.0	32.3								
			Road	344	98	7.4	39.7	0.300	1	0.30	61.27	64.8%	21.59	0.9	OK
Line 5A	5A-3A	5A-3	Lots	783	94.4	16.3	16.3								
			Road	0	98	0.0	16.3	0.225	1	0.30	28.70	56.7%	12.44	0.7	OK
Line 5A	5A-3	5A-2	Lots	606	94.4	12.6	52.3								
			Road	360	98	7.7	60.0	0.300	1	0.30	61.27	98.0%	1.25	0.9	OK
Line 5A	5A-2	5A-1 Outlet	Lots	0	94.4	0.0	76.3								
			Road	0	98	0.0	76.3	0.375	1	0.50	142.35	53.6%	66.08	1.3	OK

Line 5B	5B-5C	5B-5	Lots	3893	94.4	80.8	80.8								
			Road	1962	98	42.2	123.0	0.375	1	0.50	142.35	86.4%	19.34	1.3	OK
Line 5B	5B-5B	5B-5A	Lots	3436	94.4	71.3	71.3								
			Road	1494	98	32.1	103.4	0.375	1	0.50	142.35	72.7%	38.90	1.3	OK
Line 5B	5B-5A	5B-5	Lots	2986	94.4	62.0	165.5								
			Road	864	98	18.6	184.0	0.450	1	0.50	229.87	80.1%	45.84	1.4	OK
Line 5B	5B-5	5B-4	Lots	0	94.4	0.0	184.0								
			Road	1016	98	21.8	205.9	0.450	1	0.50	229.87	89.6%	24.01	1.4	OK

Stage 5 -
Wetland E

Line 5B	5B-4B	5B-4A	Lots	3211	94.4	66.7	66.7								
			Road	1818	98	39.1	105.8	0.375	1	0.50	142.35	74.3%	36.60	1.3	OK
Line 5B	5B-4A	5B-4	Lots	3020	94.4	62.7	168.5								
			Road	1081	98	23.2	191.7	0.450	1	0.50	229.87	83.4%	38.16	1.4	OK
Line 5B	5B-4	5B-3	Lots	0	94.4	0.0	397.6								
			Road	0	98	0.0	397.6	0.600	1	0.50	489.07	81.3%	91.51	1.7	OK
Line 5B	5B-3	5B-2	Lots	0	94.4	0.0	397.6								
			Road	0	98	0.0	397.6	0.600	1	0.50	489.07	81.3%	91.51	1.7	OK
Line 5B	5B-2	5B-1 Outlet	Lots	878	94.4	18.2	415.8								
			JOAL	233	98	5.0	420.8	0.600	1	0.50	489.07	86.0%	68.26	1.7	OK
Line 5C	5C-8	5C-7	Lots	3923	94.4	81.5	81.5								
			Road	1127	98	24.2	105.7	0.375	1	0.50	142.35	74.2%	36.66	1.3	OK
Line 5C	5C-7	5C-6	Lots	0	94.4	0.0	105.7								
			Road	3629	98	78.0	183.7	0.450	1	0.50	229.87	79.9%	46.18	1.4	OK
Line 5C	5C-6	5C-5	Lots	2391	94.4	49.6	233.3								
			JOAL	274	98	5.9	239.2	0.525	1	0.50	344.54	69.4%	105.33	1.6	OK
Line 5C	5C-4A	5C-5	Lots	4640	94.4	96.4	96.4								
			Road	1818	98	39.1	135.4	0.375	1	0.50	142.35	95.1%	6.92	1.3	OK
Line 5C	5C-5	5C-4	Lots	0	94.4	0.0	374.6								
			Road	291	98	6.3	380.9	0.600	1	0.50	489.07	77.9%	108.17	1.7	OK
Line 5C	5C-4	5C-3	Lots	1001	94.4	20.8	401.7								
			JOAL	724	98	15.6	417.2	0.600	1	0.50	489.07	85.3%	71.82	1.7	OK
Line 5C	5C-3A	5C-3	Lots	638	94.4	13.2	13.2								
			JOAL	0	98	0.0	13.2	0.225	1	0.50	37.06	35.7%	23.82	0.9	OK
Line 5C	5C-3	5C-2	Lots	545	94.4	11.3	441.8								
			JOAL	579	98	12.5	454.3	0.600	1	0.50	489.07	92.9%	34.81	1.7	OK
Line 5C	5C-2	5C-1 Outlet	Lots	0	94.4	0.0	454.3								
			JOAL	0	98	0.0	454.3	0.600	1	0.50	489.07	92.9%	34.81	1.7	OK

To be read in conjunction with 298001 - C415 - SW Catchment Plan

 Maven Waikato Ltd		Job Number 298001	Sheet 1	Rev B												
Job Title Calc Title	SL1 - R1 - WHOLE WW Demand Calc	Author MKS	Date 7/07/2026	Checked DJM												
As per Waikato Local Authority RITS standards Domestic Average Daily Flow (Water Consumption)= 200 l/person/day Infiltration Allowance= 0 l/Ha/day Surface Water Ingress= 0 l/Ha/day																
No. of residential dwellings = 937 Area of commercial facilities zone = 0.1 ha Catchment area = 33.80 Ha Total Population 2816 Wastewater Peaking factor as per 5.2.4.2 6.7 Using a population value person (max development scenario) Average Daily Flow (ADF)= 563.10 m³/day Peak Daily Flow (PDF)= 43.67 L/sec Peak Wet Weather Flow (PWWF)= 43.67 L/sec																
Pipe Ks (uPVC) = 0.60 <table border="1"> <thead> <tr> <th>PWW Flow l/s</th> <th>Pipe dia m</th> <th>Gradient %</th> <th>Capacity l/s</th> <th>Velocity m/s</th> <th>Check OK</th> </tr> </thead> <tbody> <tr> <td>43.67</td> <td>0.300</td> <td>0.33</td> <td>64.27</td> <td>0.91</td> <td>OK</td> </tr> </tbody> </table>					PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK	43.67	0.300	0.33	64.27	0.91	OK
PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK											
43.67	0.300	0.33	64.27	0.91	OK											

 Maven Waikato Ltd		Job Number 298001	Sheet 2	Rev B												
Job Title SL1 - R1 - Stage 1 Calc Title WW Demand Calc	Author MKS	Date 7/07/2026	Checked DJM													
As per Waikato Local Authority RITS standards Domestic Average Daily Flow (Water Consumption)= 200 l/person/day Infiltration Allowance= 0 l/Ha/day Surface Water Ingress= 0 l/Ha/day																
No. of residential dwellings = 321 Catchment area = 11.00 Ha Total Population 963 Wastewater Peaking factor as per 5.2.4.2 6.7 Using a population value person (max development scenario) Average Daily Flow (ADF)= 192.60 m³/day Peak Daily Flow (PDF)= 14.94 L/sec Peak Wet Weather Flow (PWWF)= 14.94 L/sec																
Pipe Ks (uPVC) = 0.60 <table border="1"> <thead> <tr> <th>PWW Flow l/s</th> <th>Pipe dia m</th> <th>Gradient %</th> <th>Capacity l/s</th> <th>Velocity m/s</th> <th>Check OK</th> </tr> </thead> <tbody> <tr> <td>14.935</td> <td>0.225</td> <td>0.55</td> <td>38.88</td> <td>0.98</td> <td>OK</td> </tr> </tbody> </table>					PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK	14.935	0.225	0.55	38.88	0.98	OK
PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK											
14.935	0.225	0.55	38.88	0.98	OK											

 Maven Waikato Ltd		Job Number 298001	Sheet 3	Rev B												
Job Title Calc Title	SL1 - R1 - Stage 2 WW Demand Calc	Author MKS	Date 7/07/2026	Checked DJM												
As per Waikato Local Authority RITS standards Domestic Average Daily Flow (Water Consumption)= 200 l/person/day Infiltration Allowance= 0 l/Ha/day Surface Water Ingress= 0 l/Ha/day																
No. of residential dwellings = 222 Area of commercial facilities zone = 0.1 ha Catchment area = 8.43 Ha Total Population 671 Wastewater Peaking factor as per 5.2.4.2 6.7																
Using a population value person (max development scenario) Average Daily Flow (ADF)= 134.10 m³/day Peak Daily Flow (PDF)= 10.40 L/sec Peak Wet Weather Flow (PWWF)= 10.40 L/sec																
Pipe Ks (uPVC) = 0.60 <table border="1"> <thead> <tr> <th>PWW Flow l/s</th> <th>Pipe dia m</th> <th>Gradient %</th> <th>Capacity l/s</th> <th>Velocity m/s</th> <th>Check OK</th> </tr> </thead> <tbody> <tr> <td>10.40</td> <td>0.150</td> <td>0.55</td> <td>13.31</td> <td>0.75</td> <td>OK</td> </tr> </tbody> </table>					PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK	10.40	0.150	0.55	13.31	0.75	OK
PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK											
10.40	0.150	0.55	13.31	0.75	OK											

 Maven Waikato Ltd		Job Number 298001	Sheet 4	Rev B												
Job Title Calc Title	SL1 - R1 - Stage 3 WW Demand Calc	Author MKS	Date 7/07/2026	Checked DJM												
As per Waikato Local Authority RITS standards Domestic Average Daily Flow (Water Consumption)= 200 l/person/day Infiltration Allowance= 0 l/Ha/day Surface Water Ingress= 0 l/Ha/day																
No. of residential dwellings = 186 Catchment area = 6.73 Ha Total Population 558 Wastewater Peaking factor as per 5.2.4.2 6.7 Using a population value person (max development scenario) Average Daily Flow (ADF)= 111.60 m³/day Peak Daily Flow (PDF)= 8.65 L/sec Peak Wet Weather Flow (PWWF)= 8.65 L/sec																
Pipe Ks (uPVC) = 0.60 <table border="1"> <thead> <tr> <th>PWW Flow l/s</th> <th>Pipe dia m</th> <th>Gradient %</th> <th>Capacity l/s</th> <th>Velocity m/s</th> <th>Check OK</th> </tr> </thead> <tbody> <tr> <td>8.65</td> <td>0.150</td> <td>0.55</td> <td>13.31</td> <td>0.75</td> <td>OK</td> </tr> </tbody> </table>					PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK	8.65	0.150	0.55	13.31	0.75	OK
PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK											
8.65	0.150	0.55	13.31	0.75	OK											

 Maven Waikato Ltd		Job Number 298001	Sheet 5	Rev B												
Job Title Calc Title	SL1 - R1 - Stage 4 WW Demand Calc	Author MKS	Date 7/07/2026	Checked DJM												
As per Waikato Local Authority RITS standards Domestic Average Daily Flow (Water Consumption)= 200 l/person/day Infiltration Allowance= 0 l/Ha/day Surface Water Ingress= 0 l/Ha/day																
No. of residential dwellings = 97 Catchment area = 3.20 Ha Total Population 291 Wastewater Peaking factor as per 5.2.4.2 6.7																
Using a population value person (max development scenario) Average Daily Flow (ADF)= 58.20 m ³ /day Peak Daily Flow (PDF)= 4.51 L/sec Peak Wet Weather Flow (PWWF)= 4.51 L/sec																
Pipe Ks (uPVC) = 0.60 <table border="1"> <thead> <tr> <th>PWW Flow l/s</th> <th>Pipe dia m</th> <th>Gradient %</th> <th>Capacity l/s</th> <th>Velocity m/s</th> <th>Check OK</th> </tr> </thead> <tbody> <tr> <td>4.51</td> <td>0.150</td> <td>0.55</td> <td>13.31</td> <td>0.75</td> <td>OK</td> </tr> </tbody> </table>					PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK	4.51	0.150	0.55	13.31	0.75	OK
PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK											
4.51	0.150	0.55	13.31	0.75	OK											

 Maven Waikato Ltd		Job Number 298001	Sheet 6	Rev B												
Job Title Calc Title	SL1 - R1 - Stage 5 WW Demand Calc	Author MKS	Date 7/07/2026	Checked DJM												
As per Waikato Local Authority RITS standards Domestic Average Daily Flow (Water Consumption)= 200 l/person/day Infiltration Allowance= 0 l/Ha/day Surface Water Ingress= 0 l/Ha/day																
No. of residential dwellings = 111 Catchment area = 4.42 Ha Total Population 333 Wastewater Peaking factor as per 5.2.4.2 6.7 Using a population value person (max development scenario) Average Daily Flow (ADF)= 66.60 m³/day Peak Daily Flow (PDF)= 5.16 L/sec Peak Wet Weather Flow (PWWF)= 5.16 L/sec																
Pipe Ks (uPVC) = 0.60 <table border="1"> <thead> <tr> <th>PWW Flow l/s</th> <th>Pipe dia m</th> <th>Gradient %</th> <th>Capacity l/s</th> <th>Velocity m/s</th> <th>Check OK</th> </tr> </thead> <tbody> <tr> <td>5.165</td> <td>0.150</td> <td>0.55</td> <td>13.31</td> <td>0.75</td> <td>OK</td> </tr> </tbody> </table>					PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK	5.165	0.150	0.55	13.31	0.75	OK
PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK											
5.165	0.150	0.55	13.31	0.75	OK											

 Maven Waikato Ltd		Job Number 298001	Sheet 1	Rev A
Job Title SL1-R1	Author MKS	Date 8/07/2026	Checked DJM	
Calc Title Stage 2 - Water Demand				

Water Catchment

As per RITS Standard 6.2.3

3 people per dwelling

260 l/person/day

Demand

Demand Rates

Average Demand = 260 litres/person/day

Peak Demand (5x) = 1300 litres/person/day

Population	Dwellings	People	Occupancy
Proposed Dwellings	222	3	666
Commercial Unit (45ppl per Ha)	1	45	45
Total			711

Demand	Persons	Rate l/p/day	Flow l/s
AD Water	711	260	2.14
PD Water	711	1300	10.70

Peak Demand	Persons	Rate l/p/day	Flow l/s
PD Water	711	1300	10.70

Job Title	SL1-R1
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Author

Date _____

Checked

Calc Title	Stage 5 - Water Demand
-------------------	-------------------------------

MKS

8/07/2026

DJM

Water Catchment

As per RITS Standard 6.2.3

Demand

3 people per dwelling
260 l/person/day

Demand Rates

Average Demand =
Peak Demand (5x) =

260 litres/person/day
1300 litres/person/day

Population

Proposed Dwellings
Commercial Unit (30ppl per Ha)
Total

Dwellings	People	Occupancy
111	3	333
0	0	0
		333

Demand

AD Water
PD Water

Persons	Rate l/p/day	Flow l/s
333	260	1.00
333	1300	5.01

Peak Demand

PD Water

Persons	Rate l/p/day	Flow l/s
333	1300	5.01

Appendix C – BBO Integrated Transportation Assessment

SL1 Industrial and Residential

Integrated Transport Assessment

04 September 2026





Document control

Project identification	
Client	SL1 Consortium
Client representative	Robert Dol, Project Director (Colliers)
BBO details	Bloxam Burnett & Olliver Ltd (BBO) Level 5, Building E, Union Square, 192 Anglesea St, Hamilton
BBO representative	Cameron Inder, Transportation Engineering Manager
BBO rep. contact details	██████████ ██████████
Job number/s	149240 / 149340
Job name	SL1 Industrial and Residential
Contract numbers	N/A
Report name and number	Integrated Transport Assessment
Date / period ending	04 September 2026
File path	C:\12dS\data\10.7.120.14\149240 - SL1 South Residential_5619\10 Traffic\Project Template\02 Reports and memos\SL1 Industrial and Residential - Final ITA V1.docx

Report status			
Status	Name	Signature	Date
Report prepared by	Siva Balachandran		04/09/2026
Checked by	Cameron Inder		04/09/2026
Approved for issue	Cameron Inder		04/09/2026

Document history			
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V2			
V3			





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1. Statement of Qualifications and Experience

1.1 Sivakumaran Balachandran

My name is Sivakumaran Balachandran. I am a Senior Transportation Engineer at Bloxam Burnett & Olliver (“BBO”), a firm of consulting engineers, planners and surveyors based in Hamilton. I have been employed by BBO since 2017.

I hold a Bachelor of Engineering (Honours) degree in Civil Engineering from the Nanyang Technological University, Singapore (2014). I am a Chartered Professional Engineer (CPEng), a Chartered Member of Engineering New Zealand (CMEngNZ), and a member of the Engineering NZ Transportation Group.

I have over eleven years’ experience in transportation and traffic engineering, including eight years in New Zealand and three years in Singapore. My experience includes transportation planning, integrated transport assessments, traffic modelling, road safety engineering, subdivision design, active mode infrastructure, intersection design, and the assessment of transport effects for resource consent applications, plan changes and structure plans.

My experience relevant to this Project is as follows:

- I was the design lead for the Cambridge Pathways project for Waipā District Council, involving active mode infrastructure connecting the Te Awa River Ride path, Hamilton Road Cycleway, Victoria high-level bridge, schools, the Cambridge town centre and Leamington. My role includes design of protected cycling and walking facilities, raised safety platforms / intersections, contract documentation, stakeholder consultation, and catchment analysis to inform facility provision.
- I am the transportation assessment lead for the proposed Calcutta Farms Ltd industrial rezoning at Matamata, including assessment of effects on the local and state highway networks, consultation with Matamata-Piako District Council and NZ Transport Agency Waka Kotahi, intersection modelling, and concept design of SH24 roundabout upgrades.
- I was the traffic design engineer for the Ruakura Road urban upgrade for Hamilton City Council, including intersection review, complex intersection modelling, preliminary and detailed design inputs for two signalised intersections, full walking and cycling crossing provision, and preparation of signal design drawings.
- I was the traffic design engineer for the Peacocke Strategic Transport and Whatukooruru Drive projects, including detailed signal design and intended operations for multiple signalised intersections. The designs supported mode-neutral outcomes through fully separated walking and cycling crossings and bus priority.
- I authored and led the Integrated Transport Assessment for the Te Rapa Racecourse Medium Density Plan Change, including intersection modelling, preliminary intersection upgrade and signalised mid-block crossing designs, and presentation of expert transportation evidence at the Commissioner-led hearing in August 2023.
- I have led and been a member of Safe System Audit and Road Safety Audit teams for a range of projects, including Kihikihi Township, Te Kowhai Road and the Lockerbie residential subdivision.

I confirm that I have read and abided by the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023 and referred to in the Fast-track Approvals Act 2024: Panel Convenors’ Practice and Procedure Guidance. This Integrated Transport Assessment has been prepared in compliance with that Code.



1.2 Cameron Beswick Inder

My name is Cameron Inder. I am a Principal Traffic and Transportation Engineer at BBO, a company of consulting engineers, project managers, planners and surveyors in Hamilton and Tauranga.

I hold a Bachelor of Engineering (Hons) from the University of Auckland and have 27 years' experience in traffic and transportation engineering. I am a Chartered Professional Engineer (CPEng) with Engineering New Zealand. I have extensive experience in transportation planning, modelling, and the design of urban and rural transport networks, with particular experience in large-scale infrastructure projects, intersection design, and the assessment of transport effects.

My experience relevant to this Project is as follows:

- I led all traffic and transportation assessments for Takitimu North Link Stage 2, authoring the Integrated Transport Assessment and numerous supporting assessments, and contributing to concept design development for the future four-lane expressway, interchanges, and tie-ins to the existing SH2 at both termini, including the link to Takitimu North Link Stage 1.
- I led transportation assessments for the rezoning of 176 ha at Ohinewai (Comfort Group), supporting a manufacturing / industrial business park and 1,100 residential units. Provided expert witness evidence, participated in joint witness conferencing and stakeholder consultation, and presented evidence at the Commissioner hearing (2020). Continuing to lead transport planning and design as the development progresses.
- I led traffic and transport assessments for the proposed rezoning of 130 ha north of Hamilton Airport. Responsibilities included ITA authorship, supplementary assessments, and concept design of new roundabout access at SH3 / Raynes Road and SH21. Prepared and presented expert evidence for the public hearing. Integrated multi-modal planning, including a strategic bi-directional cycle connection to the Peacocke growth area.
- I project managed the design and delivery of two new rural intersections on SH34 and 400 m of new access road for an industrial business park funded through the regional Infrastructure Fund in 2022. I led and co-ordinated all design inputs from concept through to detailed design, wrote the contract documentation, led the construction procurement phase, and provided design support during construction. I also managed all stakeholder engagement with NZ Transport Agency Waka Kotahi, NOC, Kawerau District Council, and safety auditors.
- Updated and extended the Te Rapa North VISSIM micro-simulation model for Hamilton City Council to assess network effects of a proposed Pak'nSave development. This included commissioning and analysing OD surveys, model calibration (2018 base), and future modelling (2031) with and without development scenarios.
- I led the traffic, walking, and cycling design for the Papamoa Eastern Interchange, including three signalised intersections. Delivered modelling and concept/preliminary design supporting a mode-neutral network, with strong emphasis on safe, fully separated walking and cycling infrastructure.
- I was the lead traffic design engineer for complex intersection modelling and design inputs for the Wairere Drive / Cambridge Road network and diamond interchange in Hamilton. The design integrated raised safety platforms (in collaboration with NZ Transport Agency Waka Kotahi trials), full pedestrian / cycle crossings, and future bus priority, with connections to key cycle networks.
- I reviewed transportation assessments and provided expert advice for a Board of Inquiry hearing relating to a proposed prison expansion, including consultation with Waipā District Council and NZ Transport Agency Waka Kotahi.



- I authored the Integrated Transport Assessment report for a private plan change for Hobbiton Movie Set Tours, assessing the transport effects of increasing permitted visitor numbers from 300,000 to 650,000 annually. I identified the required network and travel demand management responses to accommodate the significant visitor numbers, and I presented expert evidence for the applicant at the Commissioner-led hearing.
- I have extensive experience preparing Integrated Transport Assessments for resource consent applications and private plan changes, including regular attendance at hearings and provision of expert transportation evidence.

I confirm that I have read and abided by the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023 and referred to in the Fast-track Approvals Act 2024: Panel Convenors' Practice and Procedure Guidance. This Integrated Transport Assessment has been prepared in compliance with that Code.



2. Executive Summary

This Integrated Transport Assessment (“ITA”) supports the Fast-track substantive consent application for the SL1 Project, which comprises the proposed Industrial Development and Residential Development on the southern edge of Hamilton. The assessment has been prepared with regard to Hamilton City Council and NZ Transport Agency Waka Kotahi requirements and assesses the transport effects of the Project in the context of the existing and planned transport network.

The Project comprises two related development areas:

- SL1 Industrial, comprising approximately 60 hectares (“ha”), of which approximately 40 ha are expected to be developable for industrial activities, with the balance associated with the Hamilton Southern Links (“HSL”) designation, proposed wetland areas and an existing developed lot.
- SL1 Residential, comprising approximately 46 ha, with an anticipated yield of approximately 938 dwellings, together with a small neighbourhood centre and local open space.

The assessment recognises that development at this scale cannot rely on unconstrained growth in private vehicle travel. Accordingly, the transport strategy incorporates a combination of road network improvements, public transport integration, walking and cycling infrastructure, and staged development controls intended to support a more balanced transport network over time.

HSL forms an important part of the future strategic transport context, but whilst a Road of National Significance its timing remains subject to future funding and delivery decisions. The ITA therefore considers both interim and future network scenarios and identifies staging controls and mitigation measures that respond to different levels of network delivery.

The ITA assesses the existing transport environment, including the road network, public transport services, walking and cycling facilities, traffic volumes and crash history. It also assesses site access arrangements, trip generation, strategic transport modelling using the Waikato Regional Transport Model (“WRTM”), and intersection performance using SIDRA Intersection software.

The key findings are:

- The proposed transport network incorporates walking, cycling and public transport infrastructure that supports the mode share assumptions adopted in the assessment and provides connectivity between the Developments and the wider transport network.
- HSL remains an important long-term component of the future transport network and would improve wider network performance and resilience once delivered. However, the transport strategy adopted for the Project does not rely on HSL being delivered within a specific timeframe, with interim access arrangements, transport infrastructure upgrades and staging measures identified to manage transport effects under interim network conditions.
- For the Industrial Development, Interim Option B has been identified as the preferred interim access strategy. The assessment demonstrates that the full assessed Industrial Development can proceed independently of HSL delivery, while maintaining flexibility to integrate with the ultimate HSL-based transport network should it be delivered in the future.
- For the Residential Development, the Ohaupo Road / Saxbys Road / Tomin Road roundabout represents the principal transport constraint within the assessed network. Subject to implementation of the transport infrastructure upgrades identified in this ITA, the assessment indicates that Residential Development can be accommodated with acceptable transport effects up to approximately 543 dwellings under a network scenario that does not rely on HSL delivery.



- Development beyond approximately 543 dwellings should be supported by a future transport reassessment to confirm whether the assumptions underpinning this ITA remain representative of the receiving transport environment at that time and to identify whether any additional mitigation measures or staging controls are required.

Overall, the ITA concludes that the SL1 Industrial and Residential Developments can proceed without unacceptable transport effects, subject to implementation of the transport infrastructure upgrades, staging framework and reassessment provisions identified in this report.



3. Introduction

The Project relates to land at the south-western edge of Hamilton and seeks to enable industrial and residential development, together with the associated transport infrastructure required to support that growth.

The Project has two distinct components, an Industrial Development area and a Residential Development area, both bordered in red in Figure 1. The Project will enable:

- Approximately 46 hectares (“ha”) of land with residential activities, resulting in an anticipated yield of 938 residential units, a small local neighbourhood centre and supporting infrastructure; and
- Approximately 60 ha of land with industrial activities and supporting infrastructure.

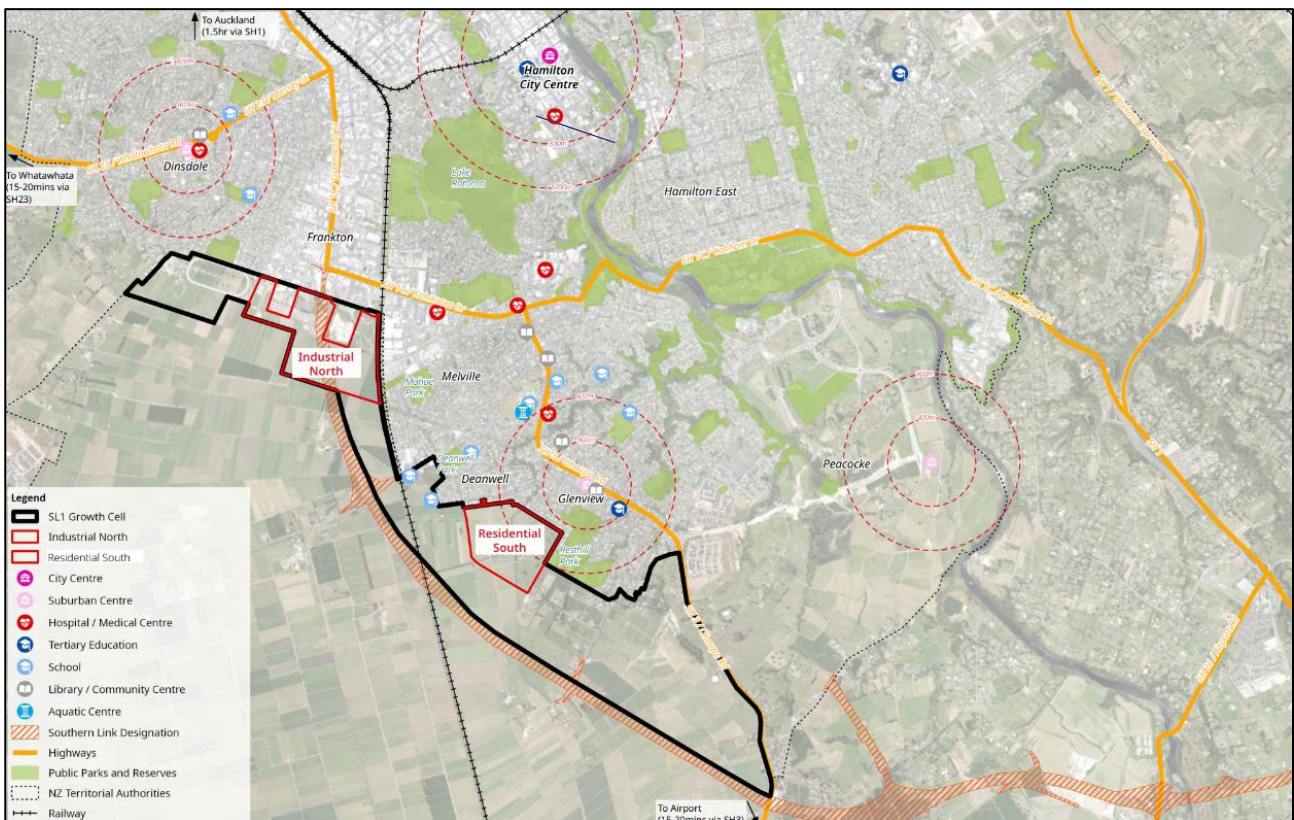


Figure 1: SL1 Industrial and Residential Sites

The Project will provide additional housing and industrial land within the southern Hamilton environs over the short, medium and long term due to the proposed Project size. It gives effect to a large-scale urban development growth cell recognised in Future Proof (“FP”) / Future Development Strategy (“FDS”) spatial planning documents.

The Project will integrate with the existing Hamilton urban fringe, facilitate improved connectivity and support the implementation of Hamilton Southern Links (“HSL”), which is designated and identified in the Government Policy Statement on land transport (“GPS 2024”) as a Road of National Significance (“RoNS”), to “unlock housing”.

The Project area is in the Waipā District, but forms part of the future southern Hamilton City growth area and will become part of Hamilton City in time. Neither of the development areas require access from existing Waipā District Council roads.



Accordingly, the Integrated Transport Assessment (“ITA”) primarily refers to the transport provisions of the Hamilton City Operative District Plan (“ODP”), planned transport infrastructure and the surrounding Hamilton transport network. This approach is appropriate given the direct urban integration of the Project, its intended future transport connections and the strategic planning framework applying to the area.

This ITA provides an overview of the traffic and transportation investigations undertaken to support the Project. It addresses:

- The existing transport environment in the vicinity of the sites, including the surrounding road network, public transport provision, walking and cycling facilities, traffic volumes and crash history.
- The nature and scale of the Project.
- The level of travel demand expected to be generated by the Project and its distribution on the surrounding network.
- The effects of development traffic on the adjacent road network, including localised intersection analysis at the sites’ interfaces with Ohaupo Road (SH3) and Greenwood Street (SH1C), to assess future roading infrastructure performance with development traffic added.
- The transport mitigation and infrastructure required to support the Project, including provision for active modes and public transport.

This ITA does not assume unconstrained growth in private vehicle travel. It recognises that public transport, walking and cycling will need to accommodate an increasing share of future travel demand as development proceeds. This will be supported through subdivision design, the provision of connected walking and cycling infrastructure, integration with the future public transport network, staged transport infrastructure delivery, and wider strategic transport investment.

4. Site Location

The Project area adjoins Hamilton City Council’s (“HCC”) south-western boundary. Located approximately 3.5 km southwest of Hamilton City Centre, the wider SL1 urban development growth cell site stretches from south Frankton to the southwestern edge of the Peacocke Structure Plan area. The Industrial and Residential sites are partially bounded by State Highway 3 (“SH3”) to the southeast, the North Island Main Trunk Rail (“NIMTR”) to the northeast and the HSL designation to the west.

The sites are currently zoned Rural under the Waipā District Plan and comprises a mix of rural, rural-residential and peri-urban land uses.

The Industrial Development area is located adjacent to the Frankton industrial area and is well positioned to connect to Greenwood Street (SH1C), Kahikatea Drive and the wider strategic freight network.

The Residential Development area adjoins the existing urban neighbourhoods of Glenview, Resthill and Deanwell and is connected to the surrounding network primarily via Ohaupo Road, Collins Road, Saxbys Road, MacMurdo Avenue and surrounding local streets. Hamilton Airport and Titanium Park industrial business precinct are approximately 4.5 km to the south-east and Waikato Hospital is approximately 3 km to the north.

The location of the SL1 Development areas is relevant to the transport assessment because it places the Project at the interface between the existing urban area and future growth areas, with access to established strategic transport corridors, public transport services and planned network upgrades to support future growth. The transport implications of that setting are outlined in the following section.



5. Existing Transportation Environment

5.1 Existing Road Network

The existing network of roads surrounding the Project are presented in Figure 2 and discussed in the following sub-sections.

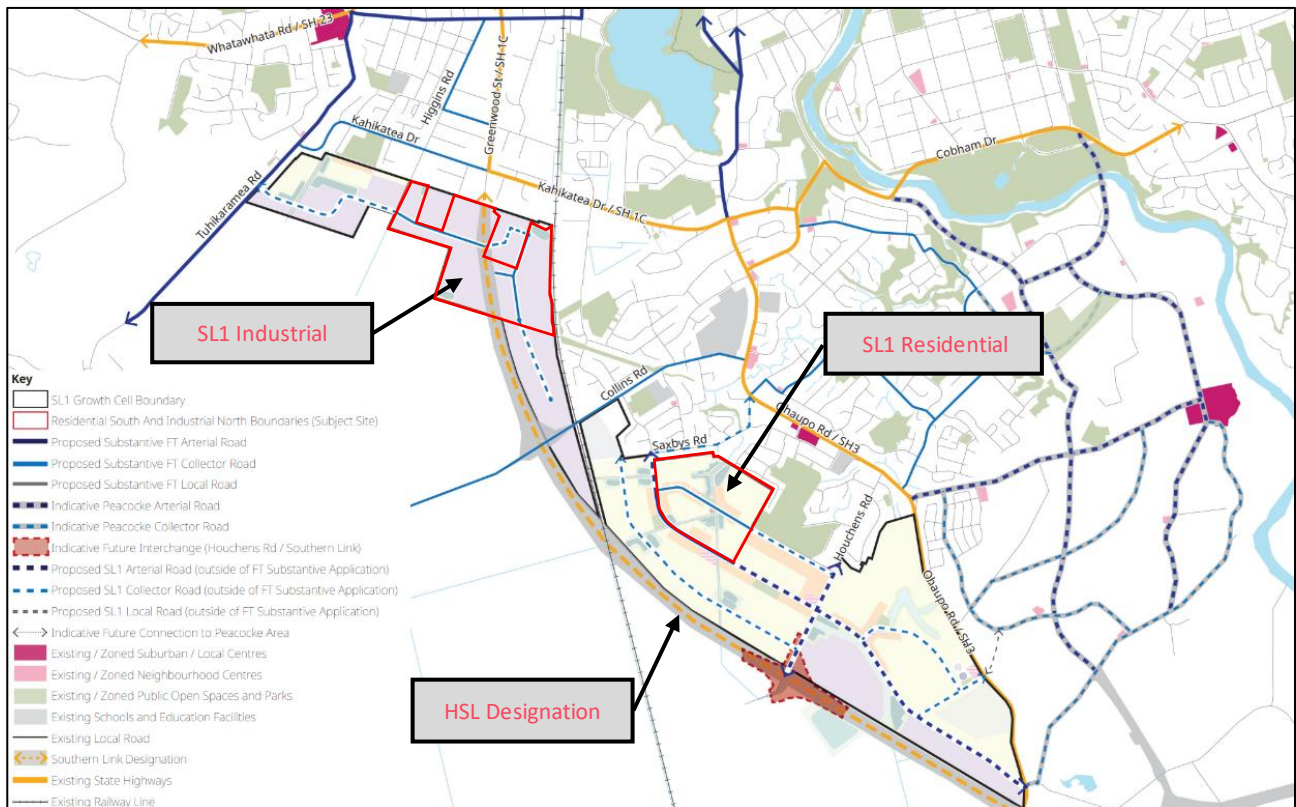


Figure 2: Adjoining Road Network (Existing and Planned / Proposed)

5.1.1 Industrial Development

The transport network adjacent to the Industrial Development area comprises local roads such as Higgins Road and Wickham Street. These roads connect to the primary network of Kahikatea Drive Extension (collector road), Kahikatea Drive and Greenwood Street (SH1C).

Table No: 1

Adjoining Road Network – Industrial Development				
Road	ONF ¹	Posted Speed Limit ²	Average Daily Traffic ³ ("ADT")	Heavy Commercial Vehicle ⁴ ("HCV") Proportion
Greenwood St (SH1C)	Transit Corridor	80 km/h	23,860 vpd	5.4%
Kahikatea Dr	Urban Connector	60 km/h	27,200 vpd	5.4%

¹ Based on NZTA MegaMaps

² Based on NZTA MegaMaps

³ Based on MobileRoad website

⁴ Based on MobileRoad website



Kahikatea Dr Extn	Urban Connector	50 km/h	5,260 vpd	15%
Higgins Rd (north of Kahikatea Dr Extn)	Urban Connector	50 km/h	4,511 vpd	14%
Wickham St	Local Street	50 km/h	1,800 vpd	5%

A known network capacity constraint in this locality is the Greenwood Street (SH1C) / Kahikatea Drive intersection. The intersection is a give-way controlled T-intersection that is proposed by NZ Transport Agency Waka Kotahi ("NZTA") to be replaced with a large urban three-arm roundabout as part of the HSL project. This is discussed further in Section 6.1.

5.1.2 Residential Development

The Residential Development area has connections to the existing transport network comprising primarily of local roads servicing the existing residential neighbourhoods of Deanwell and Glenview. These local roads connect to Collins Road (a collector road in the ODP) and Ohaupo Road (major arterial road).

Table No: 2

Adjoining Road Network – Residential Development				
Road	ONF ⁵	Posted Speed Limit ⁶	ADT ⁷	HCV ⁸ Proportion
Ohaupo Rd (north of Collins Rd)	Urban Connector / Activity St	60 km/h	30,996 vpd	6.6%
Ohaupo Rd (between Saxbys Rd and Lambert Ct)	Urban Connector	60 km/h	15,300 vpd	10.8%
Ohaupo Rd (between Resthill Cr and Houchens Rd)	Urban Connector	60 km/h	15,300 vpd	10.8%
Collins Rd (near SH3)	Urban Connector	50 km/h Variable speed limit = 30 km/h	6,786 vpd	3%
Saxbys Rd	Local Street	50 km/h	2,717 vpd	5%
Deanwell Ave	Local Street	50 km/h Variable speed limit = 30 km/h	2,050 vpd	5%
MacDonald Rd	Local Street	50 km/h	2,460 vpd	5%
MacMurdo Ave	Local Street	50 km/h	261 vpd	5%
Lambert Ct	Local Street	50 km/h	1,681 vpd	5%
Resthill Cres	Local Street	50 km/h	3,107 vpd	5%
Houchens Rd	Local Street	50 km/h	2,091 vpd	5%

Ohaupo Road is a major arterial corridor and designated SH3. It performs an important movement function for both local and inter-regional travel. It provides a primary connection between Hamilton and the wider south Waikato region, including Hamilton Airport, Te Awamutu, Otorohanga and, ultimately, New Plymouth. The proximity of these activity nodes to Hamilton means Ohaupo Road carries substantial commuter, business and inter-regional freight traffic in both peak periods. In the local context, Ohaupo Road also serves as a primary public transport corridor serving Glenview, Deanwell and Melville residential suburbs.

⁵ Based on NZTA MegaMaps

⁶ Based on NZTA MegaMaps

⁷ Based on MobileRoad website

⁸ Based on MobileRoad website



Ohaupo Road is a four-lane carriageway north of Saxbys Road and two-lanes south of Saxbys Road.

Existing intersections on Ohaupo Road with limited spare capacity during peak periods include Ohaupo Road / Saxbys Road / Tomin Road roundabout, Ohaupo Road / Lambert Court intersection, Ohaupo Road / Resthill Crescent intersection, and Ohaupo Road / Houchens Road intersection.

5.2 Existing Public Transport Network

5.2.1 Public Transport

The existing Hamilton public transport (“PT”) bus network is shown in Figure 3 (blue lines), while existing bus stop locations near the SL1 Development areas are identified in Figure 4.

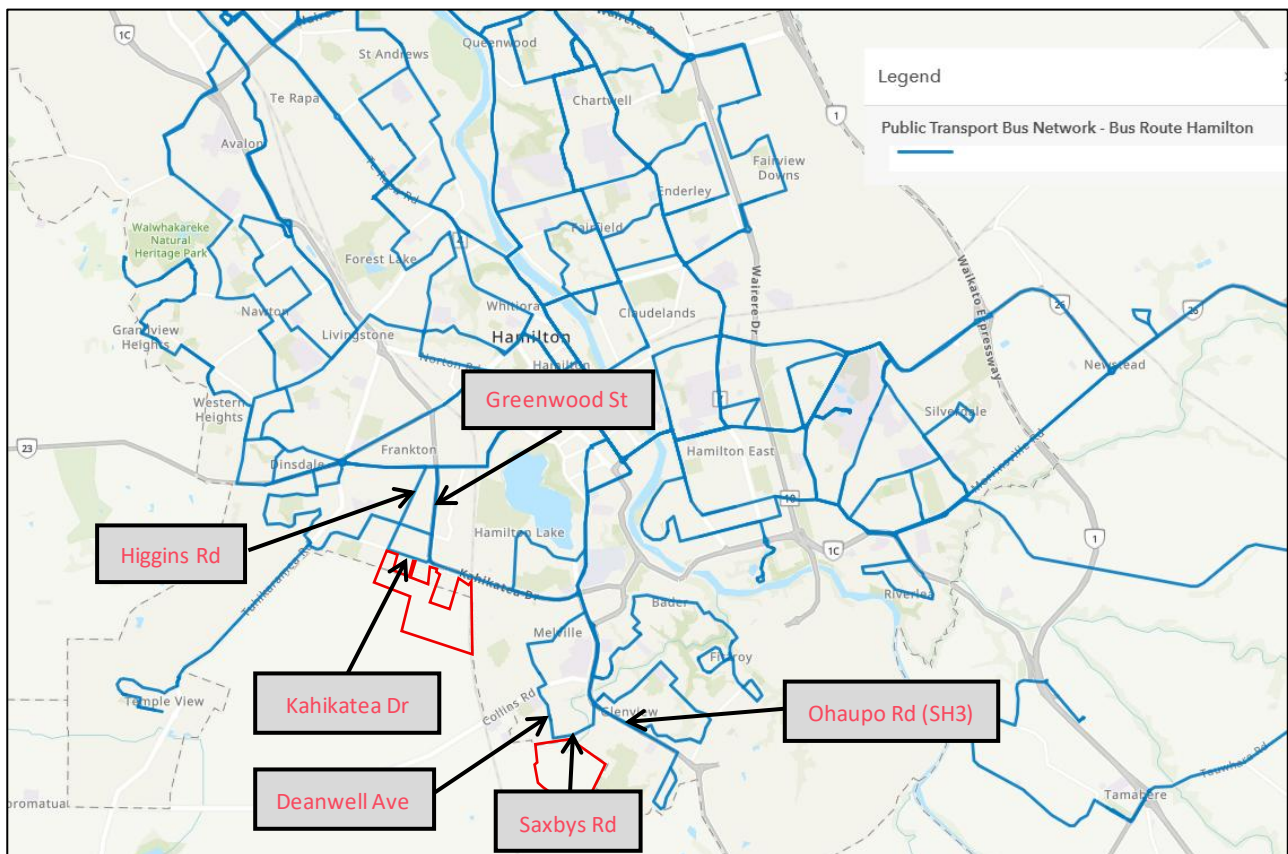


Figure 3: Existing PT Bus Network



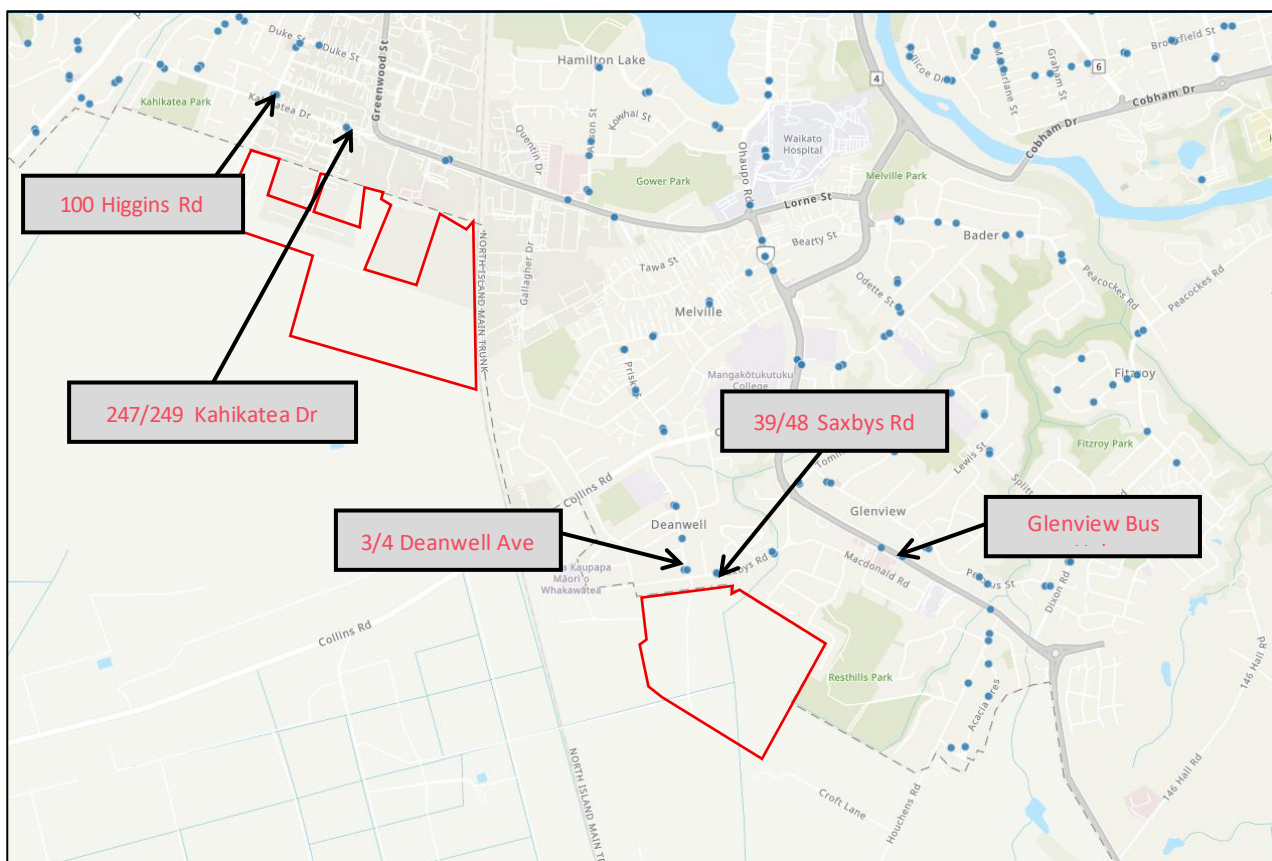


Figure 4: Existing PT Bus Stops

This demonstrates that both the Industrial Development and Residential Development areas are currently served by existing public transport services within reasonable walking distance of the sites.

5.2.2 Industrial Development

The nearest bus stops to the Industrial Development site are located at 274 / 279 Kahikatea Drive and 100 Higgins Road. These bus stops are currently served by the bus service '19 Bremworth / Temple View'. This service travels via alternative routes from the Hamilton Transport Centre, via Queens Avenue, Killarney Road and Kahikatea Drive – in both directions, seven days per week.

5.2.3 Residential Development

The nearest bus stops to the Residential Development site are located at 3 / 4 Deanwell Avenue, 39 / 48 Saxbys Road and the Glenview Bus Hub.

The bus stops at Deanwell Avenue and Saxbys Road are currently served by the Comet bus service. This is a high-frequency service⁹, which travels north-to-south through Hamilton city, approximately every 15 minutes, in both directions. South of the hospital, the Comet alternates trips in the Melville / Glenview area – stopping every 30 minutes in these areas.

The Glenview Bus Hub is currently served by the Comet, '24 Te Awamutu' and '26 Te Kūiti Connector' bus services. The '24 Te Awamutu' and '26 Te Kūiti Connector' bus services are regional buses. Route 24 operates between Hamilton Transport Centre and Kihikihi, serving key locations including Waikato Hospital, Glenview Bus Hub, Ōhaupō township, and Te Awamutu town centre, with additional weekday, term-time trips serving Hamilton Boys' High School and Southwell School. Route 26 operates on weekdays between Wintec

⁹ <https://www.busit.co.nz/hamilton-routes/comet/>



Rotokauri Campus and Te Kūiti, travelling via Hamilton Transport Centre, Glenview, Ōhaupō, Te Awamutu, Kihikihi and Ōtorohanga, and providing access to major employment, education, health and town-centre destinations along the corridor.

5.3 Existing Walking and Cycling Network

A mix of on-road, off-road and shared paths are provided in the immediate vicinity of the sites providing alternative routes and forms of transport between the proposed development areas, Dinsdale, Frankton and Hamilton Central to the north. These also provide links to key employment nodes and important destinations including Waikato Hospital, and Melville High School. Figure 5 presents the existing walking and cycling network surrounding the sites.

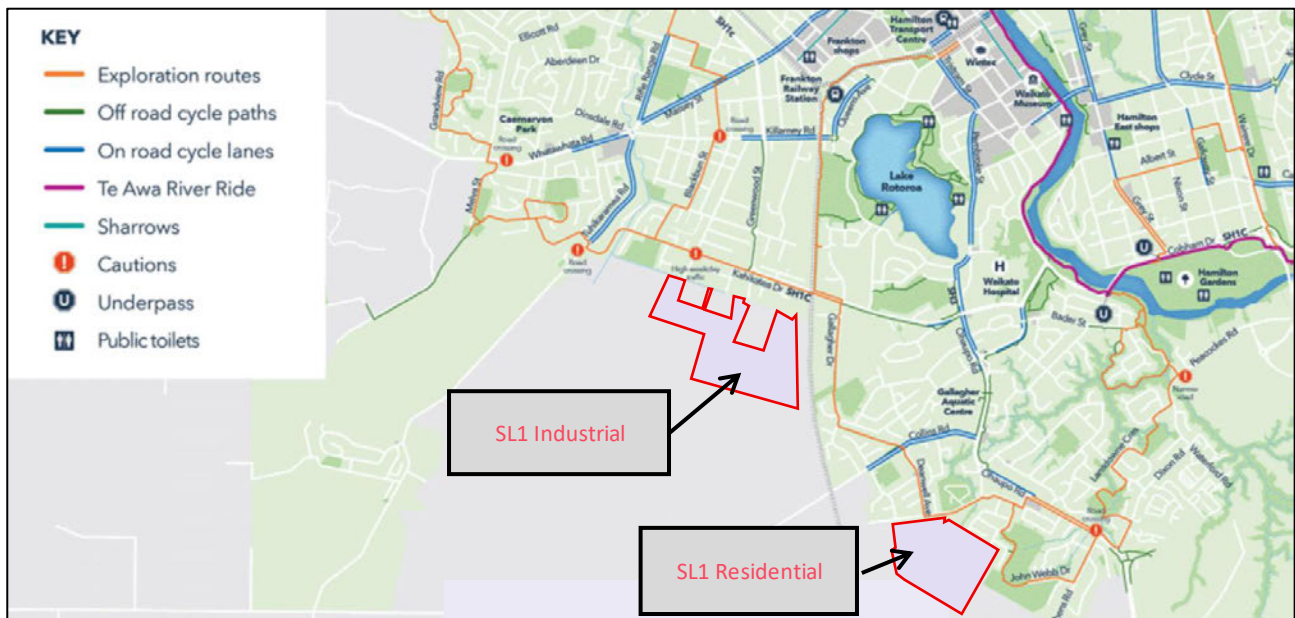
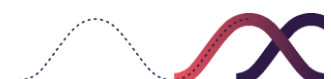


Figure 5: Existing Walking and Cycling Network

Table No: 3

Existing Walking and Cycling Provision on Adjoining Road Network	
Road	Existing Walking and Cycling Infrastructure
Greenwood St (SH1C)	3 m wide off-road walking and cycling shared path on the western side of the road - Sealed road shoulders for confident cyclists
Kahikatea Dr	3 m wide off-road walking and cycling shared path on the southern side of the road - Sealed road shoulders for confident cyclists
Kahikatea Dr Extn	1.2 m wide footpaths on both sides of the road
Higgins Rd (north of Kahikatea Dr Extn to Duke St)	2 m wide footpaths on both sides of the road
Wickham St	1.5 m wide footpath on eastern side of the road
Ohaupo Rd	3 m wide off-road walking and cycling shared path on southern/western side of Ohaupo Rd between Collins Rd and Houchens Rd. 3 m wide off-road walking and cycling shared path on eastern side of the Ohaupo Rd between Collins Rd and Saxbys Rd. - Neighbourhood greenway with sharrow markings on access road on the northern side of Ohaupo Rd between Saxbys Rd and Garden Heights Ave.



	• 3 m wide off-road walking and cycling shared path on northern side of the Ohaupo Rd between Garden Heights Ave and Houchens Rd. • 1.3 m – 1.5 m wide sealed road shoulders for confident cyclists
Collins Rd (near SH3)	• 1.5 m - 1.8 m wide on-road cycle lanes • 1.2 m wide footpath on the southern side of the road • 2.0 m wide footpath on the northern side of the road
Saxbys Rd	• 1.5 m – 1.8 m wide footpath on the northern side of the road between Deanwell Ave and MacDonald Rd
Deanwell Ave	• 1.2 m – 1.5 m wide footpaths on both sides of the road
MacDonald Rd	• 1.8 m wide footpaths on both sides of road between Saxbys Rd and Lambert Ct
MacMurdo Ave	• 1.2 m – 2 m wide footpaths on both sides of the road
Lambert Ct	• 1.8 m wide footpaths on both sides of road

5.4 Intersection Counts

Bloxam Burnett & Olliver Ltd (“BBO”) has undertaken intersection traffic counts as part of this ITA. The peak period traffic volumes are attached as Appendix D for the various intersections surveyed.

Table No: 4 summarises the surveyed data.

Table No: 4

2025 Surveyed Intersection Traffic Counts			
Road	ADT ¹⁰	Surveyed Average AM Peak Hour Two-way Volume (vph)	Surveyed Average PM Peak Hour Two-way Volume (vph)
Greenwood St (SH1C)	23,860 vpd	2,021	2,220
Kahikatea Dr	27,200 vpd	2,159	2,358
Kahikatea Dr Extn	5,260 vpd	469	571
Higgins Rd (north of Kahikatea Dr Extn)	4,511 vpd	283	342
Ohaupo Rd (north of Collins Rd)	30,996 vpd	2,210	2,663
Ohaupo Rd (between Saxbys Rd and Lambert Ct)	15,300 vpd	1,590	2,054
Ohaupo Rd (between Resthill Cr and Houchens Rd)	15,300 vpd	1,591	1,843
Collins Rd (near SH3)	6,786 vpd	782	719
Saxbys Rd	2,717 vpd	299	310
Lambert Ct	1,681 vpd	183	383
Resthill Cres	3,107 vpd	70	135
Houchens Rd	2,091 vpd	224	303

5.5 Crash History

Crash data was sourced from NZTA’s Crash Analysis System (CAS) over a ten-year period from 2016 – 2025. The study area includes all crashes within a 50 m radius of key intersections and sections of key roads in the vicinity of the Site.

¹⁰ Based on MobileRoad website



5.5.1 Industrial Development

Table No: 5

SL1 Industrial Development Crash History 2016 – 2025						
Location	Total # Crashes	Crash Severity				Comments
		Death	Serious Injury	Minor Injury	Non-injury	
Intersections						
Greenwood St / Kahikatea Dr	48	0	4	8	36	<u>Crossing crashes</u> One serious injury crash and three of the minor injury crashes involved a vehicle turning right onto Kahikatea Dr not giving way to a northbound vehicle on Kahikatea Dr. A minor injury crash involved a vehicle turning left onto Greenwood St not giving way to a northbound vehicle on Kahikatea Dr. One of the minor injury crashes involved a vehicle turning right onto Kahikatea Dr not giving way to a southbound vehicle on Greenwood St. <u>Cornering crashes</u> One serious injury crash involved a driver losing consciousness and accelerating off-road. Another serious injury crash involved a vehicle travelling northbound around the corner on Kahikatea Dr, losing control and colliding with a small retaining wall. <u>Head on crash</u> A serious injury crash involved a vehicle travelling southbound at speed, failing to manoeuvre the bend and colliding with another vehicle travelling in the opposite direction head-on.
Kahikatea Dr Extn / Wickham St	2	0	0	1	1	<u>Right turn against crashes</u> A minor injury crash involved a vehicle turning right into Wickham St failing to give way to a vehicle travelling westbound on Kahikatea Dr Extn.
Kahikatea Dr Extn / Higgins Rd	14	0	1	1	12	<u>Crossing (no turns) crashes</u> The serious injury crash involved a vehicle travelling eastbound on Kahikatea Dr failing to give way to a northbound vehicle on Higgins Rd. <u>Crossing (vehicle turning) crashes</u> The minor injury crash involved a vehicle travelling eastbound on Kahikatea Dr failing to give way to a vehicle turning right from Higgins Rd.
Tuhikaramea Rd / Kahikatea Dr Extn	5	0	0	0	5	-



Higgins Rd / Duke St	16	0	1	3	12	<u>Crossing (no turns) crashes</u> Both minor injury crashes involved a westbound vehicle on Duke St failing to stop and give way to a northbound vehicle on Higgins Rd. Another minor injury crash involved an eastbound cyclist on Duke St failing to stop and give way to a southbound vehicle on Higgins Rd. <u>Crossing (vehicle turning) crash</u> The serious injury crash involved a westbound vehicle waiting to turn right onto Higgins Rd failing to stop and give way to a southbound motorcyclist.
Road Sections						
Kahikatea Dr Extn (between Wickham St and Greenwood St)	4	0	1	0	3	<u>Overtaking / lane change crashes</u> The serious injury crash involved a police pursuit of two motorcyclists.
Kahikatea Dr Extn (between Higgins Rd and Wickham St)	1	0	0	0	1	-
Kahikatea Dr Extn (between Tuhikaramea Rd and Higgins Rd)	13	0	1	3	9	<u>Head on crash</u> The serious injury crash involved a bus going around a right-hand bend crashing into a stolen motorcycle. <u>Cornering crashes</u> A minor injury crash involved a motorcyclist losing control when going around a right turn bend and crashing into a fence. Another minor injury crash involved a westbound vehicle going around the bend at excessive speed, losing control and colliding with a parked vehicle and fence. <u>Pedestrian crash</u> A minor injury crash involved a vehicle reversing out of a driveway colliding with a cyclist on the footpath.
Higgins Rd (between Duke St and Kahikatae Dr Extn)	8		1	1	6	<u>Rear end crash</u> The serious injury crash involved a motorcyclist colliding with a vehicle that was waiting to turn right into a driveway. <u>Manoeuvring crashes</u> A minor injury crash involved a vehicle travelling northbound on Higgins Rd colliding with another vehicle attempting to perform a u-turn.

A review of the crash history indicates the following dominant crash patterns:

- Greenwood Street / Kahikatea Drive exhibits a combination of crossing, turning and lane-change related crashes consistent with the operational characteristics of a priority-controlled T-intersection



on a high-volume arterial corridor. HSL includes a three-arm roundabout at this location. When implemented, this treatment would remove priority-controlled crossing movements, reduce approach speeds and simplify driver decision-making. These changes would be expected to address the dominant crash patterns identified at this intersection.

- Kahikatea Drive Extension / Higgins Road and Higgins Road / Duke Street exhibit recurring crossing crash patterns typical of priority-controlled crossroads intersections, where crashes are generally associated with drivers failing to correctly assess or respond to conflicting traffic movements. The Project does not rely on these intersections as primary access points and therefore is not expected to materially increase exposure to the identified crash patterns. It is also noted that the current HSL concept design includes closure of the western arm of the Greenwood Street / Kahikatea Drive intersection and conversion of the Greenwood Street / Duke Street intersection to a left-in left-out arrangement, which would alter traffic movement patterns within the local road network.
- Kahikatea Drive Extension, particularly between Tuhikaramea Road and Higgins Road, exhibits a recurring loss-of-control and cornering crash pattern along the existing horizontal alignment, indicating a concentration of crashes associated with vehicles departing from their intended path. While the Project does not propose specific geometric modifications to this section of road, the future transport network, including HSL and the wider SL1 transport framework, is expected to alter travel patterns within the area and may reduce exposure to the identified crash pattern over time.
- Higgins Road between Duke Street and Kahikatea Drive extension exhibits manoeuvring-related crashes associated with driveway activity, turning movements and other access-related interactions. As the Project does not rely on Higgins Road as the primary means of access to the Industrial Development area, it is not expected to materially increase exposure to these crash patterns.

Overall, the crash history does not identify any dominant crash pattern that would preclude development of the Industrial Development area. The proposed access strategy directs traffic to the strategic road network and is not expected to materially exacerbate the identified crash patterns within the surrounding transport environment.

5.5.2 Residential Development

Table No: 6

Table 10-10

SL1 Residential Development Crash History 2016 – 2025						
Location	Total # Crashes	Crash Severity				Comments
		Death	Serious Injury	Minor Injury	Non-injury	
Intersections						
Ohaupo Rd / Ulrich Ave	14	0	0	5	9	<u>Crossing crashes</u> Four minor injury crashes involved vehicles turning right from Ulrich Ave colliding with a southbound vehicle on Ohaupo Rd. One crash involved a motorcycle. <u>Right turn against crashes</u> One minor injury crash involved a vehicle turning right into Ulrich Ave failing to give way to a southbound vehicle on Ohaupo Rd.
Ohaupo Rd / Collins Rd	27	0	0	6	21	<u>Rear end crashes</u> A minor injury crash involved a vehicle stopping at the limit line to allow a pedestrian to cross. The trailing vehicle



						could not stop in time and collided with the vehicle in front. <u>Pedestrian crashes</u> One of the minor injury crashes involved a vehicle travelling northbound on Ohaupo Rd colliding with a pedestrian who had ran in front of the vehicle. It is to be noted that there is no signalised pedestrian crossing on the southern arm of the intersection. Another minor injury crash involved a child crossing Ohaupo Rd when through movement on Ohaupo Rd had the right of way. The child was hit by a southbound vehicle. <u>Right turn against crashes</u> The minor injury crash involved a northbound vehicle on Ohaupo Rd failing to give way to a vehicle turning right into Collins Rd. <u>Cornering crashes</u> A minor injury crash involved when a vehicle turned right into Collins Rd too fast and mounted the kerb. Driver’s alcohol test was above limit. Another minor injury crash involved a motorcyclist turning right into Collins Rd and crashing into the traffic signals.
Ohaupo Rd / Saxbys Rd / Tomin Rd Roundabout	42	0	1	10	31	<u>Pedestrian crossing road crash</u> A serious injury crash involved when a southbound vehicle collided with a pedestrian crossing Ohaupo Rd via the roundabout splitter island on the south leg. <u>Cornering crashes</u> A minor injury crash which involved a driver blacking out and crashing into the median barrier. A minor injury crash which involved a vehicle crashing into the tree within the roundabout central island. A minor injury crash involved a vehicle travelling from Tomin Rd losing control and colliding with a parked vehicle on Saxbys Rd. <u>Crossing crashes</u> Four minor injury crashes involved vehicles on Tomin Rd failing to give way to vehicles travelling southbound on Ohaupo Rd. <u>Merging crashes</u> One minor injury crash involved a northbound vehicle on Ohaupo Rd entering the roundabout and colliding



						with another vehicle while attempting to change lanes. <u>Overtaking / lane change crashes</u> A minor injury crash involved a police chase. <u>Head on crash</u> A minor injury crash which involved a driver falling asleep, crossing the centre line crashing into oncoming vehicles.
Ohaupo Rd / Lambert Ct	6	0	0	1	5	<u>Right turn against crash</u> A minor injury crash involved a right turning vehicle colliding with a northbound vehicle on Ohaupo Rd.
Ohaupo Rd / Garden Heights Ave	7	0	0	1	6	<u>Crossing crashes</u> A minor injury crash involved a vehicle exiting Garden Heights Ave failing to give way to a southbound vehicle on Ohaupo Rd. Another non-injury crash involved a vehicle exiting Garden Heights Ave failing to give way to a southbound cyclist on Ohaupo Rd)
Ohaupo Rd / Resthill Cres	3	0	0	1	2	<u>Crossing crash</u> A minor injury crash involved a vehicle turning right out of Resthill Cres failing to give way to a northbound motorcycle.
Ohaupo Rd / Houchens Rd	4	0	0	0	4	-
Ohaupo Rd / Dixon Rd	7	0	0	1	6	<u>Merging crash</u> A minor injury crash involved a vehicle exiting Dixon Rd failing to give way to a southbound vehicle, accelerating and colliding with another vehicle.
Saxbys Rd / Macdonald Rd Roundabout	4	0	0	1	3	<u>Cornering crashes</u> One minor injury crash involved a vehicle travelling south on Saxbys Rd losing control at the roundabout and hitting a tree. Speed believed to be excessive.
Collins Rd / Deanwell Ave	3	0	0	1	2	<u>Head on crashes</u> A minor injury crash involved a police patrol car which was in pursuit of a motorcycle, colliding with a vehicle turning right out of Deanwell Ave.
Road Sections						
Ohaupo Rd – between Collins Rd and Saxbys Rd	11	0	2	3	6	<u>Crossing crashes</u> Serious and minor injury crashes involved vehicles exiting Urlich Shopping Centre colliding with a southbound vehicle on Ohaupo Rd. <u>Cornering crashes</u> A minor injury crash occurred when a driver travelling southbound on Ohaupo Rd lost control of the vehicle and hit the medial island and tree. Another minor injury crash involved a driver losing control and hitting the



						median island and tree while trying to avoid a cat. <u>Cyclist crash</u> A northbound vehicle on Ohaupo Rd collided with a cyclist travelling southbound on the adjacent footpath when the cyclist entered the carriageway.
Ohaupo Rd – between Saxbys Rd and Lambert Ct	15	0	0	6	9	<u>Rear end crashes</u> A minor injury crash involved a vehicle travelling northbound on Ohaupo Rd colliding with another vehicle that had stopped due to congestion ahead. A minor injury rear end crash due to congestion at Lambert Ct intersection. <u>Pedestrian crashes</u> A minor injury crash involved a pedestrian crossing the road colliding with a vehicle where the carriageway widens to two lanes closer to the roundabout. A minor injury crash involved a wheeled pedestrian on the footpath and a vehicle exiting 200 Ohaupo Rd (ABI Hamilton Inpatient and Residential Service). A minor injury crash involved northbound vehicle colliding with a pedestrian crossing the road at an undesignated location. <u>Head on crash</u> A minor injury crash involved a driver who was intoxicated crossing the centre line and crashing with oncoming vehicle.
Ohaupo Rd – between Lambert Ct and Garden Heights Ave	4	0	0	2	2	<u>Lost control / off road crashes</u> Two minor injury crashes happened when a driver fell asleep behind the wheel, going off road and colliding with the traffic signal pole / pedestrian fence.
Ohaupo Rd – between Resthill Cres and Houchens Rd	2	0	0	1	1	<u>Overtaking / lane change crashes</u> A minor injury crash involved a vehicle travelling southbound on Ohaupo Rd colliding with a vehicle merging into the carriageway from the adjacent grass berm.
Saxbys Rd – between Rhonda Ave and Macdonald Rd	11	0	1	4	6	<u>Overtaking / lane change crashes</u> A serious injury crash occurred at the Saxbys Rd / Stan Heather Dr intersection. Two cyclists travelling eastbound on Saxbys Rd performed evasive action when they noticed a vehicle approaching them from Stan Heather Dr. They hit each other. <u>Lost control / off road crashes</u> A minor injury crash involved a vehicle losing control and hitting a tree and house garage. <u>Right turn against crashes</u>



						A minor injury crash occurred at the Saxbys Rd / Deanwell Ave intersection. A cyclist riding eastbound on the footpath was hit by a vehicle turning right into Deanwell Ave. A minor injury crash occurred at the Saxbys Rd / Stan Heather Dr intersection. A westbound vehicle turning right into Stan Heather Dr failed to give way to an eastbound vehicle on Saxbys Rd. <u>Cornering crash</u> A minor injury crash involved a vehicle travelling west on Saxbys Rd going off-road and colliding with a fence and power pole having misjudged a bend.
Saxbys Rd – between Macdonald Rd and Ohaupo Rd	1	0	0	0	1	-

The crash history indicates the following key patterns relevant to the Residential Development area:

- Ohaupo Road / Collins Road exhibits strong patterns of rear-end, cornering and crossing crashes, which are characteristic of a high-volume signalised arterial intersection. However, the intersection already operates as a four-lane divided arterial with a dedicated right-turn lane, and the constrained corridor environment limits the scope for further major geometric widening or intersection expansion that would deliver proportional safety benefits.
- Ohaupo Road / Saxbys Road / Tomin Road roundabout exhibits a combination of crossing, merging, cornering and pedestrian-related crashes. While these crash types are not uncommon at urban roundabouts, the roundabout represents the principal transport constraint within the assessed network. The Project includes upgrades comprising four-laning of Ohaupo Road between Saxbys Road and Lambert Court, additional approach capacity on Saxbys Road and Tomin Road, and metering of the southbound Ohaupo Road approach. These measures are intended to improve the operational performance of the roundabout while maintaining an urban-speed environment.
- A lost control / off-road (straight) crash pattern on Saxbys Road, between Rhonda Avenue and Macdonald Road, suggests repeated departures from the roadway that may be associated with approach speed and the existing road environment. The proposed localised improvements on Saxbys Road (refer to Section 10.2.1) reinforce the role of Saxbys Road as an urban collector-type corridor rather than a high-speed local link.

Overall, the crash history does not identify any dominant crash pattern that would preclude development of the Residential Development area. The proposed intersection upgrades, active mode improvements and transport staging framework respond directly to the principal crash patterns identified within the study area and are expected to improve the safety and operation of the surrounding transport network

6. Changes in Transport Infrastructure

6.1 Hamilton Southern Links

HSL is a transport network improvement project for state highway and urban arterial routes linking SH1C from Kahikatea Drive in Hamilton to the Waikato Expressway at Tamahere and SH3 from Hamilton Airport to central and east Hamilton. The project aims to develop an effective transport network of state highway and



urban arterial routes to support Hamilton’s planned growth to the south. In 2024, HSL was identified in the GPS 2024 as a RoNS.

As outlined in the GPS 2024, HSL is intended to “*reduce congestion, improve safety, support housing development, boost economic growth, and provide a more resilient roading network*”, and specifically recognised as key infrastructure required to unlock land for significant new housing supply. In this context, HSL is particularly relevant to the Residential Development area because it has the potential to redistribute a proportion of future traffic demand away from the Ohaupo Road corridor and improve wider network connectivity within southern Hamilton.

NZTA completed an Investment Case for HSL. While the completed Investment Case identifies a preferred corridor and staging framework, the most recent NZTA Major Transport Projects Pipeline (“MTPP”)¹¹ identifies that HSL has not yet progressed to the pre-implementation phase and future progression remains subject to funding availability and National Land Transport Programme priorities. Accordingly, the delivery timing of HSL remains uncertain.

Notwithstanding, HSL remains an important component of the long-term transport plan for southern Hamilton and provides relevant strategic context for understanding the future operation of the transport network serving the SL1 Industrial and Residential Development areas.

Based on the completed Investment Case, the recommended staging framework for HSL comprises the following four stages as shown in Figure 6):

- Stage 1 – Greenwood Street to SL1 roundabout

This involves widening Greenwood Street from two lanes to four lanes from Kahikatea Drive to Killarney Road. A new three-arm roundabout is proposed at the Greenwood Street / Kahikatea Drive intersection with no access to Kahikatea Drive Extension. A roundabout is also proposed allowing access to the Industrial Development area.

- Stage 2 – SH1 to SH21

This includes a new interchange on SH1 Waikato Expressway between the Pickering Road overbridge and Tamahere Interchange, with the road heading west on a new bridge over the Waikato River to connect with a new interchange to be built where HSL meets SH21.

- Stage 3 – SL1 roundabout to SH3

The largest stage in road length, this connects the Industrial Development roundabout at Greenwood Street corner with SH3 and includes an overbridge of the NIMTR and SH3.

- Stage 4 – SH3 to SH21 including central interchange and north-south connection

The final stage completes the east-west connection, including building a new central interchange to connect to the Peacocke Structure Plan Area. It will also see a new stretch of road from the SH3 / SH21 roundabout to connect at the central interchange.

¹¹ <https://www.nzta.govt.nz/assets/projects-and-consultations/major-projects/major-transport-projects-pipeline-infographic.pdf>



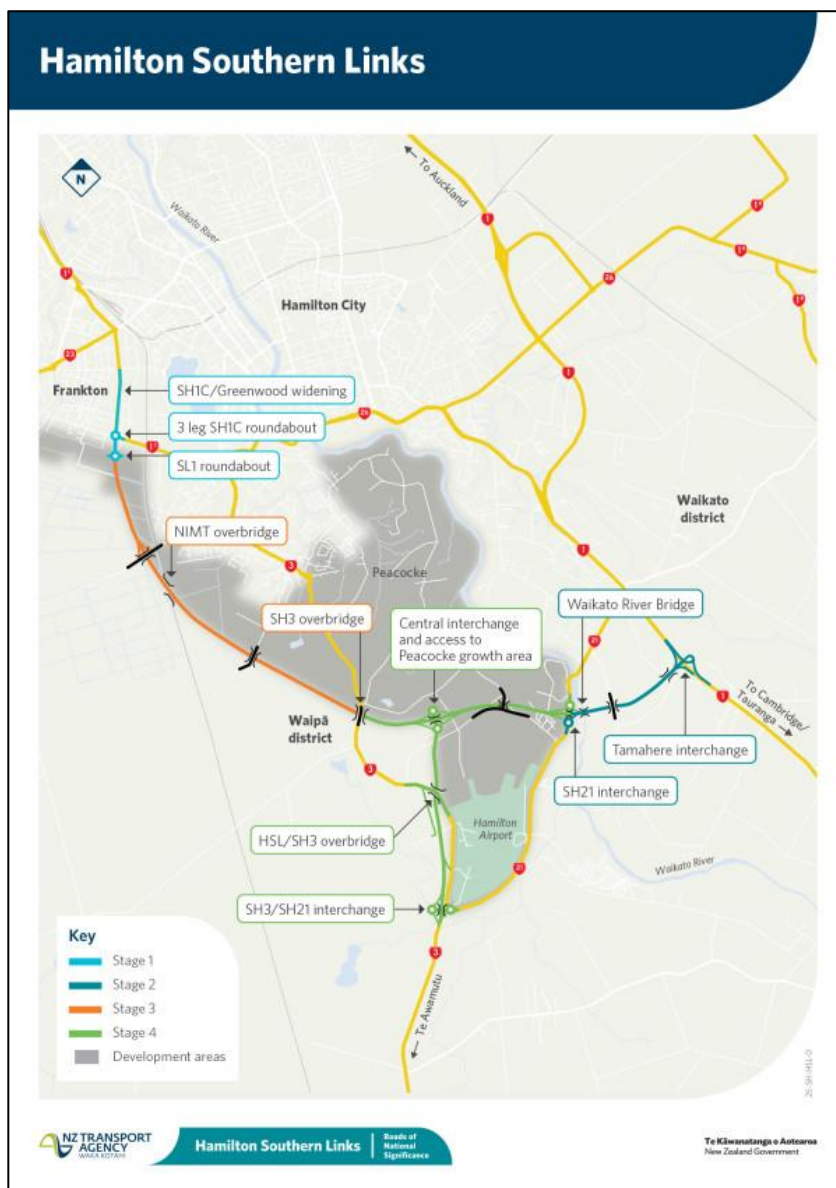


Figure 6: HSL Recommended Staging

The HSL designation borders the southwest edge of the Residential Development area. The HSL designation presently has no direct access to Glenview other than a half-diamond grade separated intersection with Collins Road. However, this location has limited accessibility to Glenview and the wider Hamilton network other than through the intersection of Ohaupo Road / Collins Road. Complicating accessibility matters is the existence of the Collins Road / NIMTR level crossing adjacent to the planned HSL half-diamond interchange.

An alternative interchange arrangement at Houchens Road has been considered as part of strategic transport investigations to improve accessibility between the Residential Development area, Glenview, Deanwell and the wider transport network. The concept has been explored with NZTA and assessed using the Waikato Regional Transport Model ("WRTM") to understand its potential transport benefits. However, the ultimate form, location, timing and delivery of any future HSL interchange remains subject to future NZTA investigation, approvals, funding decisions and statutory processes.

For the purposes of this ITA, HSL has been considered as part of the future strategic transport environment. However, the transport conclusions contained within this assessment do not rely on HSL being delivered within any specific timeframe. Rather, the assessment identifies both interim and future network scenarios and recommends appropriate mitigation and staging measures under each scenario.



6.2 Waikato Metro Spatial Plan

The Waikato Metro Spatial Plan (“MSP”) identifies “Short list Option C”¹² as the recommended programme to “support a radical transport shift and support the transformative move to a Rapid Transit Network future” in Hamilton.

The MSP illustrates the Rapid Transit (“RT”) Network¹³ components of this programme as follows:

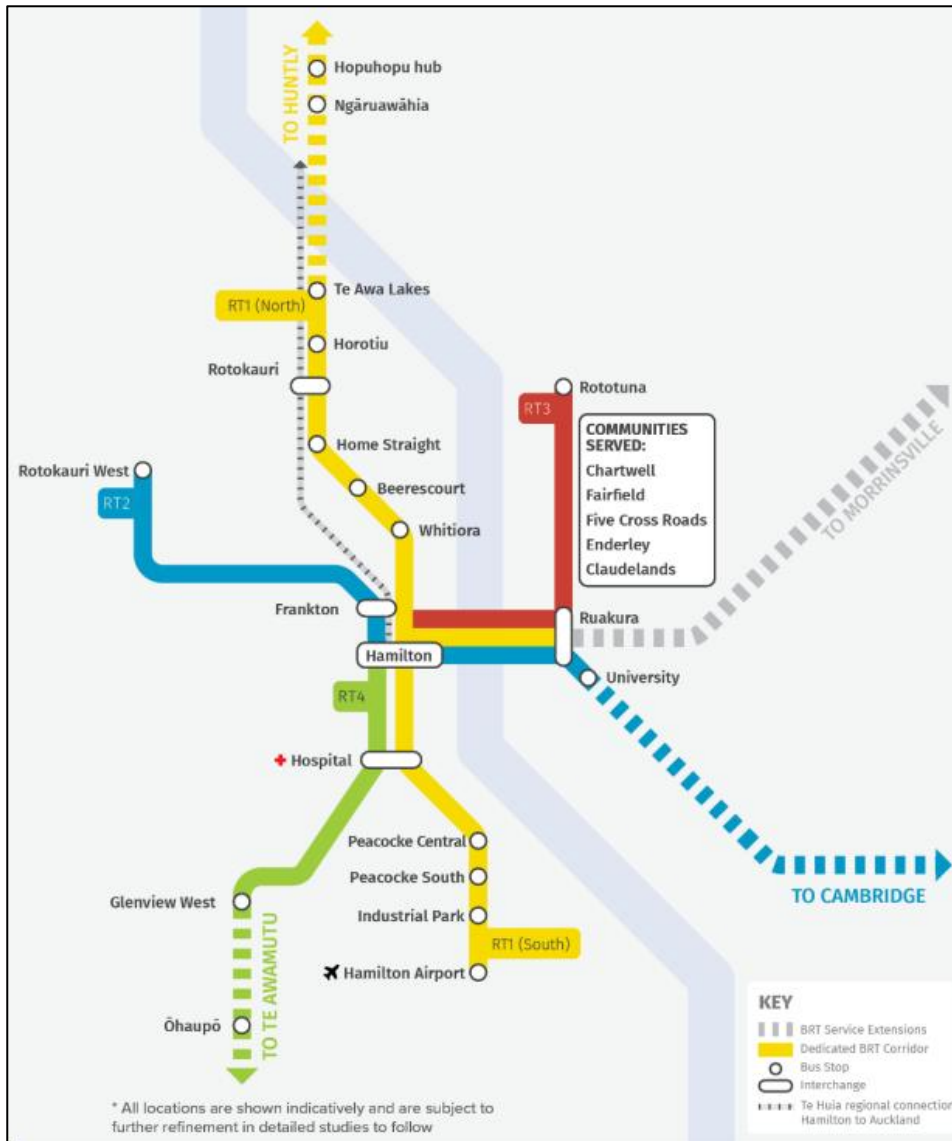


Figure 7: Proposed Rapid Transit Corridors (Source: MSP Business Case Executive Summary)

RT4 is one of four key rapid transit routes across Hamilton. It will service Waikato Hospital and Glenview West, with potential to be extended in the long-term to Te Awamutu. The Residential Development area is located adjacent to the RT4 corridor identified in the MSP and is therefore well positioned to access future rapid transit services envisaged within the wider Hamilton transport network.

The MSP describes RT4 (and RT3) as a service supporting Light Rail Transit (“LRT”) or Bus Rapid Transit (“BRT”) on RT1 and RT2 routes, by way of bus priority. This suggests RT4 is not envisaged as a BRT or LRT service itself

¹² Waikato Metro Spatial Plan Programme Business Case report. Revision D, Section 6.2.2

¹³ Waikato Metro Spatial Plan Executive Summary report. Revision C, Figure 1-8



but a frequent bus service on a route with bus priority measures including bus lanes and signal priority at intersections. The diagram suggests the route may use the Ohaupo Road corridor although that is not determined in the MSP business case report.

The use of the Ohaupo Road corridor by RT4 will require significant modifications to existing road infrastructure and space allocation, including bus priority upgrades at the key intersections identified earlier as network constraints.

One of the key requirements for BRT or LRT to be viable is sufficient medium to high-density residential population surrounding the transit route. The MSP states *“The routes designated as RT3 and RT4 will deal to increased density of existing neighbourhoods and aligns with the existing and proposed community facilities. Although these routes may not ultimately be able to achieve the demand for a full BRT – they are key routes that will require early investigation and investment to deliver bus lanes and bus priority for service functions and reliability.”*.

The above refers to existing neighbourhoods potentially not being dense enough to achieve the demand for full BRT. It should be noted that while the SL1 growth cell near the RT4 corridor is identified as a future growth cell in the MSP land-use framework, it is unlikely to reflect the proposed detailed land use understanding, density and residential typologies. These elements could potentially propel RT4 to be viable as a full BRT corridor.

The MSP also identifies a recommended timeframe to implement the programme as shown below. This indicates RT4 coming online from Year 20 onwards (year 1 is 2025).

Recommended Programme Accelerated Staging and Performance						
		YEARS 1 - 3	YEARS 3 - 10	YEARS 10 - 15	YEARS 15 - 20	YEARS 20 - 50+
Infrastructure and operations	PT Operations Span, frequency, vehicle type	Bus service 19 hour (12 hours peak) Peak: 15 min Off-peak: 20 min	Bus service+ priority 19 hour (12 hours peak) Peak: 10 min Off-peak: 15 min	BRT (RT1) 24 hour (19 hours peak) Peak: 5 min Off-peak: 15 min	BRT (RT1, RT2) 24 hour (19 hours peak) Peak: 5 min Off-peak: 15 min	BRT (RT1, 2, 3, 4) 24 hour (19 hours peak) Peak: 3 - 5 min Off-peak: 10 min
	Infrastructure Bus Priority BRT					
PT Performance	Patronage (AM peak/direction/hour) • Airport to Hamilton • Te Awa to Hamilton • Hamilton to Ruakura	-	930 650 1400	1450 1000 2150	1650 1150 2500	2250 1550 3350
	PT Travel Time (savings compared with general traffic) • Airport to Hamilton • Hamilton to Ruakura	23 min 19 min	22 min (-1 min) 10 min (-9 min)	22 min (-3 min) 10 min (-13 min)	22 min (-6 min) 10 min (-17 min)	22 min (-10 min) 10 min (-22 min)
	PT Reliability	Low	Medium	High	High	High
Micro-mobility	Micro-mobility network	Early implementation	10% of cycle network • Biking and micro-mobility 10 year programme • Develop city centre traffic circulation plan and low traffic neighbourhoods • Facilitate safe and easy active mode access to stations	40% of cycle network • Extend cross city connections to more peripheral centres and growth cells – Rotorua, Dunsdale, Rotorua, Peacocke and R2 • Begin to fill out network with build-out of cross city connections, community links and local links • Improve Te Awa River Ride cycle path to Ngāruahia and Cambridge	70% of cycle network • Active mode network in town centres and growth cells • Continue build-out of cross city connections, community links and local links	100% of cycle network • Complete build-out of cross city connections, community links and local links
Cost	Cost – CAPEX (per year)	146 million	138 million	162 million	62 million	5 million
	Existing LTP maintained (per year)	110 million	110 million	8 million	8 million	5 million
Cost	Cost – OPEX (per year)	24 million	27 million	35 million	38 million	66 million

Figure 8: Recommended RT Network Staging Approach (Source: MSP Business Case Executive Summary)

6.3 Hamilton Waikato Metro Spatial Plan - Public Transport Pathways

The *Hamilton Waikato Metro Spatial Plan - Public Transport Pathways Technical Report 2* (“PT Pathways Report”) identifies the Comet bus service as a strategic cross-city service linking Glenview, the central city, The Base and major growth areas including Peacocke and Te Awa Lakes. The report also identifies Ohaupo Road as an important future public transport corridor and supports the continued development of public transport services and infrastructure along the corridor. Future public transport improvements relevant to the Project are discussed further in Section 6.



The Comet is classified as a Tier 2 frequent service by 2030, transitioning to a Tier 1 frequent service by 2038, and is aligned in full with “Line 2” of the Bus Rapid Transit Proof of Concept. As a Tier 1 frequent route, the Comet service is expected to operate at a 10-minute peak frequency under the adopted service standards. The report further identifies Ohaupo Road (SH3) as a priority corridor for bus priority infrastructure, noting that such infrastructure is required to support higher-frequency services and improve speed and reliability, and that Tier 1 frequent routes are expected to transition to Bus Rapid Transit in the longer term, although BRT-level infrastructure is not assumed to be delivered within the twelve-year study period.

6.4 Waikato Regional Public Transport Plan 2022 - 2032

According to the Waikato Regional Public Transport Plan, it is projected that a future frequent network to be implemented over 10 years (refer to Figure 9) and a future ‘BRT lite’ network to be implemented over 30 years (refer to Figure 10) along Ohaupo Road.

For clarity, frequent services are described as “15-minute frequency or better, bus priority measures sufficient to enable competitive and reliable journey times regardless of traffic conditions. On board fare collection, zero emission vehicles, quality stops. Enables and requires moderate or greater land use.”, and BRT lite is described as “high service frequencies, extensive bus priority measures, traffic signal priority, may have off board fare collection, zero emission vehicles, high quality passenger stops. Enables and requires moderate to high intensity land use.”.

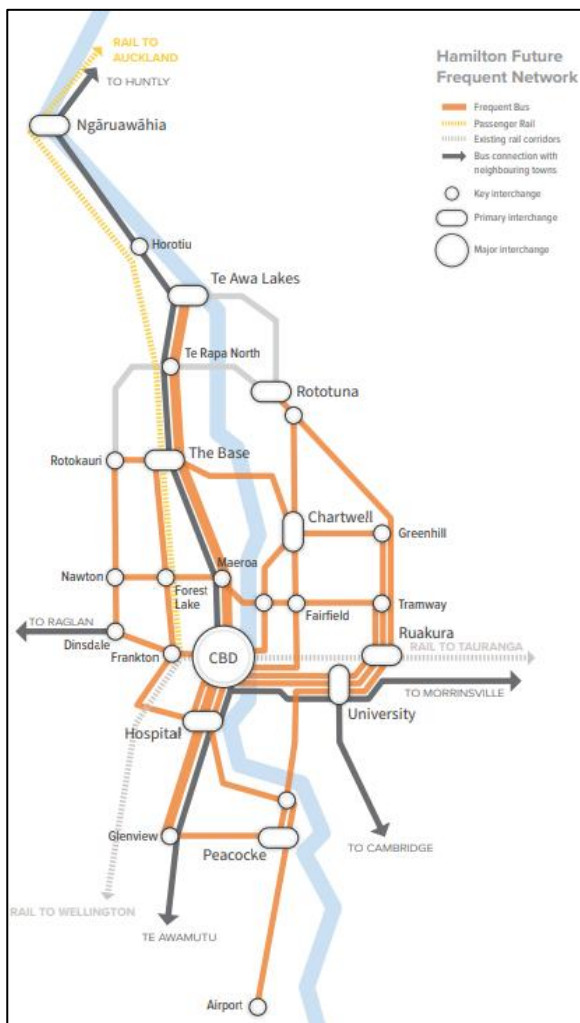


Figure 9: Future frequent network to be implemented over 10 years, 2022-2032 (Source: Waikato Regional Public Transport Plan Network Diagram 1)



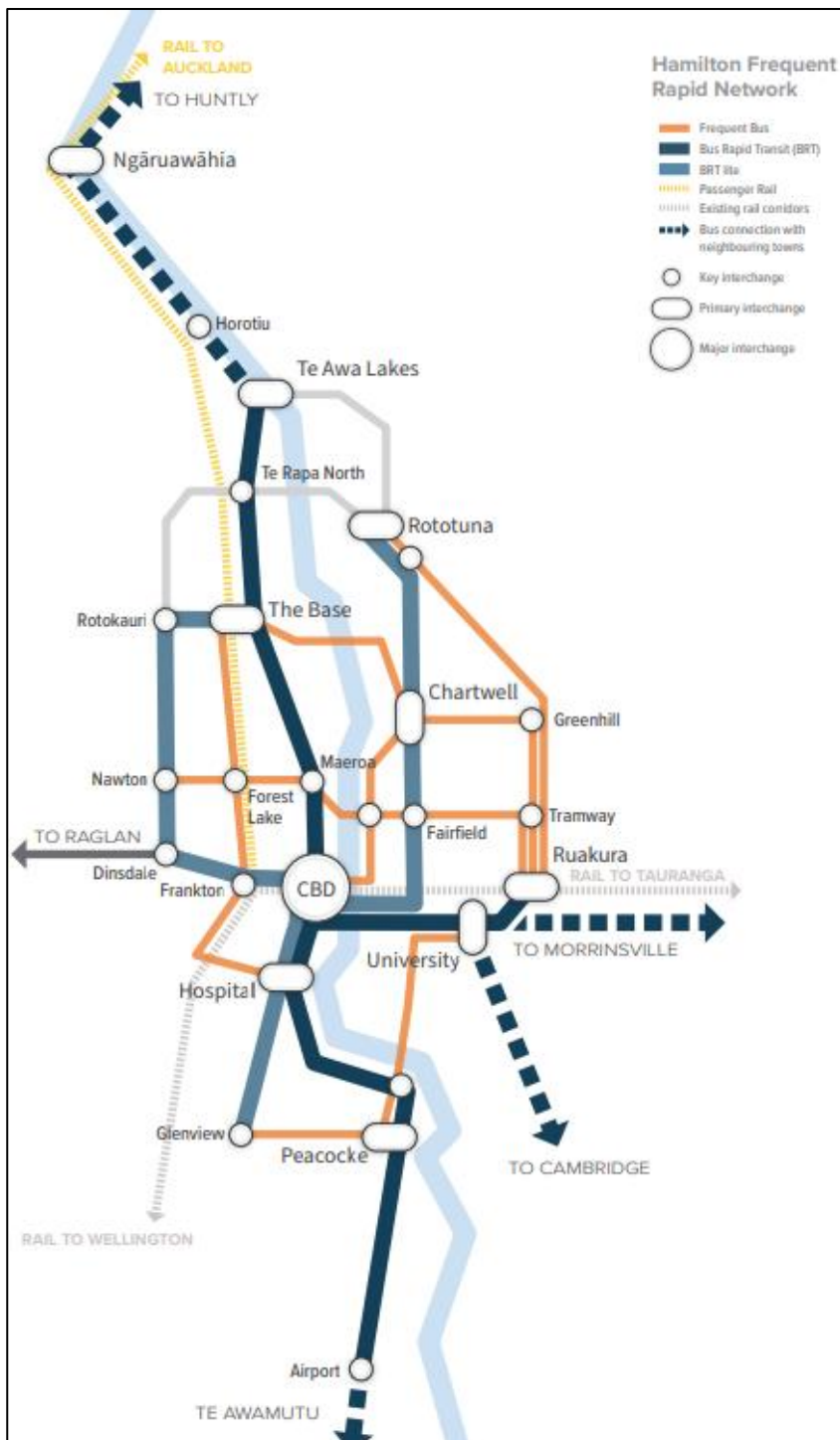


Figure 10: Future frequent network to be implemented over 30 years, 2022-2052 (Source: Waikato Regional Public Transport Plan Network Diagram 2)



7. Project Overview

7.1 Industrial Development

The Industrial Development comprises circa 60 ha of presently rural land. The net developable area is estimated to be 40 ha with the balance accommodating the HSL designation, proposed wetland areas and existing Industrie Property Tahi Limited lot (Lot 1 DP 396081) that is developed and occupied in accordance with an existing resource consent.

The industrial subdivision will comprise a mix of lot sizes and industrial activities that will be supported by the proximity to HSL and the existing Frankton Industrial area. Access to the development area is proposed via an east – west collector road connection to HSL which is future-proofed for connectivity to Wickham Street, Higgins Road, and ultimately to Tuhikaramea Road as shown in Figure 11. While the Master Plan provides for integration with HSL when it is delivered in the future, the timing of Industrial Development is not dependent on HSL delivery.

The transport assessment has been undertaken based on the functionality of the access and road network arrangements shown on the Master Plan. The ITA does not seek to determine the ultimate ownership, funding arrangements or individual delivery responsibilities for infrastructure located within the HSL designation, as those matters will be addressed through separate infrastructure delivery and approval processes. For consenting purposes, the relevant transport considerations for this ITA are to show that the proposed interim and ultimate access arrangements can operate safely and efficiently and that they do not hinder delivery of the future HSL road infrastructure. Any infrastructure intended to form part of the future state highway network would be subject to the relevant NZTA design, review and approval processes prior to implementation.

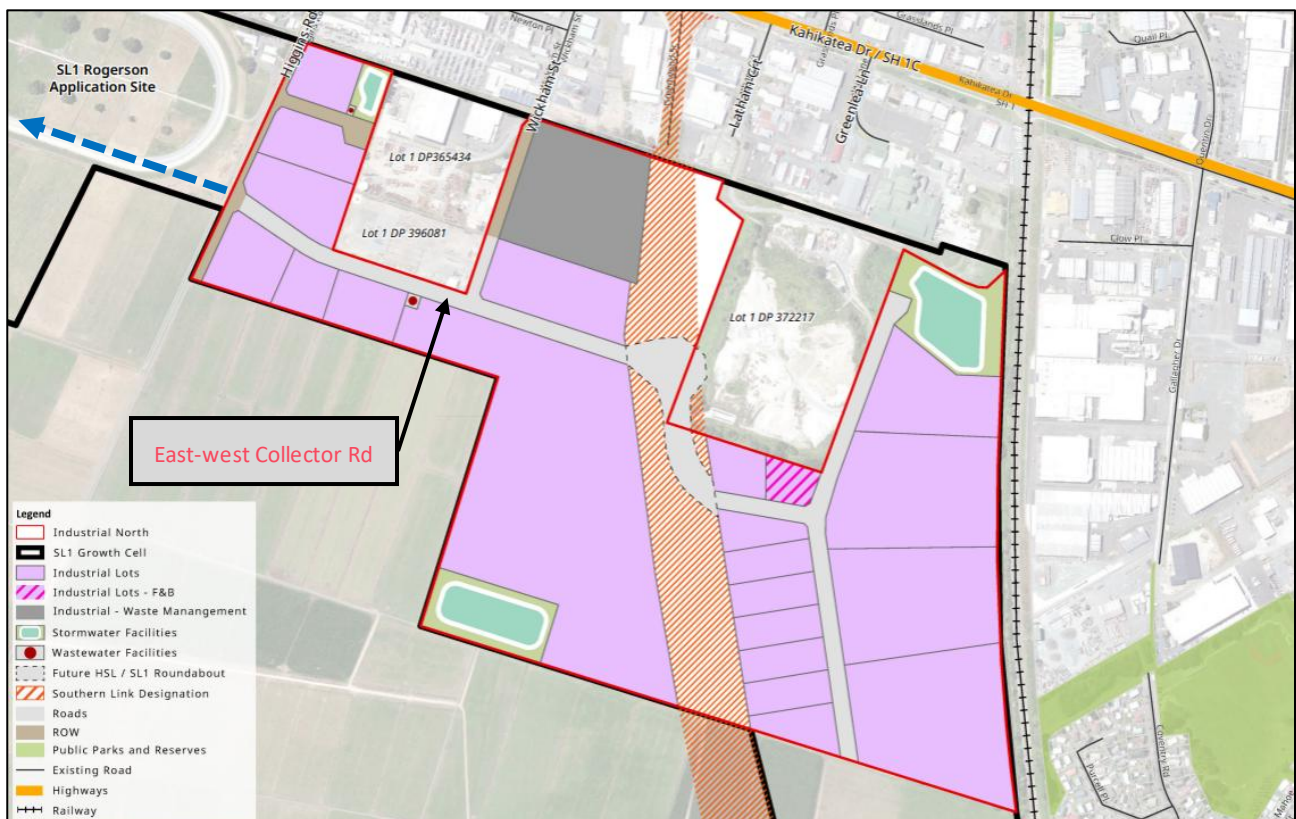


Figure 11: SL1 Industrial Development Master Plan



The Industrial Development is expected to occur progressively between 2030 and 2045. Access for the Industrial Development has been assessed “without” and “with” HSL, referred herein as the interim and ultimate network arrangements. Both are detailed further in Section 8.1.

7.2 Residential Development

The Residential Development forms part of the residential component of the wider SL1 Growth Cell. The Residential Development area is approximately 46 ha and comprises 938 residential units consisting of:

- 347 Low density dwellings (minimum 10 m lot width for detached or duplex dwellings)
- 298 Medium density dwellings (front-access terraced or duplex dwellings)
- 293 High density dwellings (rear-access lane terraced dwellings)

The Residential Development area also includes 1,000 m² of commercial land area for a neighbourhood centre and 3,200 m² for a neighbourhood park.

Access for the Residential Development has been assessed and detailed further in Section 8.2.

The Residential Development is underpinned by a comprehensive Master Plan which is illustrated in Figure 12.

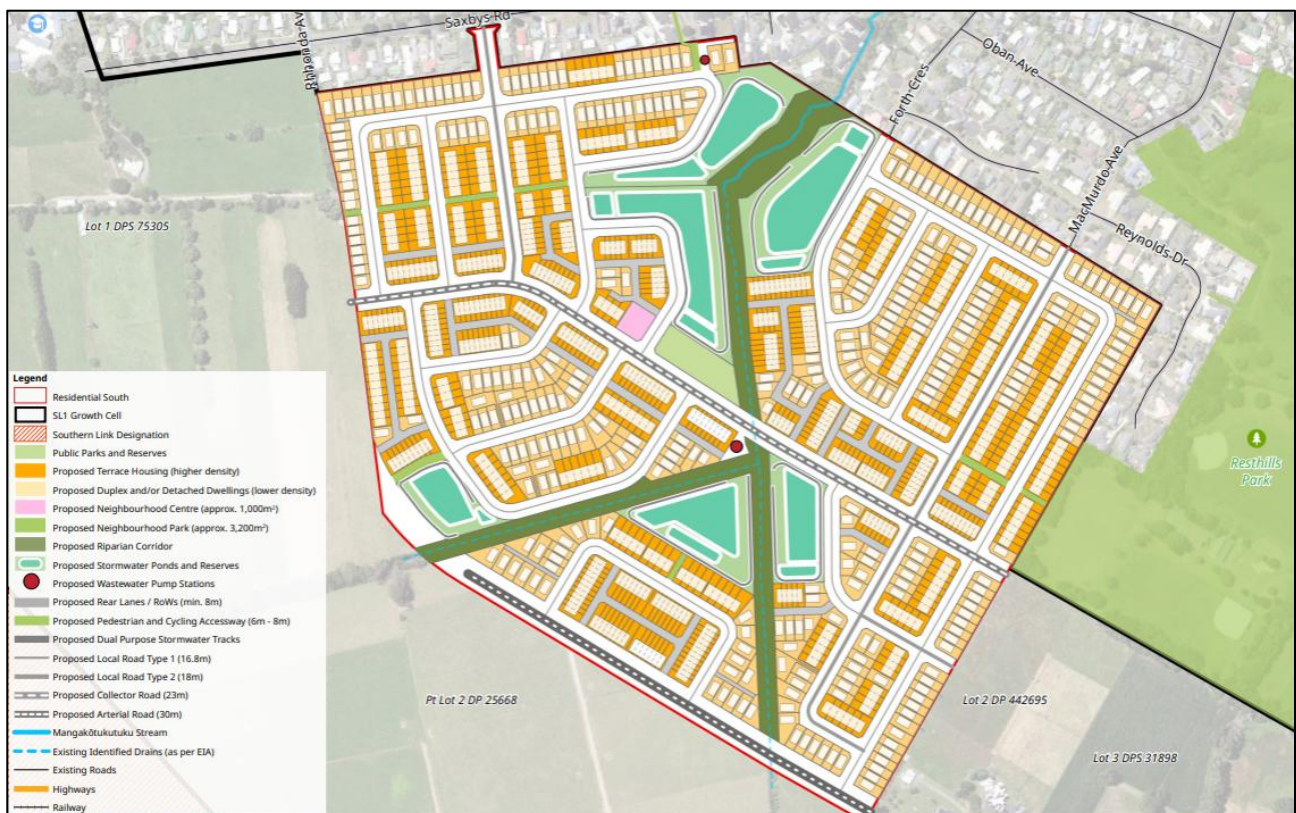


Figure 12: Residential Development Master Plan

Indicative development staging is presented in Figure 13 below.





Figure 13: Residential Development - Indicative Staging

Stage 1 is anticipated to be completed by 2030, Stages 2 and 3 are anticipated by 2035, and Stages 4 and 5 by 2045. These staging timeframes are indicative only and have been adopted for the purposes of the transport assessment.

8. Access Strategy

SL1 access arrangements have been designed to provide for the safe and efficient movement of people (and freight for the Industrial Development) with mode-choice including vehicles, walking, cycling, and public transport. A high degree of flexible transport choice is expected to assist in managing the transport effects of the development.

8.1 Industrial Development

Three access options were evaluated to assess how Industrial Development could proceed:

8.1.1 Option A: Ultimate Network Arrangement (once HSL Stage 1 is Delivered)

Once HSL is delivered in the future, the Industrial Development has been designed so that it can integrate with the ultimate HSL transport network without precluding future infrastructure. Under the ultimate arrangement, the following infrastructure may be provided:



- A four-arm roundabout connection on HSL approximately 520 m south of the future Greenwood Street / Kahikatea Drive three-arm roundabout (refer to Section 8.1.4).
- Connection of the east-west collector road to the proposed HSL / SL1 roundabout.
- Extension of Wickham Street into the site.
- Access to the eastern part of the Industrial Development is dependent on the future HSL network staging scenario. If the SL1 roundabout and associated HSL connection is delivered in HSL Stage 1, access to the eastern area is proposed via a short section of HSL arterial and a local road connection to the north-south road in the eastern development area, as shown in Figure 14. In that scenario, following completion of HSL Stage 3 by NZTA, this local road connection would become a cul-de-sac.
- Integration with the wider walking, cycling and strategic transport network associated with HSL.

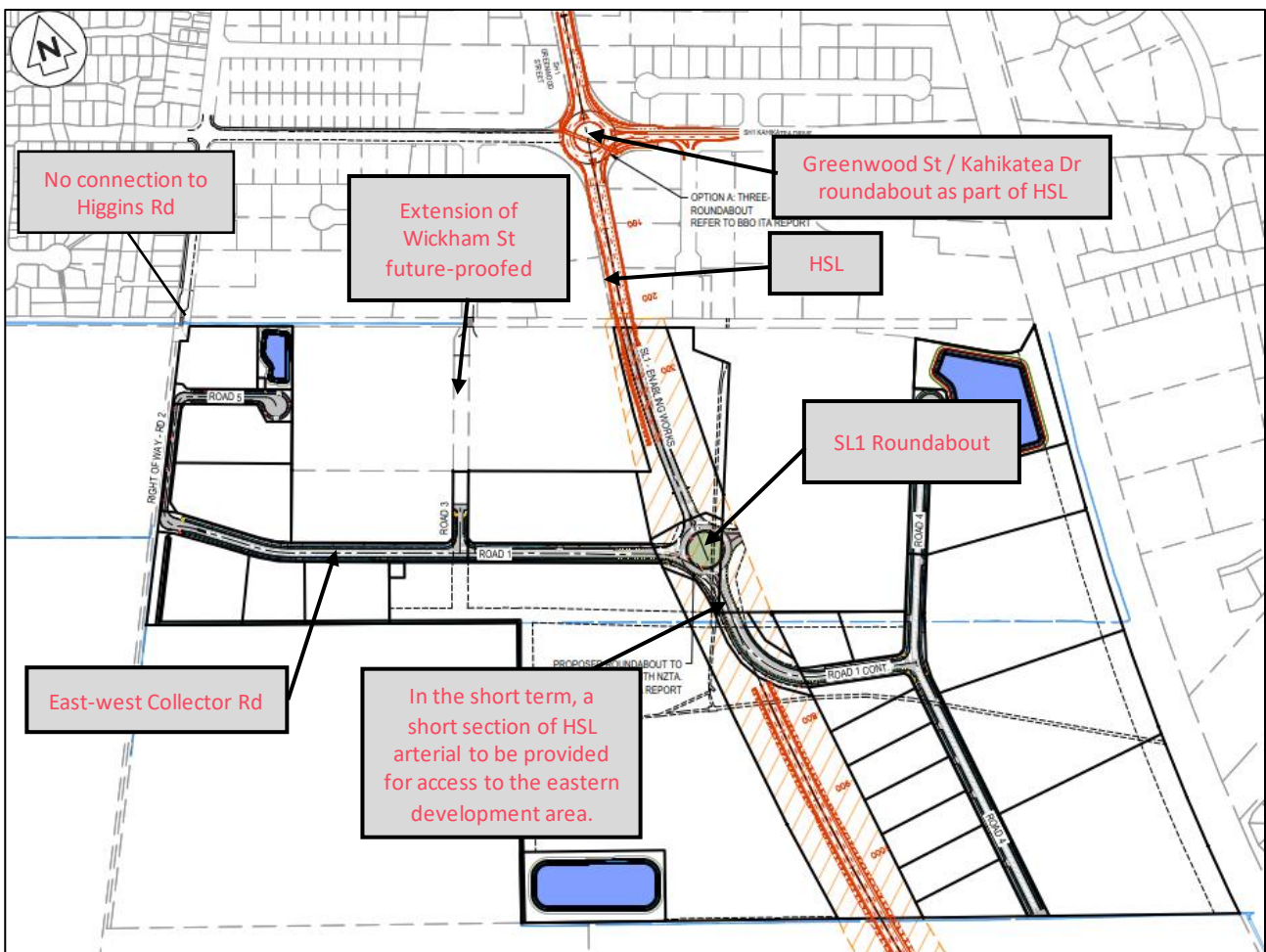


Figure 14: Option A - HSL Stage 1 constructed

8.1.2 Option B: Preferred Interim Option

The preferred access strategy (as shown in Figure 15) is Interim Option B, which does not rely on HSL Stage 1 being delivered. Under this arrangement, Industrial Development traffic is accommodated via:

- An interim four-arm roundabout at Greenwood Street / Kahikatea Drive, replacing the existing priority-controlled intersection and providing access from Greenwood Street and Kahikatea Drive.
- An interim access road between the Greenwood Street / Kahikatea Drive roundabout and east-west collector road, designed and staged so that it can transition to the ultimate HSL arrangement.



- An east-west collector road forming the primary internal movement corridor through the site.
- A temporary T-intersection on the HSL corridor connecting the interim access road to the east-west collector road.
- Extension of the interim access road further south to provide access to the eastern part of the Industrial Development.
- A walking and cycling network connecting to the existing Greenwood Street shared path and wider active mode network via Wickham Street.

These infrastructure requirements are necessary to ensure Industrial Development traffic is served by an appropriate intersection form and access route, rather than relying on the existing Greenwood Street / Kahikatea Drive priority-controlled intersection or on access through local industrial streets alone.

The Interim Option B access arrangement can accommodate the full assessed Industrial Development and is assessed in detail in Section 15.1.1.

A conceptual layout of the four-arm Greenwood Street / Kahikatea Drive roundabout is shown in Figure 16 and is based on the ultimate HSL roundabout arrangement to minimise rework in future. Interim Option B has been discussed with NZTA, who advised that, the option appears to be worth exploring. NZTA also noted that the interim roundabout would need to be sized consistently with the ultimate HSL layout and that any interim access road should be future-proofed so that it could be incorporated into the future state highway network without significant upgrading or utility relocation.

On that basis, the interim access road south to the east-west collector road would be designed and constructed to the required HSL standard, but with only the carriageway width required for an interim two-lane operation rather than the full four-lane divided carriageway. The central median and two additional traffic lanes would be delivered with the future HSL works. NZTA has not provided in-principal approval to Interim Option B, and the detailed form, staging, funding, ownership and transition to the ultimate HSL layout would remain subject to further design development, staging review and NZTA approval.

Access is intended to transition to the ultimate network arrangement when HSL is delivered in future by NZTA. The ultimate access arrangement is described in the following sections.



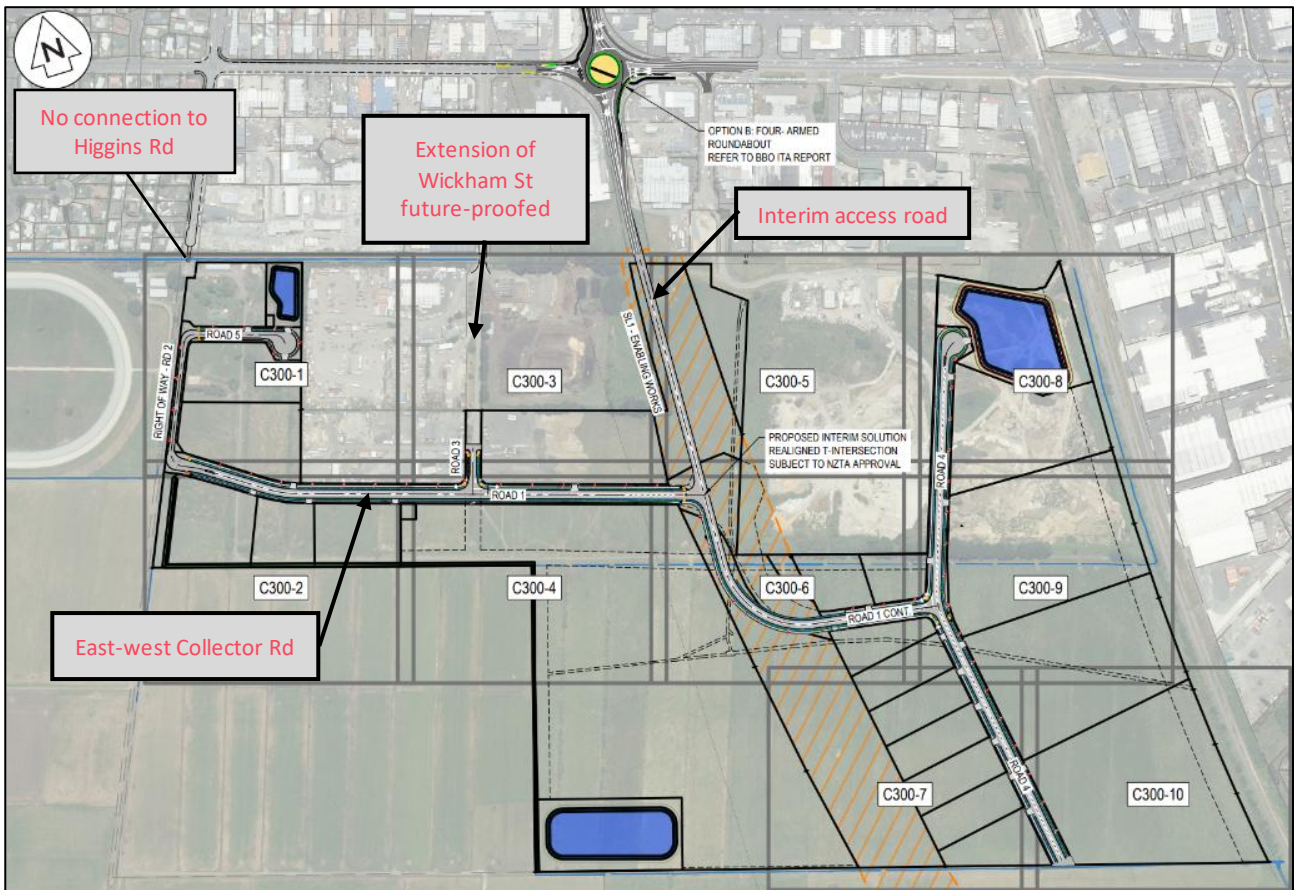


Figure 15: Interim Option B - Four-arm Roundabout and Interim Access Road



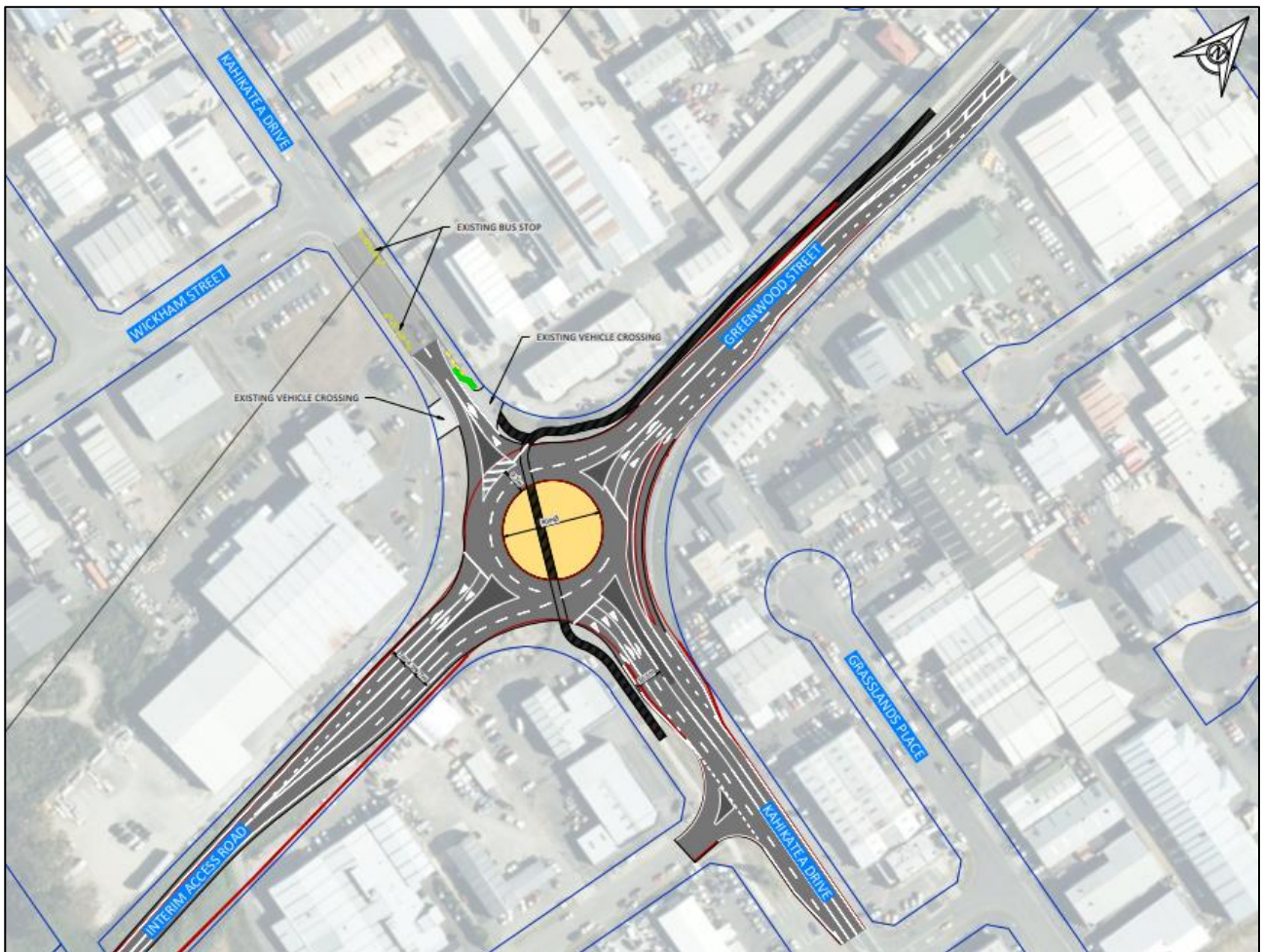


Figure 16: Interim Option B - Greenwood St (SH1C) / Kahikatea Dr Roundabout Concept Plan

8.1.3 Option C: Interim Option

Like Option B, this option is based on HSL Stage 1 construction commencing sometime after 2035.

This option involves upgrading Greenwood Street / Kahikatea Drive intersection to a three-arm roundabout as shown in Figure 17. with access to SL1 Industrial Development via Wickham Street extension.

However, this option has a developable area limitation of 23 ha due to capacity constraints with the three-arm roundabout. Development beyond 23 ha requires construction of either:

- HSL Stage 1; or
- Interim Option B four-arm roundabout arrangement and the interim access road on HSL corridor.

This is presented as Option C Stage 2 (represented by blue lines) in Figure 18.



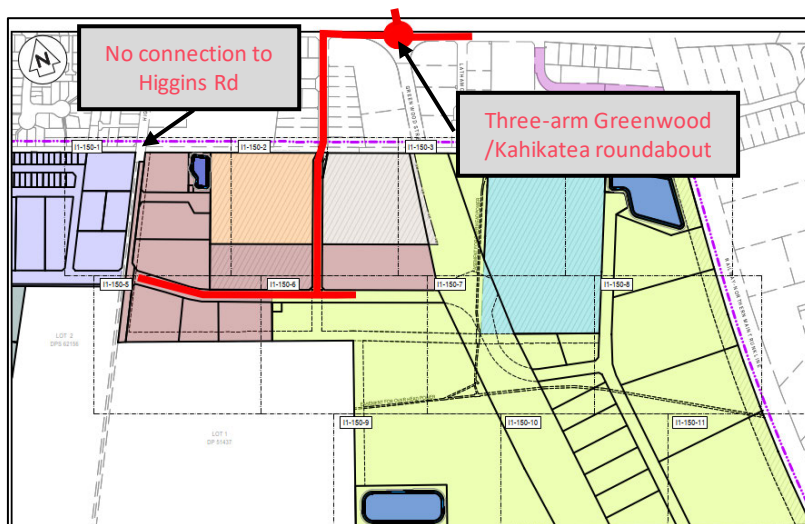


Figure 17: Option C – Stage 1 Proposed Transport Network

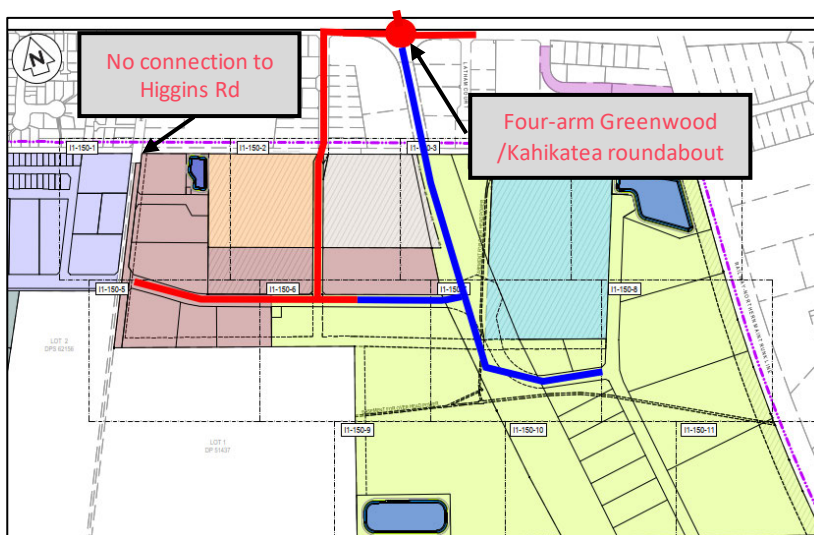


Figure 18: Option C – Stage 2 Proposed Transport Network

8.1.4 SL1 Roundabout

It was identified through consultation meetings with HCC that a direct connection from the proposed Industrial Development area to Kahikatea Drive would not be supported given the access challenges that already exist due to high traffic volumes. For this reason, HCC also advised that they have had discussions with NZTA about allowing a connection from the future HSL corridor to the Industrial Development site to avoid it becoming land-locked by the HSL designation. A direct connection to HSL enables freight and other commercial / industrial traffic to be minimised on the surrounding local roads.

A single point of access to the Industrial Development area is proposed, recognising that HSL is a RoNS where access and intersections are rationalised to maintain efficiency of the strategic road corridor.

The road connection to HSL is proposed to be a four-arm roundabout, which aligns with Safe System principles. A concept plan of the roundabout configuration is shown in Figure 19.



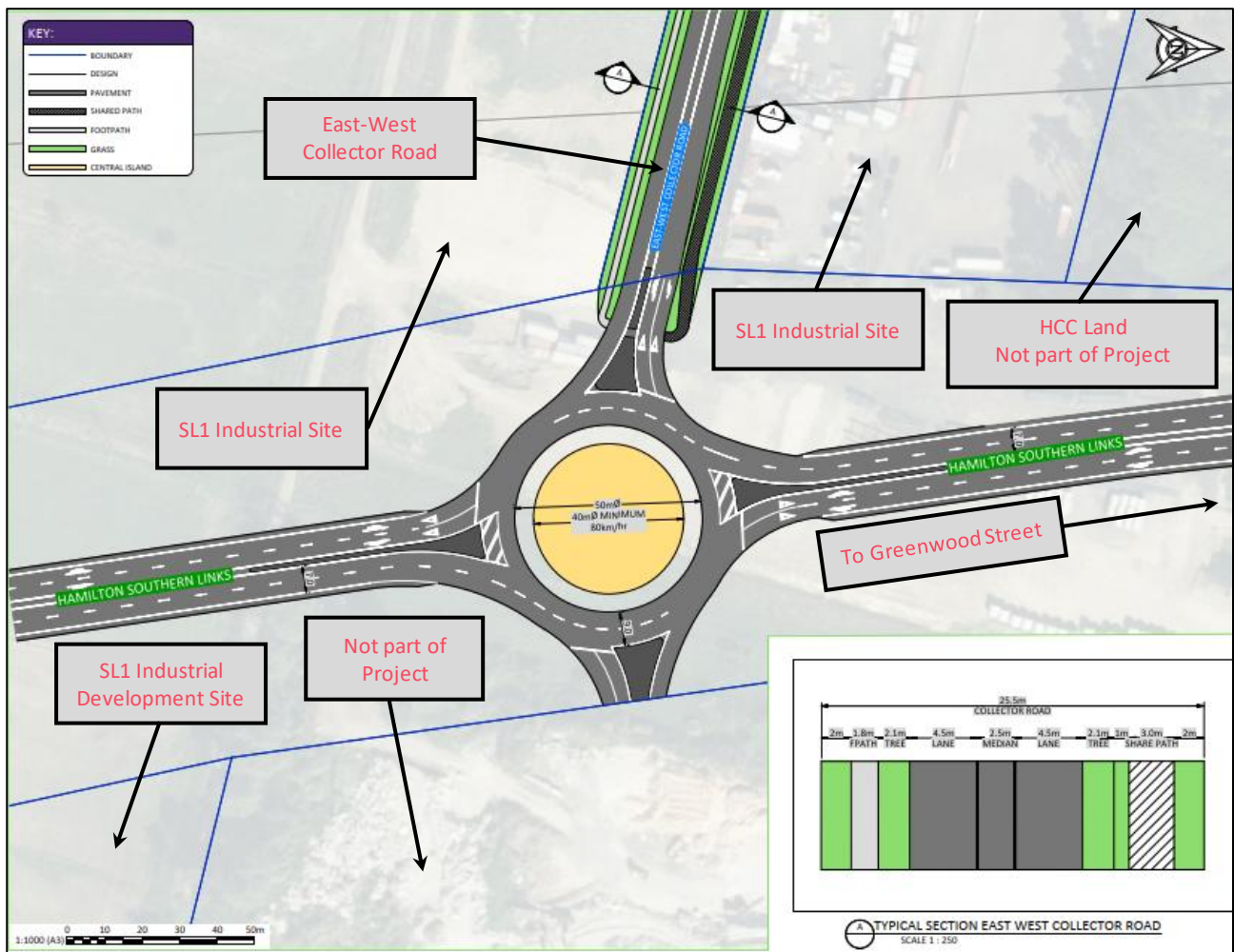


Figure 19: HSL / SL1 Roundabout Concept Design

The concept SL1 roundabout is designed in accordance with *Austrroads Guide to Road Design Part 4B: Roundabouts* ("AGRD Part 4B"). A design speed of 100 km/h has been adopted for the HSL approaches.

The central island radius is 25 m and the design accommodates the tracking curves of a 19.45 m HPMV semi-trailer (refer to Appendix A - Drawing 149340-00-0200). The concept layout has been modelled to demonstrate that the expected performance and capacity of the intersection is sufficient for the transport demands of the Project and future proofed volumes on HSL.

The concept design is therefore intended to demonstrate that the proposed access location and intersection form can be accommodated within the future HSL corridor without precluding the ultimate strategic transport function of HSL. The detailed geometric design, pavement design, drainage, utilities, safety barriers, tie-ins and any other state highway-specific requirements would be subject to further design development, safety audits and NZTA's approval process before being accepted as part of the state highway network.

The land required to form the eastern arm of the proposed roundabout is outside the SL1 Industrial Development area and is not part of the current Fast-track substantive consent application. Accordingly, the eastern arm is not proposed to be delivered as part of SL1 Industrial Development but the roundabout will be future proofed for it with a stub road to the east, sized and located so as not to preclude future extension when the adjoining land to the east is brought forward for development.

There is limited guidance on separation distance between highway intersections. The proposed position of the SL1 roundabout on HSL is approximately 520 m south of the future Greenwood Street / Kahikatea Drive roundabout that connects HSL to Greenwood Street and Kahikatea Drive.



The SL1 roundabout is proposed at this location for the following reasons:

- A position further south on HSL would result in less direct access between the Industrial Development area and the strategic road network. This may encourage some industrial traffic to utilise alternative local routes to travel north to Greenwood Street and Kahikatea Drive, which is inconsistent with the objective of directing industrial and freight traffic to the strategic road network.
- It supports a direct and intuitive east-west collector road corridor between Tuhikaramea Road and HSL, which in future will replace the existing function of Kahikatea Drive Extension that passes through a residential suburb. The new collector road route will maintain a strategic road connection between Hamilton's western fringe and the Frankton industrial area. Relocating the roundabout further south creates a convoluted alignment that risks rerouting some traffic north through residential streets.
- It allows the east-west collector road to be aligned strategically between two SL1 landowners' lots without dissecting lots to any owner's disadvantage. This provides important continuity for both applicants to progress their land development aspirations.

Intersection modelling for the SL1 roundabout and the future HSL roundabout at Greenwood Street / Kahikatea Drive intersection demonstrates that the proposed 520 m separation distance is suitable for both intersections to function well under the predicted future traffic volumes without causing adverse capacity and efficiency effects to the HSL network. Refer to Section 15.1.1.

It is acknowledged that NZTA is undertaking more detailed Aimsun modelling to inform future HSL design decisions, including the operation of Duke Street and the separation between the future Greenwood Street / Kahikatea Drive roundabout and the proposed SL1 roundabout. The modelling undertaken for this ITA demonstrates that the proposed separation distance is expected to function well from a capacity and queuing perspective under the assessed concept layout and traffic demands. However, the final form and location of infrastructure within the HSL corridor will remain subject to NZTA's future design development, modelling and approval processes to ensure that future HSL design options are not precluded.

8.2 Residential Development

Transport access for the Residential Development is designed to provide for the safe and efficient movement of people in a higher density living environment with mode-choice including vehicles, walking, cycling, and public transport. A high degree of flexible transport choice is expected to assist in managing the transport effects of the development.

Three road access points are proposed to the Residential Development area:

- Saxbys Road
- MacMurdo Avenue
- Forth Crescent

A new intersection on Saxbys Road will be formed at a location approximately 65 m west of Saxbys Road / Deanwell Avenue intersection.

MacMurdo Avenue and Forth Crescent are proposed to be extended into the site. Further details on each of these specific site connections is provided in the subsequent sections.





Figure 20: Proposed Site Accesses – Residential Development

8.2.1 MacMurdo Avenue Access

MacMurdo Avenue is currently a low volume no-exit road that stops at the north-eastern boundary of the site. MacMurdo Avenue is proposed to be extended further southwest connecting to the new north-south collector road at the southern end. The intersection between MacMurdo Avenue extension and the new collector road is proposed to be a roundabout.

MacMurdo Avenue extension is proposed to have an 18.0 m wide road reserve width as shown in Figure 21.

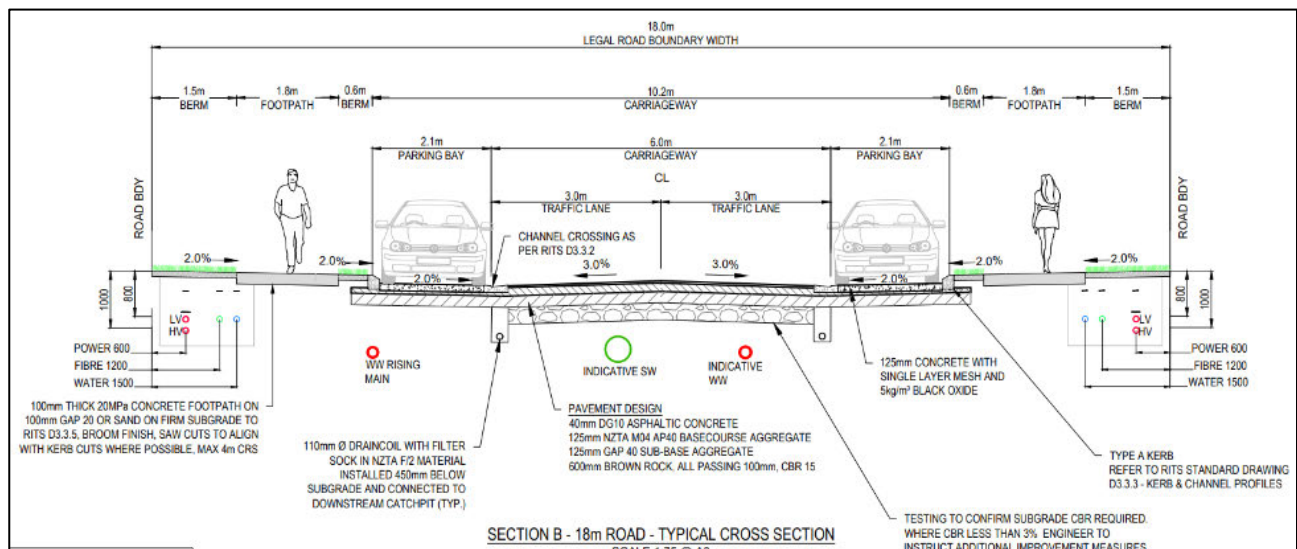


Figure 21: 18.0 m Wide MacMurdo Avenue Extension

8.2.2 Forth Crescent Access

Forth Crescent is currently a low volume road that stops at the north-eastern boundary of the Site. It is proposed to be extended further southeast connecting to MacMurdo Avenue extension at the eastern end.



Forth Crescent extension is proposed to have a 16.8 m wide road reserve width as shown in Figure 22.

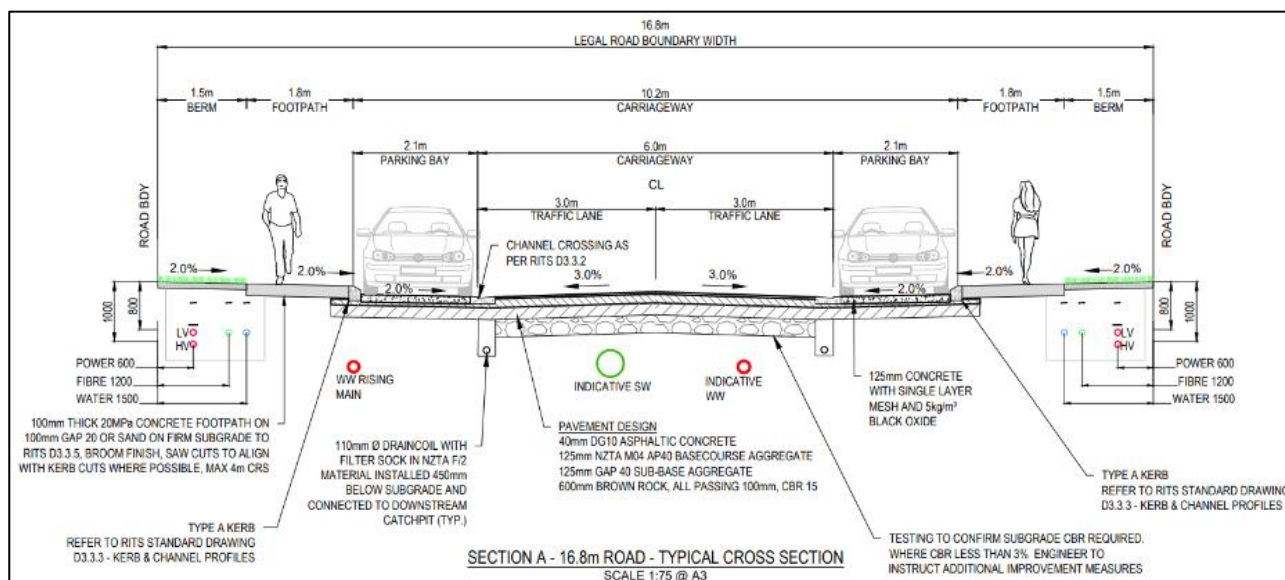


Figure 22: 16.8 m Wide Forth Cres Extension

8.2.3 Saxbys Road Access

The access intersection proposed on Saxbys Road will operate as a priority-controlled T-intersection. Traffic exiting the Residential Development will give way to traffic on Saxbys Road. Saxbys Road is closed at its western end and therefore functions as a no-exit local road.

A stop control may be required on the site access approach as preliminary assessment indicates that sight distance measured from a point 9 m back from the limit line may be restricted by the existing boundary fencing at 55 and 57 Saxbys Road. This will be confirmed through detailed design. Notwithstanding this potential constraint, the straight alignment of Saxbys Road provides available sight distances of approximately 300 m to the east and 400 m to the west. These distances exceed the minimum safe intersection sight distance ("SISD") of 114 m specified in *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* ("AGRD Part 4A"), Table 3.2, for a 60 km/h design speed.

A review of the projected turning movement volumes at the proposed access, relative to the future through volumes on Saxbys Road in the 2045 full-development scenario (i.e. Modelling Scenario 4 in Section 13.2), indicates that auxiliary turning lanes or a channelised layout are not warranted under the relevant Austroads criteria¹⁴. Accordingly, the access intersection is expected to be appropriately designed in accordance with *Traffic Control Devices Manual Part 4* ("TCDM Part 4A"), Figure 4-14 or Figure 4-17.

The final form of control and detailed intersection layout will be confirmed at the detailed design stage.

9. Public Transport Provision

Public transport accessibility is a key component of the transport strategy for the proposed developments, particularly in managing future travel demand and reducing reliance on private vehicle travel. This section considers the extent to which the proposed Development layouts supports the existing and enables the planned bus networks identified through consultation with Waikato Regional Council ("WRC").

¹⁴ Austroads Guide to Traffic Management Part 6, Figure 3.25



While the proposed development transport infrastructure and connections are designed to promote public transport accessibility so that public transport mode-share increases over time, the Applicants cannot require WRC to implement the necessary future services or amend exiting bus routes. The following are WRC's current plans, noting that the networks shown in Figure 23 and Figure 24 were developed in 2024 and do not fully account for all Fast-track growth cells in Hamilton, including SL1.

- WRC advised that, in the short term (to 2028), bus services are planned to continue using Saxbys Road, the olive-coloured route shown in Figure 23.
- In the medium-term (2037), the indicative bus network no longer shows services using Saxbys Road, as shown in Figure 24.
- The indicative network plans also do not show bus services using Higgins Road between Kahikatea Drive and Duke Street, which is likely to reflect the proposed closure of the Kahikatea Drive western leg at the future Greenwood Street / Kahikatea Drive intersection as part of HSL.

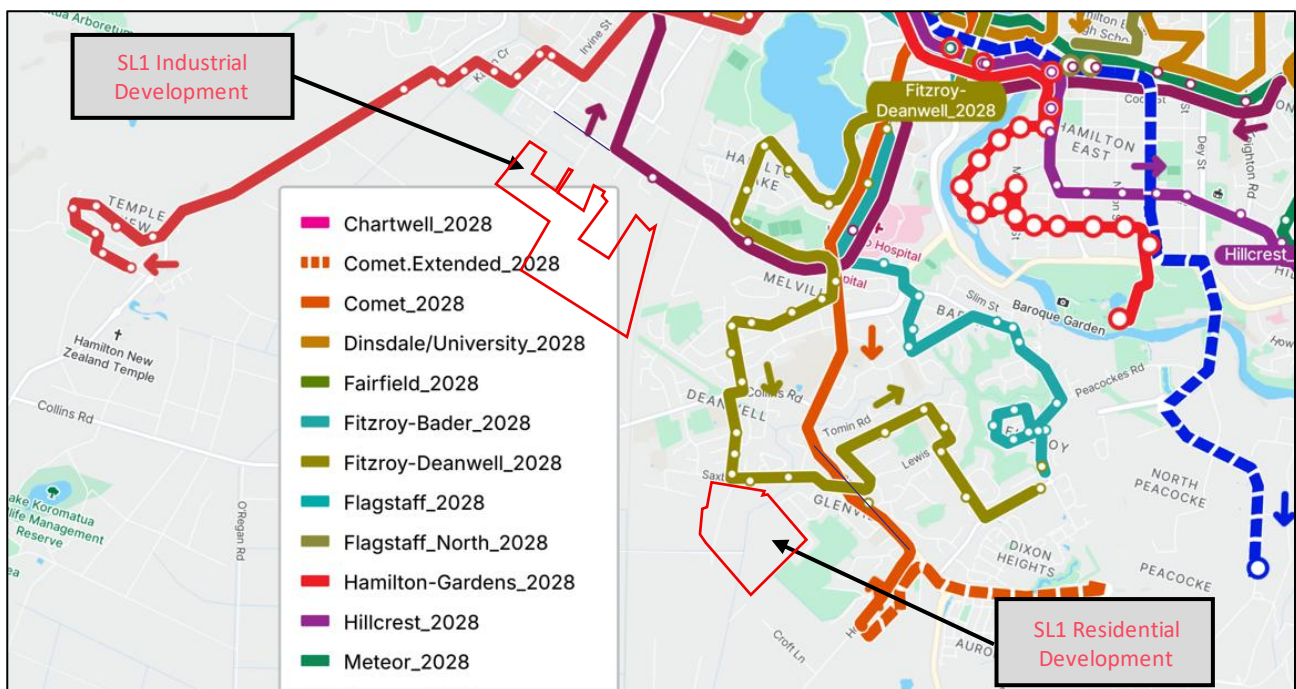


Figure 23: WRC 2028 Hamilton Bus Network Plan



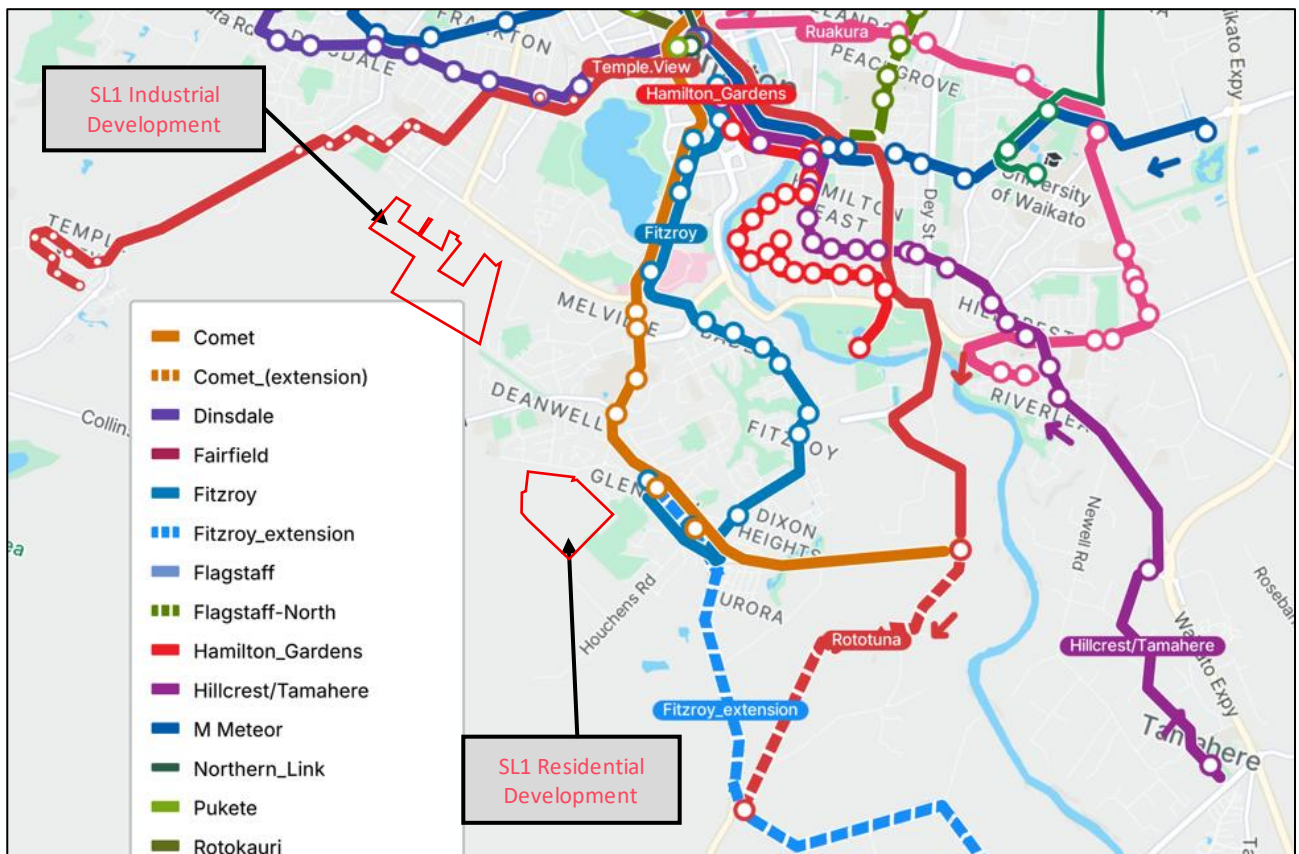


Figure 24: WRC 2037 Hamilton Bus Network Plan

9.1 Industrial Development

Public Transport services presently travel through Higgins Road and Kahikatea Drive as shown in Figure 3. This is likely to continue until the Kahikatea Drive Extension arm at the Greenwood Street / Kahikatea Drive intersection is closed as part of the HSL project. Following its closure, bus services are planned to travel via Lethborg Street.

The Industrial Development provides pedestrian access to existing and future public transport services via the proposed walking and cycling infrastructure and connections to the existing network. Future walking and cycling connections are discussed further in Section 10.1.

9.2 Residential Development

Figure 25 shows indicative bus routes through the proposed Residential Development. The proposed route represented by purple dashed lines demonstrates how it can integrate with WRC's short-term and medium-term proposed bus networks (Figure 23 and Figure 24) by looping through the subdivision and connecting back to Saxbys Road / MacDonald Road intersection.

The bus route represented by maroon dashed lines could potentially be implemented when the SL1 wider growth cell, south of the site, is developed, connecting Saxbys Road to Houchens Road via the extended minor arterial road.



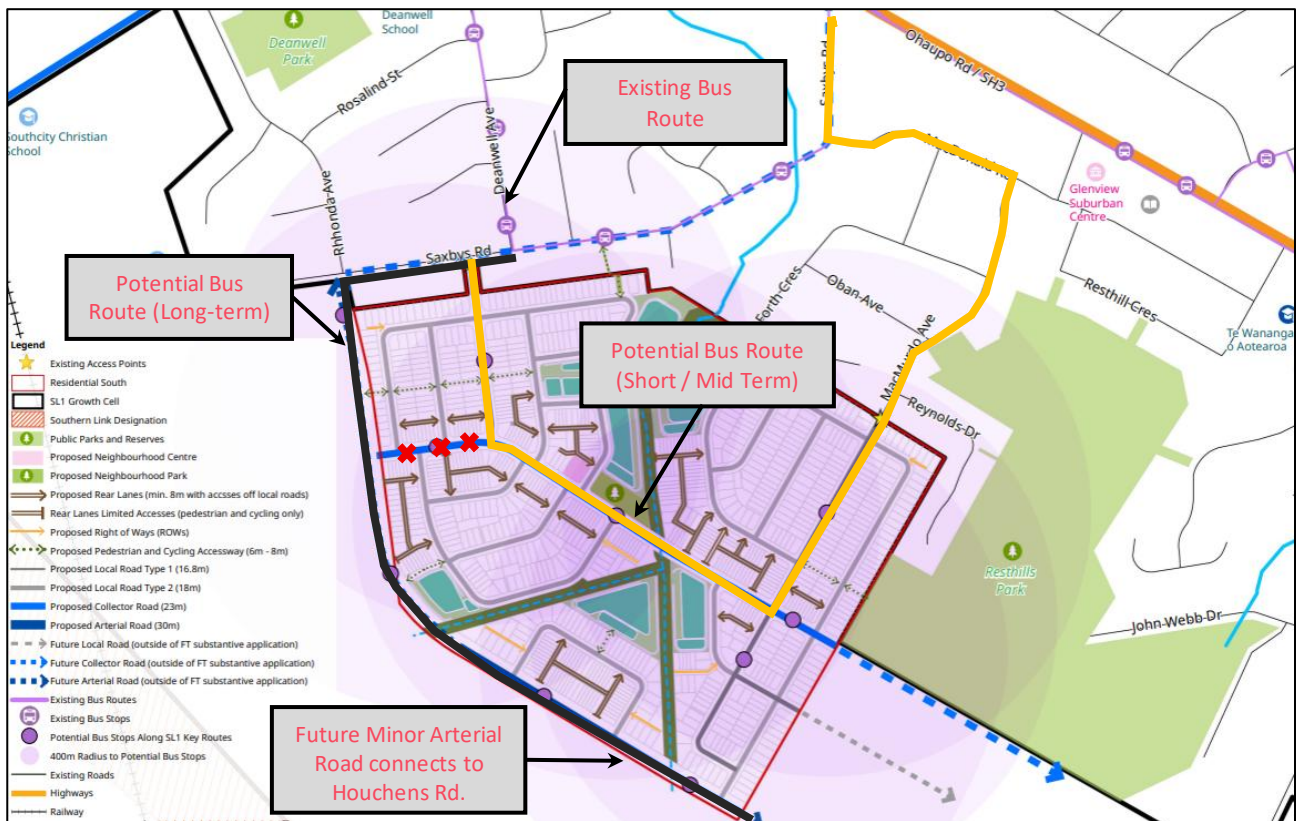


Figure 25: Proposed Bus Route through Residential Development

The Residential Development scheme plan aligns with this assessment by providing suitable road carriageway widths on:

- The minor arterial road (Figure 37) for future PT corridor.
- The internal collector road (Figure 38) for short and mid-term bus routes.
- MacMurdo Avenue extension (Figure 21)

In accordance with the ODP Table 15-5a_{ii}, all bus stops along the internal collector road will be in lane.

10. Walking and Cycling Connections

Walking and cycling infrastructure is an integral part of the SL1 transport network rather than an ancillary amenity. Increasing walking and cycling also supports increased public transport use which together, reduces reliance on private vehicles for local trips. The proposed network is designed to be direct and cohesive while prioritising safety by generally routing users away from higher-volume arterial roads to low speed, low volume roads where suitable alternative local routes exist.

Cycling infrastructure design for SL1 focuses on the following three trip types:

- Short neighbourhood trips within Glenview and Deanwell where walking may be undesirable due to distance. This would include trips to the Glenview Shopping Centre and schools (i.e. Deanwell School and Melville High School).
- Recreational trips within and potentially beyond the wider SL1 growth cell. This would likely connect to existing exploration routes such as the Western Rail Trail.



- Longer distance commuter / education trips, including between neighbourhoods and to employment nodes such as Waikato Hospital and Frankton Industrial area.

The proposed roading network provides a highly connected network of streets, which will enable walking trips to be made on direct routes within and beyond the development. Footpaths are provided to support walking accessibility throughout the Site.

The proposed network for pedestrians and cyclists is shown in Figure 26 and Figure 27. The proposed network is designed to provide direct and connected routes that support everyday trips and reduce dependence on private vehicle travel.

10.1 Industrial Development Walking and Cycling Connections

The indicative walking and cycling network for the Industrial Development is shown in Figure 26. The network has been developed to provide connections between the site, surrounding transport infrastructure, and the wider active mode network.

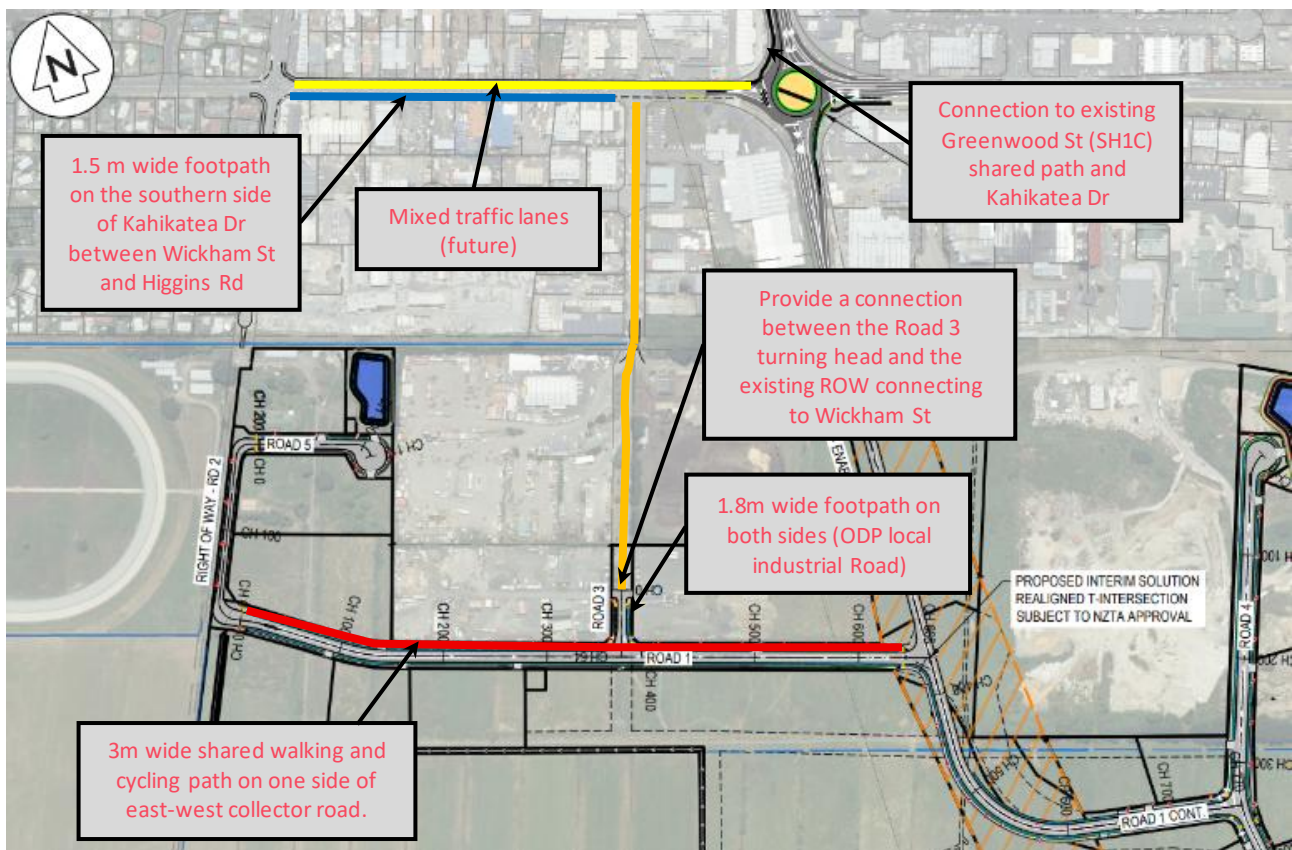


Figure 26: Industrial Development – Proposed Walking and Cycling Network

10.1.1 Shared Walking and Cycling Paths (Red Line)

A 3.0 m wide shared path is proposed along the northern side of the east-west collector road. This facility will form the primary active mode spine through the Industrial Development.

The shared path is intended to connect with the existing 3.0 m shared path on Greenwood Street via Wickham Street and the existing Right-of-Way ("ROW") south of Wickham Street (represented by orange lines in Figure 26). Cycling on Wickham Street and the existing ROW will be accommodated on-road in a shared traffic environment, as is the present case in alignment with the ODP. This arrangement provides



continuity of active mode access from the existing Greenwood Street shared path into the Industrial Development area.

In the longer term, the east-west collector road is expected to be extended westwards through the adjacent Rogerson Block towards Tuhikaramea Road. This would enable the shared path to form part of a broader east-west active mode corridor linking the Frankton industrial area, Greenwood Street shared path and cycling facilities on Tuhikaramea Road. While the timing and delivery of these wider connections are dependent on future development outside the Project area, the proposed shared path has been designed to support that future network integration.

10.1.2 New Footpath Connection (Blue Line)

A new 1.5 m wide footpath (in alignment with the ODP requirements for a collector industrial road) is proposed to provide pedestrian connectivity between the Industrial Development and existing public transport services west of the site. The footpath will enable pedestrians to access existing bus stops on Kahikatea Drive, Higgins Road and Lethborg Street and maintain connectivity to the surrounding pedestrian network.

10.1.3 Mixed Traffic Lanes (Yellow Line)

Kahikatea Drive Extension will experience substantially lower traffic volumes and operating speeds following its permanent closure at the Greenwood Street / Kahikatea Drive intersection as part of HSL Stage 1 implementation. This will create an environment suitable for mixed traffic lanes, providing an on-road cycling connection between the Industrial Development, Greenwood Street shared path and the wider active mode network. Supporting measures such as sharrow markings, wayfinding and traffic-calming treatments could be considered during the detailed design phase.

10.2 Residential Development Walking and Cycling Connections

Walking and cycling wider network connectivity general arrangement plans for the Residential Development are attached as Appendix A.

The proposed active mode network has been developed as an integrated network that connects the Residential Development to key destinations including Deanwell School, Waikato Hospital, the Western Rail Trail, MacDonald Road, Greenwood Street and the wider Hamilton cycling network. The proposed facilities have been selected having regard to corridor function, expected active mode demand, safety outcomes, and the physical constraints of the existing road reserve.

The form of facility varies by location, reflecting the surrounding street environment, available corridor width and the role each corridor performs within the wider network. Higher levels of separation are proposed where cyclist volumes, school travel demand or traffic exposure are expected to be greater, while lower-speed local roads are proposed to accommodate cyclists within the mixed traffic environment.



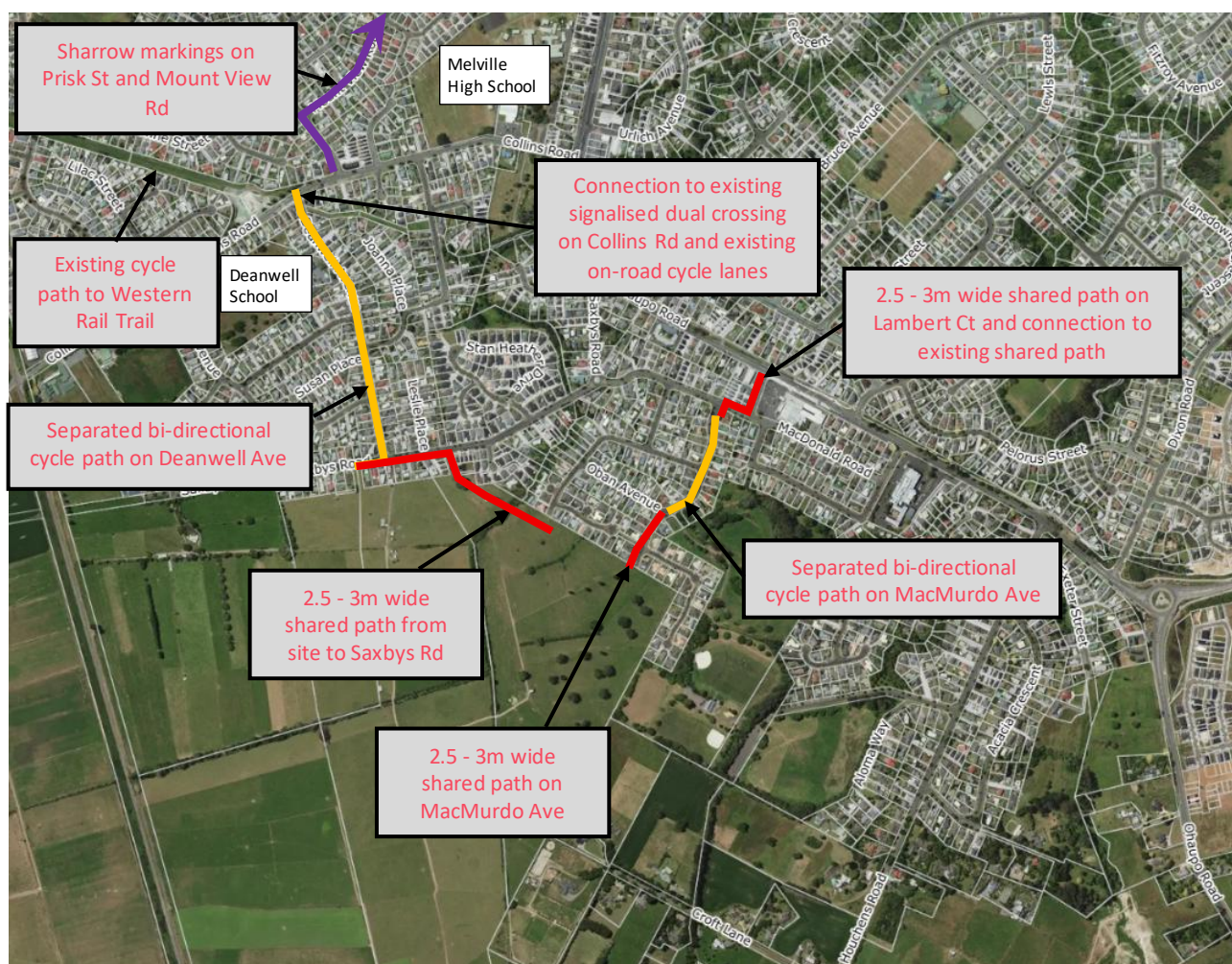


Figure 27: Residential – Proposed Walking and Cycling Network

The proposed walking and cycling network comprise three facility types:

- **Separated bi-directional cycle paths:** These are dedicated cycling facility on one side of the road accommodating cycling in both directions. They involve some form of physical separation (horizontal or vertical components) from motor traffic and pedestrians. In the Residential Development context, these facilities provide key connections to schools and local destinations and can generally be accommodated within the existing sealed carriageway width.
- **Shared walking and cycling paths:** Shared use facilities for pedestrians, cyclists, mobility devices and wheeled recreational devices, without physical separation between user types. These facilities provide a high level of separation from general traffic and are intended to support active mode trips on corridors where a shared path is appropriate.
- **Mixed traffic lanes:** Mixed traffic lanes are common to most roads, where no formal cycle facilities are provided and cyclists can share the roads with general traffic. Prisk Street and Mount View Road are proposed to operate in this manner, with sharrow markings, providing an alternative route to Ohaupo Road while maintaining connectivity to the existing on-road cycle lanes north of Normandy Avenue.

The proposed shared path network is intended to support active mode travel across the development for a broad range of users, while maintaining separation from general traffic lanes. This includes local trips by lower-speed users accessing destinations such as the neighbourhood centre, parks and schools.



Recognising general guidance for shared paths, the width of the shared path on the collector road is proposed at 3.5 m while the shared paths on existing residential streets are proposed at 3.0 m wide due to space constraints with existing trees and infrastructure. This is wider than the “desirable minimum width¹⁵” of 2.5 m for a local access path, and consistent with the typical maximum width included in Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling Edition 2.1 (“AGR Part 6A”). The increased width supports the multi-user nature of the paths and reduces the risk of pedestrian – cyclist conflict.

10.2.1 Saxbys Road

Although Saxbys Road is identified as a local road in the ODP transport corridor hierarchy, it already performs a collector-type function by facilitating movement of people and goods between local destinations and higher-order corridors (i.e. Ohaupo Road). The Residential Development will reinforce that existing function, particularly following development beyond Stage 1, as Saxbys Road will provide the primary connection between the development’s internal collector road network and Ohaupo Road.

In this context, corridor-wide upgrades to fully achieve the ODP collector road cross-section are not considered necessary. Instead, targeted improvements are proposed, comprising the walking and cycling connections described in Section 10.2 and localised rationalisation of on-street parking where required to accommodate those facilities. These works are proposed to be delivered through the development staging framework and associated consent conditions and are to be completed prior to occupation of the relevant stage of Residential Development that relies on access via Saxbys Road. This is reflected in the recommended transport infrastructure staging framework set out in Table No: 44.

The ODP collector road standard recommends a 24.6 m (based on single direction separated cycle paths on both sides of the road) or 23.3 m (based on bi-directional cycle path on one side of the road) road reserve with 6.8 m wide carriageway, 2.1 m wide recessed parallel parking bays and 2 m wide footpaths on both sides of the road. However, given the existing 20.1 m road reserve and carriageway width of approximately 10 m to 12 m, it is not practicable to fully achieve all elements of that cross-section without significant widening and associated effects. In this instance, the Project adopts a targeted, network-based response that is proportionate to the corridor’s existing and future function.

Cycle facilities and a footpath on the southern side of Saxbys Road are not proposed as part of the upgrade. Instead, cycle movements are directed to an alternative parallel route via Deanwell Avenue, Mount View Road and Prisk Street, which provides a lower volume and lower speed environment that is more suitable for active mode users than the Ohaupo Road arterial corridor, while still providing direct access to key destinations including Waikato Hospital and the Western Rail Trail.

A pedestrian refuge island is proposed east of Leslie Place, as shown in Figure 24, to enable pedestrians to cross from the proposed shared path to the existing footpath on the opposite side of the road. This approach reflects a deliberate network design response that prioritises low speed and low volume routes for walking and cycling, rather than duplicating facilities on both sides of a constrained corridor.

As shown in Figure 28, a 3 m wide walking and cycling shared path could potentially be accommodated within the existing 4.5 m wide berm on the southern side of Saxbys Road between Leslie Place and Deanwell Avenue. This would likely require the removal or relocation of existing trees and power/communications feeder poles along approximately 150 m of the road corridor.

The final design and configuration of Saxbys Road will be confirmed at the detailed design stage, having regard to corridor constraints, safety outcomes, and input from HCC. The 3.0 m wide shared path along Saxbys Road, together with the associated wetland connection to the development, is to be delivered as part of Stage 1A and prior to occupation of any Stage 1A lots.

¹⁵ Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling, Edition 2.1, Table 5.3





10.2.2 MacMurdo Avenue

MacMurdo Avenue forms an important local active mode connection between the Residential Development, MacDonald Road, Lambert Court and the wider network to the north and east. A shared path is proposed on MacMurdo Avenue between the site and Oban Avenue, transitioning to a separated bi-directional cycle path with adjoining footpath between Oban Avenue and MacDonald Road. This approach responds to the differing corridor constraints and network function along the route while maintaining continuity of connection for cyclists and pedestrians.

Between the site and Oban Avenue, where the road reserve narrows to approximately 17 m, a 3.0 m shared path can be accommodated within the existing corridor. Between Oban Avenue and MacDonald Road, a separated bi-directional cycle path is proposed so that the removal of mature trees in the eastern side road berm can be avoided. Accommodating that treatment within the existing road reserve requires removal of on-street parking along parts of the corridor and provision of localised recessed parking bays.

This response is consistent with HCC's Parking Policy (V2 March 2024)¹⁶, which gives greater priority to safe and efficient movement of people than to long-stay parking on residential streets. While some demand for on-street parking is expected, the Project retains as much parking as practicable through recessed bays while prioritising provision of the walking and cycling connection within the constrained existing road reserve.

¹⁶ <https://hamilton.govt.nz/assets/Uploads/Documents/Policies/Hamilton-City-Parking-Policy.pdf>



Location	Central City/ Commercial areas	Residential	Employment
Overarching Priority	Safety		
1 st Priority	Movement and place	Movement and place	Movement and place
2 nd priority	mobility parking spaces	mobility parking spaces	mobility parking spaces
3 rd priority	Bus stops	Bus stops	Loading and servicing
4 th priority	Loading and servicing	Residents' parking	Bus stops
5 th priority	Biking and micro-mobility parking	Biking and micro-mobility parking	Biking and micro-mobility parking
6 th Priority	Short to medium stay parking	Short to medium stay parking	Short to medium stay parking
7 th Priority	Long-stay/ commuter parking	Long-stay/ commuter parking	Long-stay/ commuter parking

Figure 29: Prioritisation of Road Space (HCC Parking Policy – Principle Two)

The walking and cycling connection along MacMurdo Avenue, and continuing to MacDonald Road and Lambert Court, is to be delivered prior to Stage 1C of the Residential Development (approximately 198 dwellings). This reflects the point at which active mode demand is expected to become more established, and the route begins to perform a stronger wider-network function.

This is on the basis that in Stage 1A and 1B, the demand for walking and cycling infrastructure is expected to still be low, whereas cycling trips in Stage 1C are expected to increase to more than 10 users per hour based on the calculation method described in Section 12.2.2 and an aspirational active mode share target of 11.4% (i.e. target for 2045 with full development within Residential Development).

AGRD Part 6A, Figure C1 identifies that fewer than 10 users (cyclists or pedestrians) per hour is considered low volume demand. As the path volumes (i.e. both pedestrians and cyclists) on MacMurdo Avenue are expected to range between 10 to 30 users per hour across all horizon years, the risk of conflict between pedestrians and cyclists is low and therefore does not justify a bi-directional cycle path separate from the footpath.





Figure 30: Indicative Alignment and Cross-section of MacMurdo Ave

10.2.3 Deanwell Avenue

Deanwell Avenue is an important transport corridor linking the Residential Development and wider Resthill residential area to Deanwell School and the Hamilton Cycle Network via the Western Rail Trail. The number of primary school aged children walking and cycling to Deanwell School is expected to increase significantly with the development of SL1, and Deanwell Avenue will also become a primary route for commuter cyclists travelling to and from Waikato Hospital and the CBD via Prisk Street and Mount View Road.

Therefore, for the safety of all cyclists, but particularly primary school aged students, a 3.0 m wide bi-directional cycle path is proposed on the western side Deanwell Avenue as shown in Figure 31.

The indicative cross-section demonstrates that a bi-directional cycle path can be accommodated within the existing 18.3 m wide road reserve. However, this involves the removal of on-street parking on the western side of the road and a reduction in traffic lane widths to 3.1 m. Existing Lane widths would be maintained on approaches and exits to existing roundabouts, while wider 3.4 m lanes are proposed adjacent to the existing bus stop shelter. There is also a 0.8 m wide buffer to allow properties to place their wheelie bins without obstructing both the path users as well as the traffic lanes.

It is recommended that the bi-directional cycle path on Deanwell Avenue and the sharrow markings on Prisk Street and Mount View Road be provided prior to Stage 3 (i.e. 725 dwellings). This is on the basis that a



moderate walking and cycling demand (i.e. approximately 30 cyclists plus 30 pedestrians per hour) is expected to be generated by the Residential Development on Deanwell Avenue based on the calculation method described in Section 12.2.2 and an aspirational active mode share target of 11.4% (i.e. target for 2045 with full development within the Residential Development). The path volumes (i.e. both pedestrians and cyclists) on Deanwell Avenue are expected to reach approximately 110 users per hour in 2045 and thus a separated cycle path is considered appropriate to limit the incidence of conflict between users.

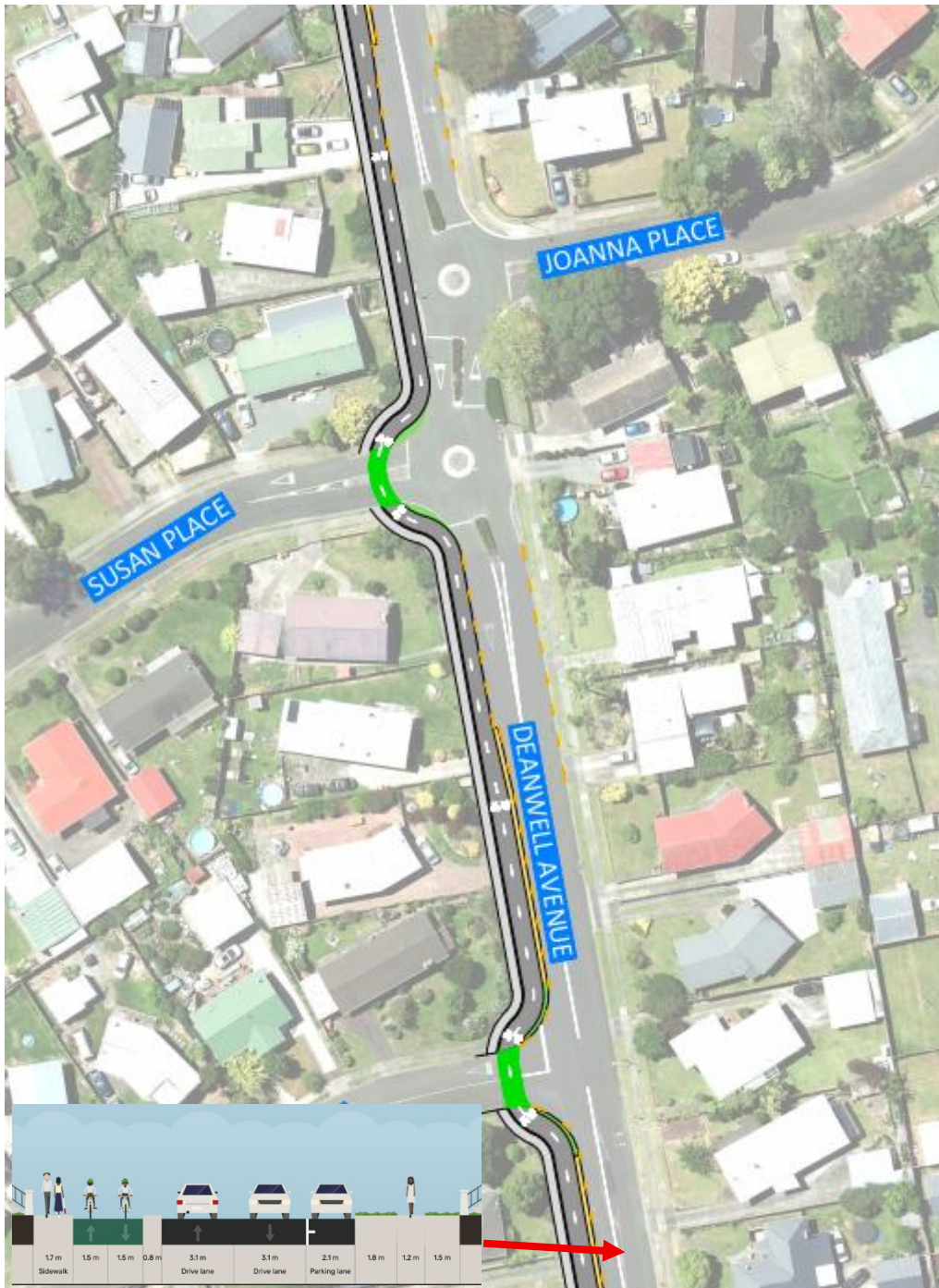


Figure 31: Indicative Alignment and Cross-section of Deanwell Ave

11. Internal Road Network

The road networks in the Industrial and Residential developments are designed to encourage multi-modal transport in response to differing operational requirements. The proposed road hierarchy reflects expected



traffic volumes including heavy vehicles, active mode requirements, future access for public transport and the surrounding land use context. The subdivision layouts were assessed against Table 15-5a(ii) of the ODP, which provides indicative geometric standards for each road classification. Where appropriate, the proposed cross-sections have been refined to respond to the specific context, transport function and anticipated demand associated with the development.

11.1 Road Carriageway Widths

11.1.1 Industrial Development

Figure 32 illustrates the proposed road network for the Industrial Development, and the road hierarchy and widths are shown in the legend. The road corridor typologies are designed to appropriately cater for heavy vehicle traffic associated with industrial activities, along with safe provision for walking and cycling to provide travel-mode options for future workers in the area.

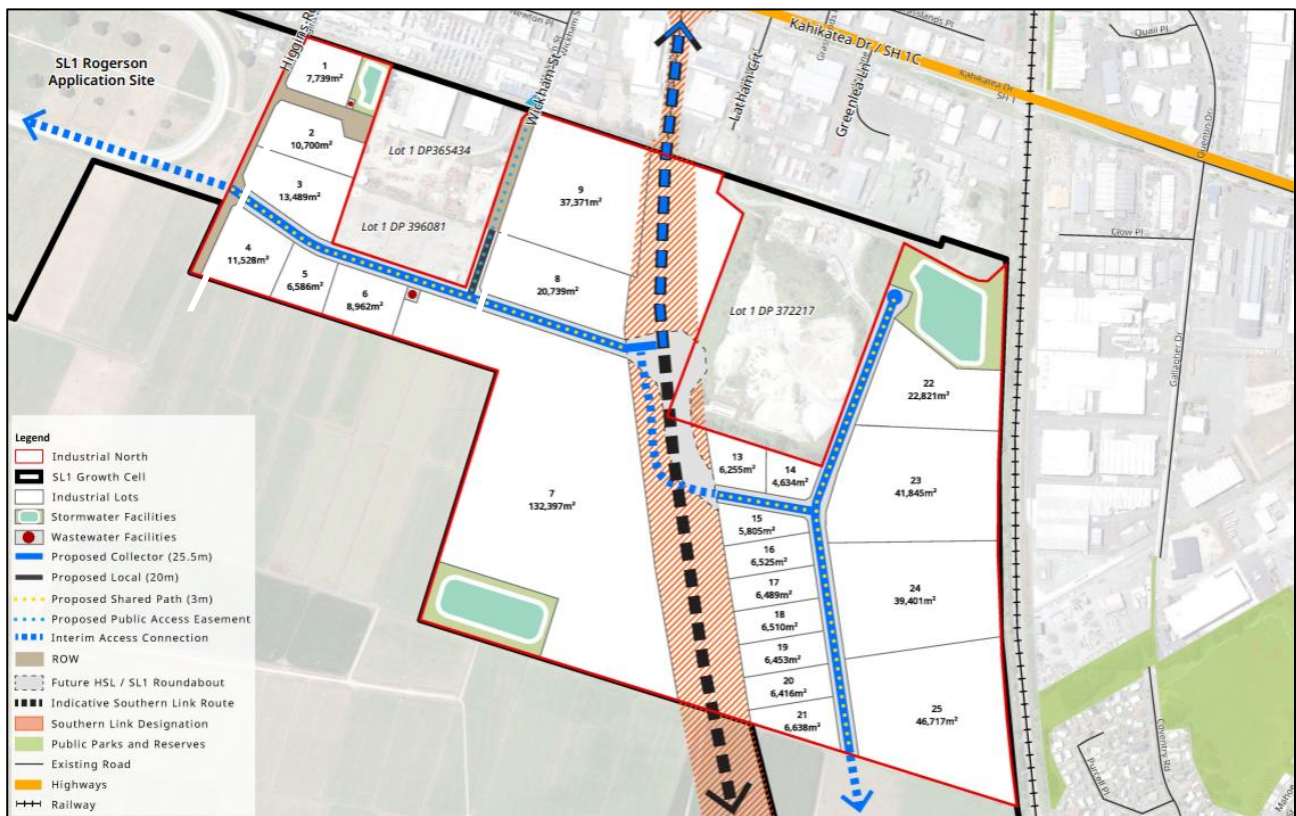


Figure 32: Industrial Development – Road Carriageway Width Hierarchy

Industrial Collector Road

The collector road will provide the principal movement corridor through the Industrial Development, with its primary connection via the SL1 roundabout on HSL. The position of the collector road future proofs it for extension west to Tuhikaramaea Road to provide an integrated collector road corridor through the adjacent SL1 Rogerson Block (a Fast-Track referred project) when that area is developed.

The proposed collector road cross-section is illustrated in Figure 33. It provides a carriageway width of 11.5 m inclusive of a 2.5 m wide flush median within a 25.5 m wide road reserve. A 3.0 m wide shared walking and cycling path is provided on the northern side of the road to support active mode access within the Industrial Development and connections to the wider walking and cycling network. Pockets of recessed parallel parking bays are provided on both sides of the carriageway.



However, the proposed collector road cross-section does not fully align with the ODP standard, which recommends a 27.8 m or 26.5 m wide road reserve and provision of a separated bi-directional cycleway and footpath on both sides of the road.

This assessment finds that a single 3.0 m wide shared walking and cycling path on one side of the road is sufficient active mode infrastructure because future use is unlikely to be high as through trips by walking and cycling are expected to be low in this location on the southeastern perimeter of Hamilton. Accordingly, a 25.5 m wide road reserve width is considered appropriate. Furthermore, a shared path facility is consistent with nearby active mode facilities, including the primary network path on Greenwood Street.

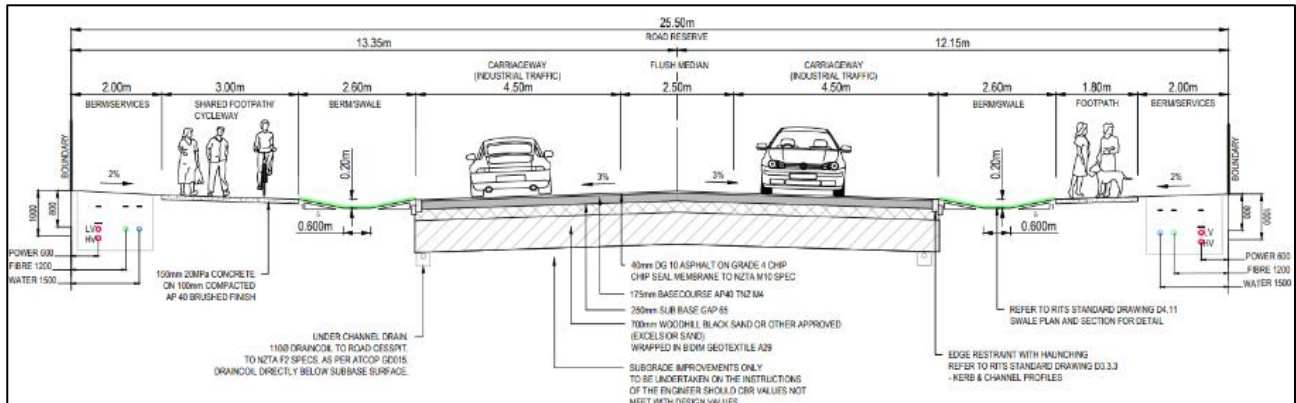


Figure 33: Industrial Development – Collector Road Indicative Typical Cross-section

Industrial Local Road

Local roads within the Industrial Development will fulfil ODP minimum requirements for a local industrial road as shown in Figure 34.

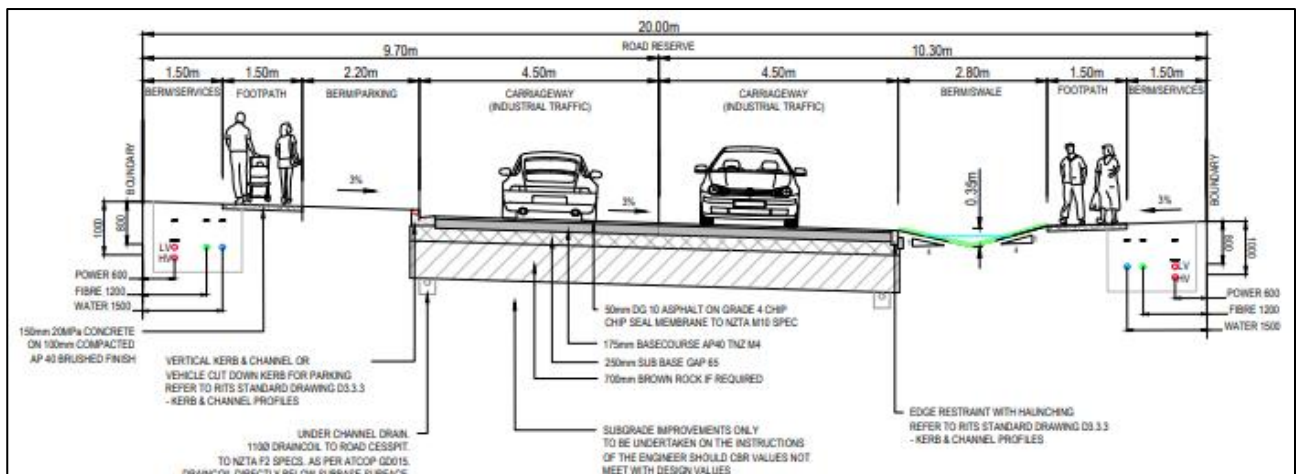


Figure 34: Industrial Local Road Indicative Typical Cross-Section

Industrial Private Right-of-Ways ("ROW") / Jointly Owned Access Lots ("JOAL")

All ROWs / JOALs are expected to be private roads. However, they have a carriageway width of 7 m which is in accordance with the Regional Infrastructure Technical Specifications V2 ("RITS"). The RITS Section 3.3.11.4 (c) specifies a minimum carriageway width of 6.4 m for an industrial private way serving two or more lots. The ROWs / JOALs can accommodate a 12.6 m rigid truck in accordance with RITS.



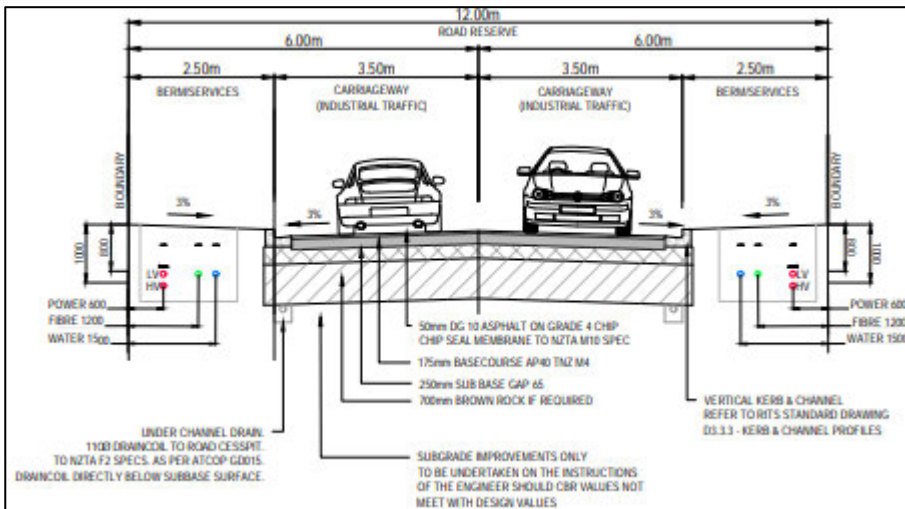


Figure 35: Industrial ROW Indicative Typical Cross-Section

11.1.2 Residential Development

Figure 36 illustrates the proposed road network for the Residential Development, and the road hierarchy and widths are shown in the legend. The road corridor typologies are designed to appropriately cater for vehicle traffic that is typically anticipated, along with safe provision for walking and cycling and PT.



Figure 36: Residential Development – Road Carriageway Width Hierarchy

Residential Minor Arterial Road

A 500 m long section of the minor arterial road is proposed to be constructed as part of the Residential Development along the southern boundary of the site. This road is expected to be extended northwards with a connection to Saxbys Road, and southwards towards Houchens Road when land surrounding the road (but not included in this Project) is developed in future.



The ODP requires minor arterial roads within a residential land use environment to be a two-lane transport corridor with a 3 m flush median. All bus stops along a minor arterial corridor are expected to be kerbside and separated cycle lanes on both sides or bi-directional off-road separated from carriageway one side is to be provided.

To maintain flexibility for the minor arterial road to potentially serve as a future bus route or frequent transit corridor, the corridor has been designed and safeguarded to enable future public transport priority measures, if required. This ITA does not assume or require dedicated public transport lanes as part of the Project. Figure 26 illustrates a representative typical cross-section.

Delivery of the full minor arterial road carriageway is not required to support the level of development proposed by the Residential Development. Accordingly, only one half of the ultimate carriageway (i.e. one lane in each direction) is proposed to be constructed initially. The balance of the carriageway can be delivered at a later stage when the wider SL1 growth cell to the south and west of the minor arterial road (not part of this Project) is developed. This will include connection of the minor arterial road to Saxbys Road and Houchens Road.

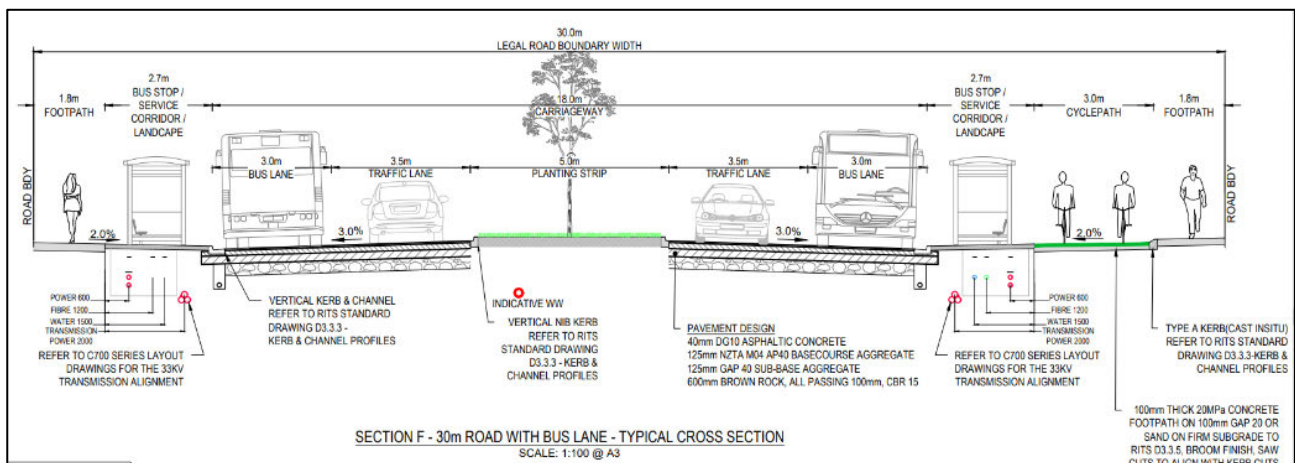


Figure 37: Residential Development – Minor Arterial Rd Indicative Typical Cross-section

Residential Collector Road

The primary access through the Residential Development is proposed via the north-south collector road. The indicative cross-section of the residential collector road is illustrated in Figure 38. This road typology provides a carriageway width of 7.0 m within a 23.0 m wide road reserve. Certain sections of the collector road include a 3.3 m wide flush median as shown in Figure 39 to facilitate right turning movements into side local roads

A 3.5 m wide shared walking and cycling path is provided on one side of the road and recessed parallel parking bays are provided on both sides of the carriageway. While separated cycleways (Table 15-5a(ii) of the ODP) were considered during development of the cross-sections, they were not preferred due to the existing walking and cycling shared paths in the adjoining road network. A shared path will ensure the continuity of the facility type.



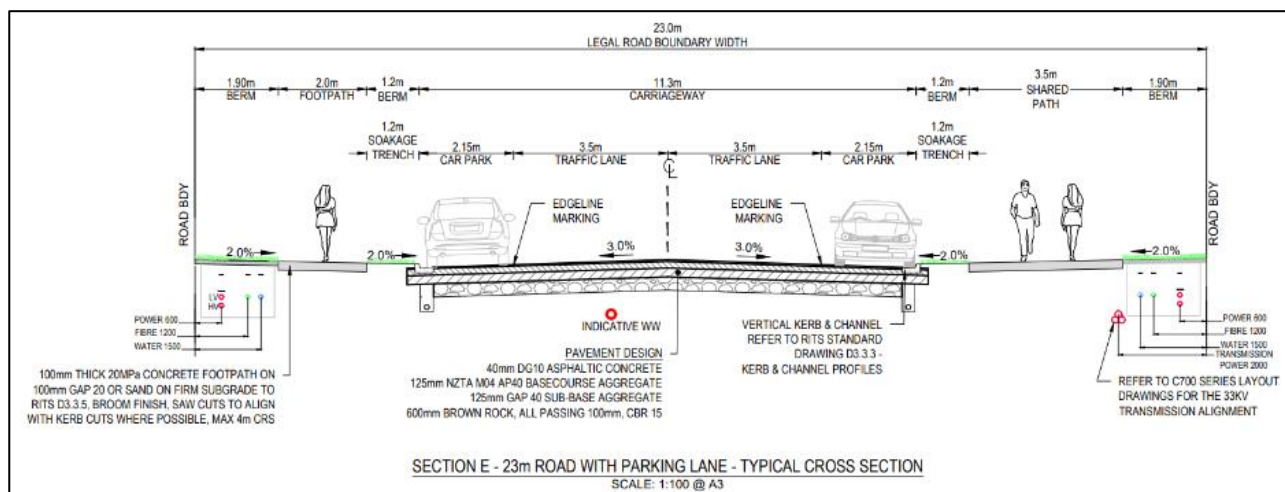


Figure 38: Residential Development – Collector Rd Indicative Typical Cross-section

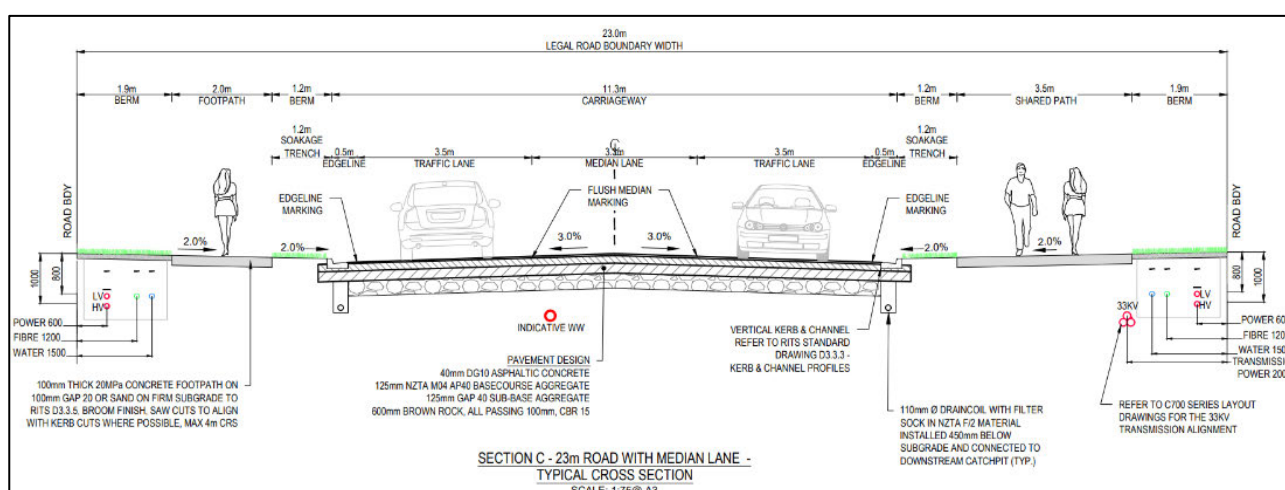


Figure 39: Residential Development – Collector Rd with Flush Median Indicative Typical Cross-section

Residential Local Road Type 1

Refer to Section 8.2.1 with regards to proposed MacMurdo Avenue extension.

Residential Local Road Type 2

All other internal roads will be designed as per the cross-section illustrated in Figure 40. This local residential road typology provides a carriageway width of 6 m within a 16.8 m wide road reserve in accordance with the ODP. 1.8 m wide footpaths and 2.1 m wide recessed parallel parking bays are provided on both sides of the carriageway. It is intended that cyclists can safely share the road with vehicles on local roads given the low vehicle speeds and volumes on these roads.



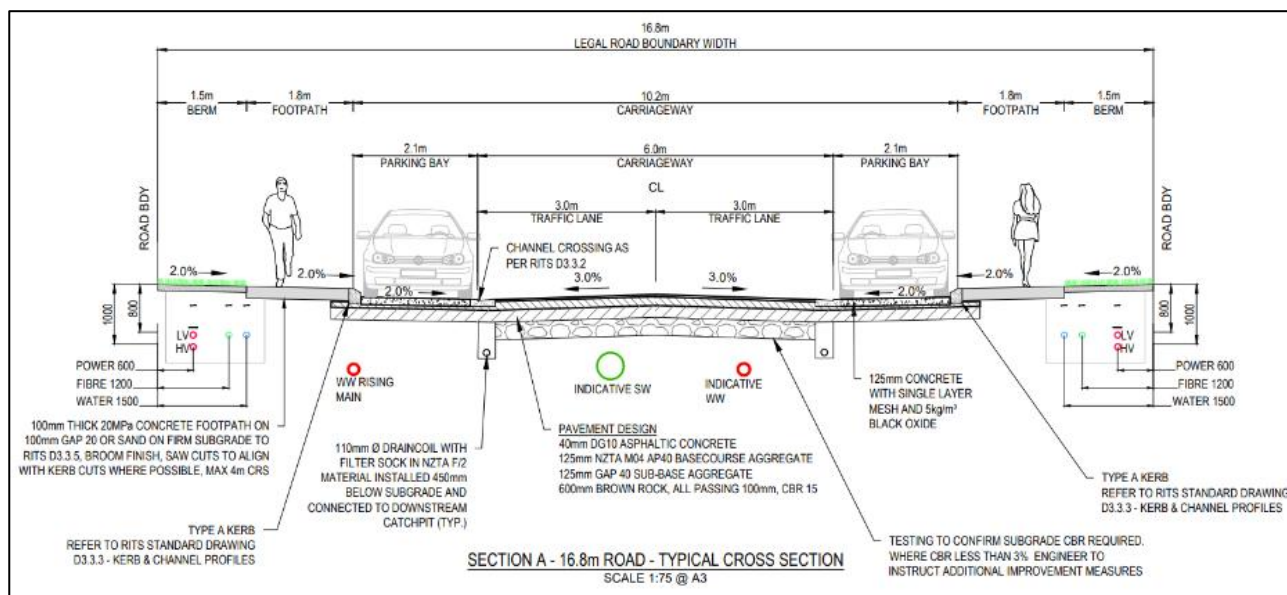


Figure 40: Residential Development – Local Rd Type 2 Indicative Typical Cross-section

JOAL / Rear Lanes

JOAL or rear lanes where proposed, will be designed in accordance with the ODP and confirmed through detailed design.

11.2 SL1 Development Intersections

The RITS requires the following separation distance between intersections. The proposed internal intersections fulfil these minimum requirements.

	LOCAL ROADS	COLLECTOR OR ARTERIAL ROADS	INDUSTRIAL ROADS
Same Side	60m	90m	200m
Opposite Side	30m	45m	100m

Figure 41: Minimum Intersection Spacing (Source: RITS)

Local road intersections are expected to be designed and constructed as priority-controlled intersections, either in the form of a T-intersection, or a crossroad with the side road giving way (or stopping). Kerb buildout could potentially be provided to support reduced pedestrian crossing lengths. This is a design detail that can be addressed at Engineer Plan Approval stage with HCC.

Specific intersections within the site will be in the form of a compact roundabout with a raised central island and mountable apron/collar.

Internal intersection designs will be addressed in detailed design phase.

Recommended Condition

All new road intersections shall be designed in accordance with the relevant Austroads Guide to Road Design and applicable Waikato Regional Infrastructure Technical Specifications, with final designs confirmed through the detailed design and engineering approval process.



12. Trip Generation

12.1 Travel Mode Splits

The future year periods assessed for the Project are 2030, 2035, 2045 and 2055. While the Project's transport effects are principally assessed through the 2030, 2035 and 2045 scenarios, a 2055 scenario has also been included to understand the longer-term performance of the wider transport network under a broader growth scenario. This scenario incorporates development beyond the Project, including other areas of the wider SL1 growth cell, and is intended to provide strategic context only.

Public Transport and active travel mode shares have been increased incrementally to take account of the increasing provision of walking and cycling facilities within the proposed development areas and on the adjoining road network. Table No: 7 and Table No: 8 below present the aspirational active mode and PT mode share targets for the various periods assessed.

The forecast mode shares should not be interpreted as guaranteed outcomes. Rather, they represent reasonable planning assumptions having regard to the proposed urban form, active mode connections, future public transport opportunities and strategic planning framework. Achievement of future mode share outcomes will be influenced by future transport investment, service provision, fuel price and travel behaviour trends.

12.1.1 Industrial Development Travel Mode Estimates

Travel mode splits in 2030 are estimated based on the 2023 Census data for travel to work in the Frankton Junction area of Hamilton (industrial zone).

The 2035 travel mode splits are based on 2023 Census data on how people travel to work in Riverlea and Ruakura (Hamilton). These statistical areas consist of industrial land use with good accessibility to walking and cycling, and PT networks to surrounding residential areas, therefore are considered reasonable proxies to anticipate the mid-term uptake of PT and active travel modes.

The 2055 travel mode splits are based on 2023 Census data on how people who work in Rongotai and Miramar South in Wellington travel to work. These statistical areas within Wellington consist of industrial land use and have high frequency routes currently servicing the areas as shown in Figure 42. This is also aligned with the Waikato Regional Transport Plan that indicates a frequent bus route is envisioned at the Kahikatea / Frankton area by 2032 (refer to Figure 9).

The 2045 travel mode splits for public transport and active modes have been adopted as reasonable and conservative assumptions having regard to the 2035 and 2055 mode share scenarios. They are intended to represent a gradual transition towards higher public transport and active mode use over time, rather than a direct interpolation between the two scenarios.

Table No: 7

Travel Mode Splits – Industrial Development				
Travel Mode	2030 ¹⁷	2035	2045	2055
Private Vehicle (Driver)	90.3%	84.5%	82.6%	78.2%
Public Transport	1.2%	2.2%	4.0%	6.8%

¹⁷ <https://tools.summaries.stats.govt.nz/places/SA2/frankton-junction#main-means-of-travel-to-work>



Active Mode	3.4%	8.4%	8.5%	10.1%
Private Vehicle (Passenger)	3.2%	3.2%	3.2%	3.2%
Working from Home	0.5%	0.5%	0.5%	0.5%
Other	1.2%	1.2%	1.2%	1.2%

The working from home component shown in Table No: 7 reflects Census travel-to-work reporting for the comparator industrial areas only. It has not been applied as a reduction to the adopted Industrial Development vehicle trip generation rate (refer to Section 12.2.1), as the adopted rate is based on observed vehicle trips per developable hectare and already reflects the operational characteristics of comparable industrial activity.

12.1.2 Residential Development Travel Mode Estimates

Travel mode splits in 2030 are estimated using 2023 Census data on how people who live in Resthill, Hamilton travel to work.

2035 PT and active mode shares are based on 2023 Census data from Peachgrove-Greensboro, Hamilton East and Hillcrest (all in Hamilton). These areas currently densely populated (approximately 7,000 to 10,000 population) with good accessibility to PT and walking and cycling connections.

2045 PT and active mode shares are based on 2023 Census data from statistical areas within Wellington comprising predominantly medium density residential land use and served by existing high frequency public transport routes (i.e. Island Bay, Lyall Bay and Miramar East). These areas are not in central Wellington and have been selected because they represent suburban residential environments where frequent public transport services support higher levels of public transport and active mode use (refer to Figure 42). For context, Table No: 9 below presents the typical service frequencies for the for the three high-frequency Metlink bus routes in Wellington, based on current Metlink / Transit App data (as of April 2026).

The Wellington comparator areas are not intended to directly predict future travel behaviour within the Residential Development area. Rather, they provide examples of mode share outcomes achieved in New Zealand urban environments that are served by frequent public transport corridors and supported by high-quality walking and cycling infrastructure.

Ohaupo Road (SH3) is identified in the PT Pathways Report as a bus priority transport corridor, serving Glenview with one frequent bus services (i.e. Comet – Tier 1 frequent service). By the long-term network (i.e. 2038), this route operates at a 10-minute peak frequency which equates to approximately 6 buses per hour per direction. This level of service is consistent with the frequencies of the Metlink bus routes identified above. Therefore, this assessment considers that the adopting Census data from the identified statistical areas within Wellington provides a reasonable proxy of the mode share split that can be expected in the year 2045. Frequent bus services provide substantial passenger-carrying capacity and enables a proportion of future travel demand to be accommodated by public transport rather than additional private vehicle movements.

2055 PT and active mode shares are aspirational mode-shift from car dependence during commuter peaks, but it is supported by the proposed medium-density residential in SL1 (reduced car parking and garaging) and aligns with the “transformational” shift to PT enabled by the Rapid Transit Network key moves envisaged in the Waikato Metro Spatial Plan. The MSP Programme Business Case states in Section 1.8 that *“The assessment of the public transport and active modes share in 2051, and based upon the preferred land use scenario 2a, has concluded that the region wide mode shift would be 20%; with the ability to achieve up to 44% (forecast as 32% for public transport and 12% for walking/cycling and micromobility) in the identified*



key BRT corridors of Hamilton City.”. This is further supported by the PT Pathways Report which states that the Comet – Tier 1 frequent route is expected to “eventually transition to BRT, which would have dedicated rights-of-way or continuous bus lanes, purpose-built bus stations, and dedicated traffic signalling at all locations”.

Table No: 8

Travel Mode Splits – Residential Development				
Travel Mode	2030 ¹⁸	2035	2045	2055
Private Vehicle (Driver)	77.2%	70.6%	59.2%	44.5%
Public Transport	3.9%	4.6%	13.9%	30%
Active Mode	3.4%	9.3%	11.4%	10%
Private Vehicle (Passenger)	3.7%	3.7%	3.7%	3.7%
Working from Home	10.8%	10.8%	10.8%	10.8%
Other	1.4%	1.4%	1.4%	1.4%

¹⁸ <https://tools.summaries.stats.govt.nz/places/SA2/resthill#main-means-of-travel-to-work>





Figure 42: Wellington City PT Network (Source: Wellington Regional Public Transport Plan, 2021 – 2031)

Table No: 9

Typical Service Frequencies for Metlink Bus Routes in Wellington			
Route	Core Corridor	Peak Frequency ¹⁹	Buses per peak hour (per direction) ²⁰
1	Johnsonville – CBD – Island Bay	8–10 min	6–8
2	Karori – CBD – Miramar/Seatoun	7–8 min	7–9

¹⁹ Relate to headways (minutes between buses)

²⁰ Calculated by converting documented peak headways (by Metlink and Transit App) into buses per direction per hour



3	Lyall Bay – Newtown – CBD	7–10 min	6-9
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12.2 Predicted Trip Generation

12.2.1 Industrial Development

The trip generation rates surveyed at the Central Precinct of the Airport Business Zone (Hamilton Airport - Titanium Park) are considered applicable to the proposed industrial land use in SL1. The Airport Business Zone has been gradually developed into one of the region's strategic industrial nodes and therefore provides a reasonable proxy to predict the number of trips that are likely to be generated by the proposed SL1 Industrial Development activities. Thus, a daily trip generation rate of 138.5 per developable hectare and a peak hour trip generation rate of 16.3 per developable hectare were adopted for this ITA.

It is recognised that the adopted trip generation rate pertains specifically to vehicles. It should be noted, however, that public transport accessibility as well as walking and cycling infrastructure are currently limited within the surveyed Central Precinct. As such, BBO considers that a proportion of these vehicle trips could transition to public transport or active modes, particularly in the context of the proposed Industrial Development area where new walking and cycling infrastructure linking to existing bus stops is recommended.

To recognise the potential for increased public transport and active mode uptake over time, a proportion of the vehicle trips derived from the Titanium Park surveys has been assumed to transition to public transport and active modes in future years. For the purposes of this assessment, an assumed mode shift of 5.8% has been applied in 2035, increasing to 7.7% in 2045 and 12.1% in 2055. The remaining vehicle trips were then assigned to the road network. Table No: 10 to Table No: 12 summarise the resulting trip generation assumptions.

Person-trip rates as outlined in the NSW Guide have not been adopted, as these are based on gross floor area (GFA) and the site coverage details for the Industrial Development remain unconfirmed at this time.

Table No: 10

Predicted Trip Generation – Industrial Development Year 2035 Scenarios 2 and 3					
Year	Dev Area (ha)	Peak Hour Vehicle Trip Gen Rate (veh trips / dev ha / hr)	Total no. of vehicle trips generated during peak hour	Assumed PT and Active Mode Shift (5.8%) (veh trips / hr)	Remaining Vehicle Trips (94.2%) (veh trips / hr)
2035	40	16.3	652	38	614
Total Trips Modelled in WRTM	35.8				536
					15%



Table No: 11

Predicted Trip Generation – Industrial Development Year 2045 – Scenario 4					
Year	Dev Area (ha)	Peak Hour Vehicle Trip Gen Rate (veh trips / dev ha / hr)	Total no. of vehicle trips generated during peak hour	Assumed PT and Active Mode Shift (7.7%) (veh trips / hr)	Remaining Vehicle Trips (92.3%) (veh trips / hr)
2045	40	16.3	652	50	602
Total Trips Modelled in WRTM	35.8				535
					12%

Table No: 12

Predicted Trip Generation – Industrial Development Year 2055 – Scenario 5					
Year	Dev Area (ha)	Peak Hour Vehicle Trip Gen Rate (veh trips / dev ha / hr)	Total no. of vehicle trips generated during peak hour	Assumed PT and Active Mode Shift (12.1%) (veh trips / hr)	Remaining Vehicle Trips (87.9%) (veh trips / hr)
2055	40	16.3	652	79	573
Total Trips Modelled in WRTM	35.8				507
					13%

WRTM modelling for the Project was undertaken at an earlier stage of the project using the best available land use assumptions at that time. As the Masterplan has subsequently been refined, the developable area within the Industrial Development has increased relative to the land use inputs adopted in the WRTM model runs.

A comparison of the refined trip generation calculations with the WRTM outputs indicates that the WRTM model runs represent lower Industrial Development traffic than that derived from the updated developable area and adopted trip generation assumptions. The difference ranges from approximately 12% to 15% across Scenarios 2 to 5, with an average difference of approximately 13%. To ensure the intersection assessments are based on a conservative demand scenario, the Industrial Development turning movements extracted from the WRTM were increased by 13% prior to undertaking the SIDRA assessments. The additional Industrial Development traffic was distributed across the assessed intersections in accordance with the WRTM trip distribution patterns. The magnitude of the adjustment (i.e. 13%) is relatively modest and does not materially alter the strategic distribution of trips within the network but ensures that intersection performance assessments are based on a conservative demand scenario.

Accordingly, the assessment adopts WRTM-derived trip distribution patterns together with locally refined trip generation assumptions based on the updated developable area. The application of a 13% uplift to the WRTM Industrial Development traffic ensures that the intersection assessments are conservative while maintaining consistency with the strategic traffic distribution represented within the WRTM.

12.2.2 Residential Development

As the number of low, medium and high-density lots are known, person-trip rates for each residential land use were adopted from the *NSW Government Guide to Transport Impact Assessment* ("NSW Guide") to estimate the number of trips generated by the proposed development during the peak hour. For the



purposes of trip generation calculation, the proposed high-density lots have been assessed using the medium-density person-trip rate, as they do not align with the NSW Guide definition of high-density residential dwellings.

Table No: 13 to Table No: 17 outline peak hour trip generation calculation for various development scenarios.

Table No: 13

Predicted Trip Generation – Residential Development – Scenarios 1A to 1E (Year 2030 Stage 1)							
Type of Residential Unit	No. of Units	Peak Hour Person Trip Gen Rate ²¹ (person trips / dwelling / hr)	Total no. of person trips generated during peak hour	PT (3.9%) (person trips / hr)	Active Modes (3.4%) (person trips / hr)	Private Veh ²² (80.9%) (veh trips / hr)	Calculated Vehicle Trip Generation Rate
Lower density	119	1.15	137	5	5	85	0.72
Medium density	202	1.09	220	9	7	137	0.68
Total	321	-	357	14	12	222	-

Table No: 14

Predicted Trip Generation – Residential Development – Scenario 2 (Year 2035 Stages 1 and 2)							
Type of Residential Unit	No. of Units	Peak Hour Person Trip Gen Rate (person trips / dwelling / hr)	Total no. of person trips generated during peak hour	PT (4.6%) (person trips / hr)	Active Modes (9.3%) (person trips / hr)	Private Veh (74.3%) (veh trips / hr)	Calculated Vehicle Trip Generation Rate
Lower density	200	1.15	230	11	21	131	0.66
Medium density	343	1.09	374	17	35	214	0.62
Total	543	-	604	28	56	345	-
Total Trips Modelled in WRTM						316	9% (Difference)

²¹ Based on NSW Guide. Rates are average of the AM and PM peak hour person trip generation rates.

²² Assumes a vehicle occupancy of 1.3 persons per vehicle in accordance with NSW Guide. Vehicle trips = (Person trips x car mode share %) / (Assumed vehicle occupancy)



Table No: 15

Predicted Trip Generation – Residential Development – Scenario 3 (Year 2035 Stages 1 to 3)							
Type of Residential Unit	No. of Units	Peak Hour Person Trip Gen Rate (person trips / dwelling / hr)	Total no. of person trips generated during peak hour	PT (4.6%) (person trips / hr)	Active Modes (9.3%) (person trips / hr)	Private Veh (74.3%) (veh trips / hr)	Calculated Vehicle Trip Generation Rate
Lower density	256	1.15	294	14	27	168	0.66
Medium density	474	1.09	517	24	48	295	0.62
Total	730	-	811	37	75	464	-
Total Trips Modelled in WRTM						419	11% (Difference)

Table No: 16

Predicted Trip Generation – Residential Development – Scenario 4 (Year 2045 Stages 1 to 5)							
Type of Residential Unit	No. of Units	Peak Hour Person Trip Gen Rate (person trips / dwelling / hr)	Total no. of person trips generated during peak hour	PT (13.9%) (person trips / hr)	Active Modes (11.4%) (person trips / hr)	Private Veh (62.9%) (veh trips / hr)	Calculated Vehicle Trip Generation Rate
Lower density	347	1.15	399	55	45	193	0.56
Medium density	591	1.09	644	90	73	312	0.53
Total	938	-	1,043	145	119	505	-
Total Trips Modelled in WRTM						446	13% (Difference)

Table No: 17

Predicted Trip Generation – Residential Development – Scenario 5 (Year 2055 Stages 1 to 5)							
Type of Residential Unit	No. of Units	Peak Hour Person Trip Gen Rate (person trips / dwelling / hr)	Total no. of person trips generated during peak hour	PT (30%) (person trips / hr)	Active Modes (10%) (person trips / hr)	Private Veh (48.2%) (veh trips / hr)	Calculated Vehicle Trip Generation Rate
Lower density	347	1.15	399	120	40	148	0.43
Medium density	591	1.09	644	193	64	239	0.40
Total	938	-	1,043	313	104	387	-
Total Trips Modelled in WRTM						357	8% (Difference)



Initial feedback from NZTA suggested that a 10.8% work from home factor (refer to Table No: 8) is likely to be excessive and that it would only be a justified reduction if the residential trip rates from the NSW Guide included 0% work from home factor.

The NSW Guide does not specify work-from-home assumptions. Accordingly, the resulting vehicle trip generation rates were compared against the NSW Guide vehicle trip rate benchmarks to confirm that the adopted assumptions produce reasonable transport outcomes.

Table No: 18 below provides a comparison between the NSW Guide vehicle trips rates against the calculated driver-only vehicle trip rates in Table No: 13 to Table No: 17.

Table No: 18

Vehicle Trip Generation Rates		
Type of Residential Unit	NSW Guide Vehicle Trip Rate	Calculated Vehicle Trip Rate from Table No: 13 to Table No: 17
Lower Density	0.83 – 0.84	0.43 – 0.72
Medium Density	0.41 – 0.60	0.40 – 0.68

As presented in Table No: 18, the calculated vehicle trip generation rates for lower density dwellings are below the NSW Guide vehicle trip rate range across all assessed scenarios. The difference increases in the later scenarios as greater levels of public transport and active mode uptake are assumed. This reflects the transport strategy adopted for the Residential Development, which seeks to reduce reliance on private vehicle travel through the provision of connected walking and cycling infrastructure, improved public transport accessibility and transport demand management measures.

The NSW Guide notes that its lower-density residential vehicle trip rates are generally derived from surveys undertaken in areas with limited public transport accessibility. In contrast, the Residential Development is expected to be supported by progressively improved public transport access and frequency, and active mode connections over time. Accordingly, lower private vehicle trip generation rates are expected relative to the NSW Guide benchmark and are considered consistent with the transport outcomes sought for the Project.

For medium-density dwellings, the calculated vehicle trip generation rates are above the NSW Guide range in Scenario 1, generally within the NSW Guide range in Scenarios 2 to 4, and slightly below the range in Scenario 5. This reflects the increasing mode share assumptions for public transport and active modes in the later scenarios.

Data from Census 2023 indicates that Hamilton City and Glenview have work-from-home rates of approximately 12.5% and 10.0% respectively. These figures are broadly consistent with the assumptions adopted for the Residential Development trip generation calculations and support the inclusion of a work-from-home adjustment within the assessment methodology.

WRTM modelling for the Project was undertaken at an earlier stage of the project prior to final confirmation of the dwelling mix and typologies within the Residential Development. As the Masterplan has subsequently been refined, the residential yield and composition have been updated relative to the land use inputs adopted in the WRTM model runs.

Consistent with the approach adopted for the Industrial Development, a comparison of the refined trip generation calculations with the WRTM outputs indicates that the model represents slightly lower residential traffic, with an average difference of approximately 10% across Scenarios 2 to 5. To address this, the intersection modelling presented in Section 15 incorporates a 10% increase to the modelled residential trips.



The additional Residential Development traffic was applied to the relevant residential development-related turning movements at each assessed intersection, using the WRTM distribution patterns as the basis for assigning the uplift across the surrounding network. This adjustment is modest and does not materially alter the strategic distribution of trips within the network but ensures that the intersection assessments are based on a conservative demand scenario.

In addition, the site's urban context, proximity to local employment and services, and the provision of walking, cycling, and future public transport connections support reduced reliance on private vehicle travel over time. In this context, the adopted trip generation assumptions are considered appropriate and, when combined with the applied adjustment, provide a robust and proportionate basis for assessing transport effects at the intersection level.

13. Transport Modelling

BBO has undertaken a transport modelling exercise as a key input to this transport assessment. This task included undertaking trip generation calculations for the Project (refer to the previous Section 12.2), and transport modelling of those future trips on the surrounding network using the WRTM to assess the trip distribution and any resulting capacity or safety effects on affected intersections and the proposed accesses to the Site.

13.1 WRTM Validity

The WRTM is presently the most appropriate strategic transport planning tool for predicting transport demands of proposed and consented land-use activity zones in the Waikato.

BBO obtained the latest WRTM model run ("HSL Scenario 31") from CoLab that was developed for NZTA's Investment Case for HSL. HSL Scenario 31 included the following key network infrastructure for HSL:

- HSL Central interchange south of Peacocke, as designated
- North-south corridor (Greenwood Street), 2+2 lanes with 100 km/h posted speed limit
- SL1 at-grade roundabout, approximately 970 m south of Greenwood Street / Kahikatea Drive intersection
- Half-diamond interchange at Collins Road, as designated
- Greenwood Street / Duke Street left-in-left-out intersection
- Three-arm roundabout at Greenwood Street / Kahikatea Drive intersection with no access via Kahikatea Drive Extension.

BBO conducted a review of the WRTM network and zone structure surrounding the SL1 development areas and identified refinement work shown in Figure 43 was required to better reflect the future road network surrounding the sites.



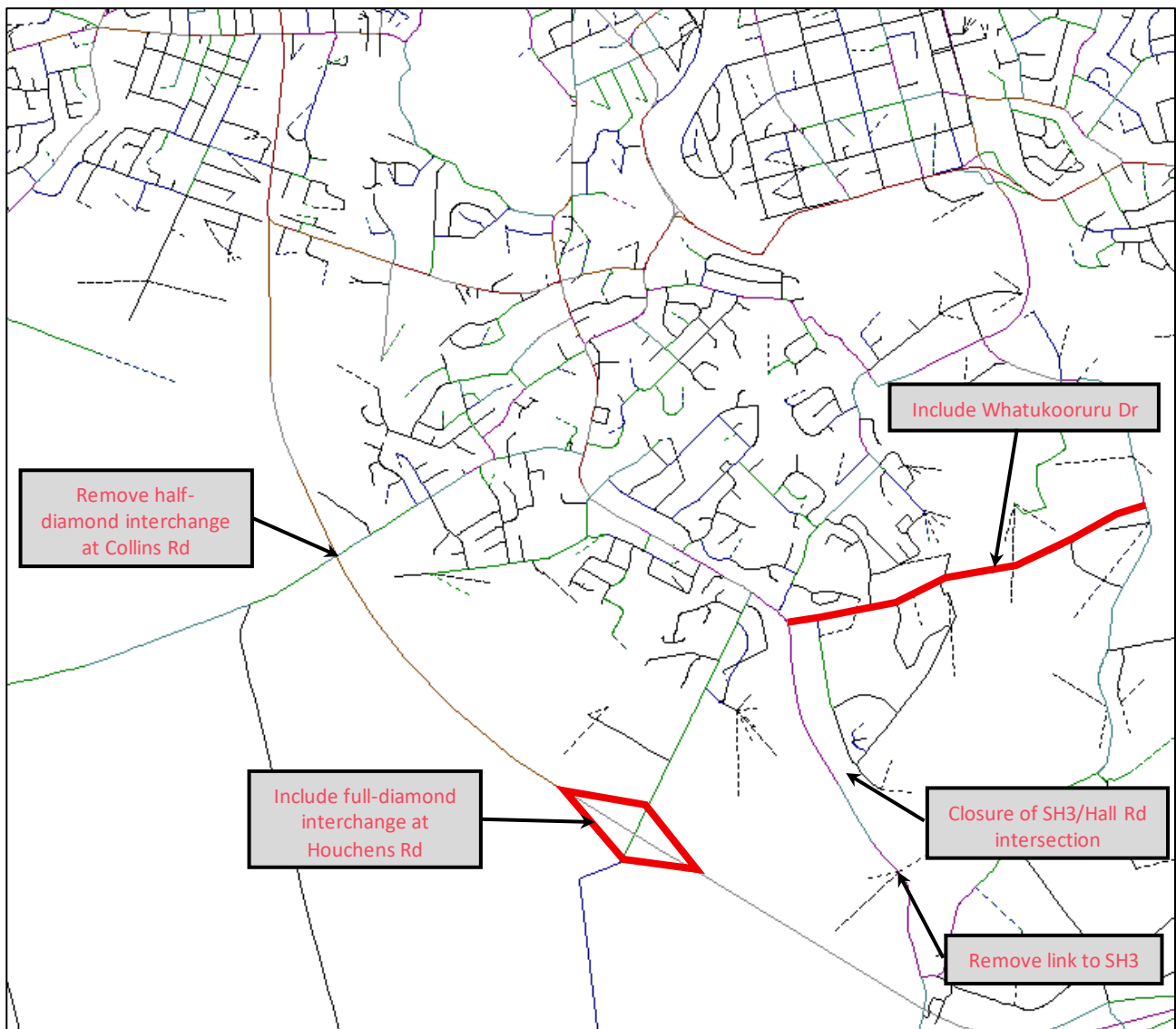


Figure 43: Required WRTM Network Amendments

13.2 Modelled Scenarios

Table No: 19 summarises the scenarios that have been assessed with the WRTM for this Project by incorporating the amendments mentioned in the preceding section.

The modelling scenarios incorporate assumptions regarding increased public transport use and active travel over time, consistent with planned investment and corridor-level improvements. Network performance improvements are therefore not attributable solely to new road infrastructure, but to the combined effects of connectivity, accessibility, and restrained growth in general traffic volumes through mode shift.

Table No: 19

Modelling Scenarios		
Scenarios	Transportation Infrastructure / Elements	Land Use Assumptions
2035 Baseline Scenario	No Southern Links	- No SL1 land use. - Land use within Airport Business Zone and Peacocke Structure Plan area to adopt Southern Links Scenario 31 model assumptions.
Scenario 1A (Year 2030)	No Southern Links	SL1 Residential Development = 59 dwellings



Scenario 1B (Year 2030)	No Southern Links	SL1 Residential Development = 123 dwellings
Scenario 1C (Year 2030)	No Southern Links	SL1 Residential Development = 198 dwellings
Scenario 1D (Year 2030)	No Southern Links	SL1 Residential Development = 271 dwellings
Scenario 1E (Year 2030)	No Southern Links	SL1 Residential Development = 321 dwellings
Scenario 2 (Year 2035)	- With Stage 1 Hamilton Southern Links (i.e. Greenwood St to SL1 roundabout) - Ohaupo Rd / Houchens Rd intersection to be signalised. - Ohaupo Rd / Resthill Cres intersection to be signalised - Collector Rd through SL1 Industrial Development area provided. - Collector Rd through SL1 Residential Development area provided.	- SL1 Residential: Development Stages 1 and 2 (575 dwellings) - SL1 Industrial: Full development (approx. 36ha developable area)
Scenario 3 (Year 2035)	- Full length of Southern Links - Remove partial interchange at Collins Rd and include full interchange at Houchens Rd. - Ohaupo Rd / Houchens Rd intersection to be signalised. - Ohaupo Rd / Resthill Cres intersection to be signalised - Collector Rd through SL1 Industrial Development area provided. - Collector Rd through SL1 Residential Development area provided.	- SL1 Residential: Stages 1 to 3 (776 dwellings) - SL1 Industrial: Full development (approx. 36ha developable area)
Scenario 4 (Year 2045)	- Full length of Southern Links - Remove partial interchange at Collins Rd and include full interchange at Houchens Rd. - Ohaupo Rd / Houchens Rd intersection to be signalised. - Ohaupo Rd / Resthill Cres intersection to be signalised - Minor arterial within SL1 Residential Development area provided.	- SL1 Residential Development: Full development (1,009 dwellings) - SL1 Industrial: Full development (approx. 36ha developable area)
Scenario 5 (Year 2055)	- Same as Scenario 4 plus: - SL1 Houchens proposed 3-arm roundabout on Ohaupo Rd. - HCVs to be banned on Houchens Rd. - Collector and Minor arterial roads within SL1 Houchens provided. - New roundabout connection on Tuhikaramea Rd providing access to SL1 Rogerson Block. - Collector Rd through Rogerson Block provided.	- Same as Scenario 4 plus: - Future Residential Areas within wider SL1 Growth Cell: 16ha industrial developable area + 4,000 dwellings - SL1 Rogerson Block: Full development (217 dwellings + 20ha industrial developable area) - SL1 Houchens: Full development (1,565 dwellings + 400 RV units + 47ha industrial developable area)

The modelling scenarios presented in Table No: 19 represent the transport modelling assumptions adopted within the WRTM and were intended to test a range of future network outcomes. They should not be interpreted as forecasts of HSL delivery timing or commitments regarding future infrastructure implementation.

The modelling scenarios have been developed to progressively assess the transport effects of the Project as development proceeds. The Rogerson Block and Houchens Development areas in the wider SL1 growth cell do not form part of this Project so were excluded in the earlier development modelling scenarios. These developments are introduced only in the 2055 scenario to test the future operation of the transport network under a broader growth scenario within the wider SL1 growth area.

While Scenarios 2 to 5 were modelled using the WRTM, Scenario 1A to 1D were based on manual distribution of traffic flows to minimise the time and cost of running numerous WRTM scenarios.



Scenarios 1A to 1E were analysed to determine if any development within the SL1 Residential Development area could be progressed in advance of HSL construction, and if so, identify the transportation infrastructure required to support the development. Scenarios 1A to 1E are assumed to be developed within the first five years (i.e. approximately 2030) which is sooner than the predicted timeline to construct HSL.

The 2030 baseline traffic volumes were derived from the surveyed peak hour traffic flows²³ and include an allowance for background traffic growth independent of the proposed development. This approach recognises that future traffic volumes on the state highway network will not be attributable solely to trips generated by the proposed developments. From the most recent data extracted from the NZTA TMS State Highway records, Greenwood Street and Ohaupo Road (SH3) have had an approximate average baseline growth of 1.2% and 1.5% per annum respectively.

A seasonal factor is applied to the surveyed traffic flows to account for traffic flow variation throughout the course of the year. To determine an appropriate factor, traffic counts from the Greenwood telemetry site on SH1C (i.e. site 97) and Ohaupo telemetry site on SH3 (i.e. site 119) have been assessed. Both telemetry sites indicate an average daily factor of 1.14 for the month of October 2025 during which the intersection count surveys were undertaken.

Additional traffic associated with the Residential Development area (i.e. Scenarios 1A to 1E) were then added to the 2030 baseline volumes to understand the effects on the intersections for a future year scenario.

13.3 Key Findings from WRTM Modelling

The following key findings have been drawn from the WRTM outputs and have informed the subsequent intersection capacity assessments in Section 15:

- **Ohaupo Road traffic distribution:**

Earlier HSL Scenario 31 outputs indicated that approximately 10% of traffic from the Residential Development zones would use the Ohaupo Road / Lambert Court intersection, compared with approximately 30% using the Ohaupo Road / Resthill Crescent intersection. On that basis, Ohaupo Road / Resthill Crescent was initially considered for signalisation. However, the subsequent SL1 project WRTM model runs indicate that a greater proportion of Residential Development traffic is distributed to Ohaupo Road / Lambert Court. Accordingly, the intersection capacity assessment in Section 15.2.3 identifies Ohaupo Road / Lambert Court as the appropriate location for signalisation, rather than Resthill Crescent. On this basis and noting the proposed signalisation of both Ohaupo Road / Lambert Court and Ohaupo Road / Houchens Road, together with the nearby mid-block signalised crossing on Ohaupo Road, signalisation of Ohaupo Road / Resthill Crescent is no longer proposed. Instead, the right-turn movement out of Resthill Crescent is proposed to be removed, with southbound traffic redirected via the signalised Lambert Court intersection. This is assessed further in Section 15.2.4.

- **Adjustment of modelled development traffic:**

Following consultation with NZTA and HCC, the updated trip generation calculations presented in Section 12 indicate that the development trips represented in the WRTM are lower than the refined estimates for both developments. Specifically, the WRTM modelled demand is approximately 13% lower for Industrial Development and approximately 10% lower for Residential Development. The modelled development trips have therefore been increased by these respective percentages for the intersection performance analyses presented in Section 15.

²³ Based on 2025 intersection count surveys undertaken by BBO.



- **Effect of HSL on baseline traffic volumes:**

Comparison of the 2035 baseline scenarios, with and without HSL and excluding SL1 growth cell, indicates that the full length of HSL is expected to materially reduce daily traffic volumes on key corridors adjacent to the sites. Particularly, daily traffic volumes are forecast to reduce by approximately 23% on Kahikatea Drive (between Kahikatea Drive Extension and Latham Court) and by approximately 39% on Ohaupo Road (between Saxbys Road and Houchens Road). These reductions create spare capacity to accommodate traffic from the later stages of the Project, therefore effectively fulfilling the purpose of HSL being a RoNS project, stated in the current GPS for Transport. By contrast, HSL is expected to increase daily traffic volumes on Greenwood Street north of Kahikatea Drive, on Houchens Road, and on Collins Road by approximately 34%, 74%, and 21% respectively.

14. Average Daily Traffic Volume Changes

Table No: 21 provides a comparison of the changes in ADT on strategic roads surrounding the sites in the various WRTM scenario modelling undertaken for this Project. Intersections that the WRTM model runs demonstrate will experience more than 10% volume change relative to the 2035 WRTM baseline scenario without HSL, have been carried through for further assessment.

14.1 Industrial Development

Table No: 20

Changes in ADT (vehicles per day)				
Road Section	2035 Baseline without HSL	2035 Scenario 2 (% Change)	2035 Scenario 3 (% Change)	2045 Scenario 4 (% Change)
Kahikatea Dr Extn (between Melanie Ct and Higgins Rd)	5,542	3,546 (-36.0%)	4,680 (-15.6%)	4,967 (-10.4%)
Higgins Rd (between Kahikatea Dr and Duke St)	3,737 ²⁴	4,030 (7.8%)	4,718 (26.3%)	5,407 (44.7%)
Duke St (between Higgins Rd and Greenwood St)	3,850	4,524 (17.5%)	3,664 (-4.8%)	4,731 (22.9%)
Greenwood St (between Killarney Rd and Duke St)	31,006	30,429 (-1.9%)	32,412 (4.5%)	42,280 (36.4%)
Greenwood St (between Duke St and Kahikatea Dr)	32,279	32,695 (1.3%)	36,266 (12.4%)	44,594 (38.2%)
Greenwood St (between Kahikatea Dr Latham Ct)	33,160	30,913 (-6.8%)	23,743 (-28.4%)	26,989 (-18.6%)
Killarney Rd (between Higgins Rd and Greenwood St)	21,328	23,342 (9.4%)	23,676 (11.0%)	23,647 (10.9%)
Killarney Rd (between	21,907	23,264 (6.2%)	24,002 (9.6%)	24,252 (10.7%)

²⁴ Based on classified traffic volume tube counts undertaken in May 2024. WRTM underestimates baseline volumes on Higgins Road (i.e. 2035 baseline volumes on Higgins Road = 979 vpd based on WRTM model run).



Tuhikaramea Rd and Higgins Rd)				
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The Higgins Road / Duke Street intersection and Greenwood Street / Duke Street intersection have not been assessed further despite traffic volumes increasing more than 10% with the proposed Industrial Development. This is because the Greenwood Street / Duke Street is already proposed to be upgraded to a left-in-left-out intersection as part of the HSL project.

14.2 Residential Development

Table No: 21

Changes in ADT (vehicles per day)				
Road Section	2035 Baseline without HSL	2035 Scenario 2 (% Change)	2035 Scenario 3 (% Change)	2045 Scenario 4 (% Change)
Ohaupo Rd (between Normandy Ave and Ulrich Ave)	28,450	29,986 (5.4%)	22,676 (-20.3%)	23,992 (-15.7%)
Ohaupo Rd (between Collins Rd and Saxbys Rd)	31,029	32,490 (4.7%)	25,577 (-17.6%)	28,066 (-9.5%)
Ohaupo Rd (between Saxbys Rd and Lambert Ct)	22,295	22,164 (-0.6%)	14,786 (-33.7%)	16,501 (-26.0%)
Ohaupo Rd (between Lambert Ct and Garden Heights Ave)	19,331	18,219 (-5.8%)	11,799 (-39.0%)	14,277 (-26.1%)
Ohaupo Rd (between Garden Heights Ave and Resthill Cres)	20,258	18,924 (-6.6%)	12,049 (-40.5%)	14,909 (-26.4%)
Ohaupo Rd (between Resthill Cres and Houchens Rd)	21,391	20,195 (-5.6%)	13,583 (-36.5%)	17,036 (-20.4%)
Ohaupo Rd (between Houchens Rd and Dixon Rd)	20,035	18,902 (-5.7%)	12,121 (-39.5%)	15,932 (-20.5%)
Collins Rd (between Ohaupo Rd and Anderson Rd)	4,740	4,863 (2.6%)	5,376 (13.4%)	6,245 (31.8%)
Collins Rd (between Deanwell Ave and Rhonda Ave)	8,967	9,188 (2.5%)	9,046 (0.9%)	9,568 (6.7%)
Saxbys Rd (between Ohaupo Rd and MacDonald Rd)	6,206	8,256 (33.0%)	9,118 (46.9%)	10,492 (69.1%)
Saxbys Rd (between Deanwell Ave and Leslie Pl)	2,689	4,045 (50.4%)	5,174 (92.4%)	7,110 (164%)
Saxbys Rd (between Rhonda Ave and Deanwell Ave)	2,606	2,840 (9%)	3,179 (22.0%)	3,211 (23.2%)



Deanwell Ave (between Collins Rd and Saxbys Rd)	3,239	3,287 (1.5%)	3,285 (1.4%)	3,376 (4.2%)
MacDonald Rd (between Saxbys Rd and MacMurdo Ave)	1,878	2,468 (31.4%)	2,540 (35.3%)	2,065 (10%)
MacDonald Rd (between Lambert Ct and Resthill Cres)	1,347	1,717 (27.5%)	1,865 (38.5%)	2,244 (66.6%)
MacMurdo Ave	2,072	3,835 (85.1%)	3,857 (86.1%)	2,731 (31.8%)
Lambert Ct	3,325	4,185 (25.9%)	4,314 (29.7%)	3,785 (13.8%)
Resthill Cres	1,627	1,877 (15.4%)	2,022 (24.3%)	2,402 (47.6%)
Houchens Rd	3,493	3,462 (-0.9%)	6,167 (76.6%)	5,678 (62.6%)

15. Intersection Capacity Performance

Based on Table No: 20 and Table No: 21, the area of influence of the Industrial and Residential Developments can be summarised as incorporating the following intersections which have been modelled using the industry-recognised SIDRA Intersection 10 software (“SIDRA”) to assess the effects of traffic associated with this Project.

- Greenwood Street / Kahikatea Drive intersection
- SL1 Roundabout
- Kahikatea Drive / Higgins Road intersection
- Ohaupo Road / Collins Road signalised intersection
- Ohaupo Road / Saxbys Road / Tomin Road roundabout
- Ohaupo Road / Lambert Court intersection
- Ohaupo Road / Resthill Crescent intersection roundabout
- Ohaupo Road / Higgins Road intersection
- Houchens Road full-diamond interchange

SIDRA models were prepared for the key intersections assessed using the surveyed peak-hour turning movements as the base input. The base models were checked against observed queue lengths and general operating conditions from traffic surveys to confirm that the models reasonably represent existing intersection performance before future traffic demands were applied.

Future-year models were then developed using WRTM-derived traffic demands, adjusted where necessary to reflect the refined trip generation calculations set out in Sections 12.2.1 and 12.2.2. SIDRA movement summaries are provided in Appendix B to support review of the modelling outputs.

The capacity assessment results are summarised in the following sub-sections in terms of Level of Service (“LOS”) with full SIDRA outputs provided in Appendix B. LOS is a standard measure for intersection performance and is based on the average delay experienced by drivers in each lane, by arm. In general, LOS levels A to C are considered acceptable, LOS D to E are considered permissible where reasonable improvements cannot be made, provided safety effects can be mitigated. LOS F is generally considered to be



an unsatisfactory level of service. Delay thresholds in seconds of delay for LOS A to F are given in Table No: 22 below.

Table No: 22

SIDRA Level of Service Definitions			
Level of Service	Average Control Delay per Vehicle (seconds)		
	Priority-Controlled Intersections	Signalised Intersections	Roundabout (SIDRA Roundabout LOS method)
A	≤ 10	≤ 10	≤ 10
B	10 – 15	10 - 20	10 - 20
C	15 – 25	20 – 35	20 – 35
D	25 – 35	35 – 55	35 – 50
E	35 – 50	55 – 80	50 – 70
F	> 50	> 80	> 70

15.1 Industrial Development

15.1.1 Greenwood Street / Kahikatea Drive Intersection

The existing intersection layout modelled within SIDRA is shown in Figure 44. The results of the intersection performance for all scenarios during the peak periods are presented in Table No: 23.

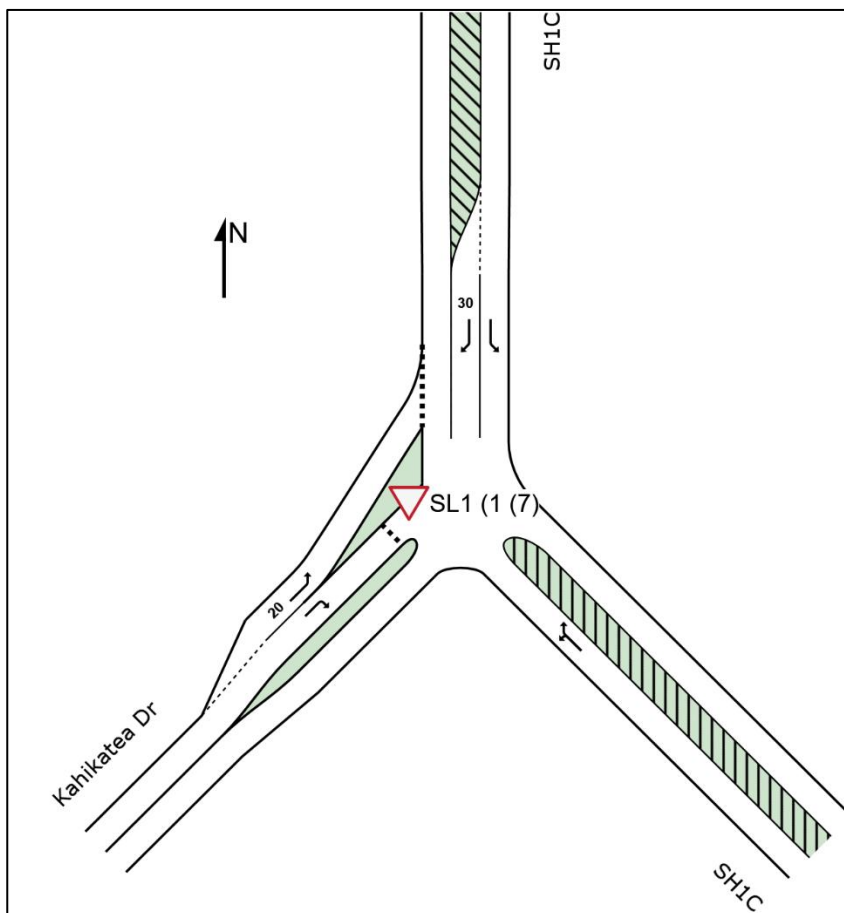


Figure 44: Existing Greenwood St (SH1C) / Kahikatea Dr Intersection Layout



Table No: 23

Existing Greenwood St / Kahikatea Dr Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2030 Baseline	AM	0.86	10.1	27.7 Kahikatea Dr (W)	NA	RT from Greenwood St (N)	60.4	18.3	F
	PM	0.77	8.0	23.1 Kahikatea Dr (W)	NA	RT from Greenwood St (N)	49.6	17.1	E
2030 Baseline + 1 ha Industrial	AM	0.89	10.6	30.5 Kahikatea Dr (W)	NA	RT from Greenwood St (N)	66.6	20.3	F
	PM	0.77	8.1	22.9 Kahikatea Dr (W)	NA	RT from Greenwood St (N)	51.0	17.6	F

The modelling indicates that the right turn movement from Greenwood Street fails (LOS F) in the 2030 baseline scenario during the AM peak hour.

A sensitivity check was undertaken to determine the amount of developable land that can be practically and safely serviced before the average delay for the right-turn movement increases by more than 10 seconds per vehicle. A change of this magnitude is considered material in the context of the SIDRA level of service definitions presented in Table No: 22, where the delay ranges for each level of service are generally of the order of 10 seconds per vehicle. On that basis, the sensitivity testing indicates that approximately 1 ha of land within the Industrial Development can be accommodated before further transport infrastructure upgrades are required.

The three access options described in Section 8.1 were evaluated to assess how further Industrial Development could proceed.

Option A: Ultimate Network Arrangement (once HSL Stage 1 is Delivered)

Figure 45 presents NZTA's conceptual design of the Greenwood Street / Kahikatea Drive upgrade proposed as part of HSL Stage 1. However, an alternative roundabout configuration was tested for this intersection (Figure 46) to minimise potential adverse safety and capacity effects of traffic weaving from the southbound continuous left turn exit lane to the right turn lane at the proposed HSL / SL1 roundabout positioned approximately 520 m to the south.



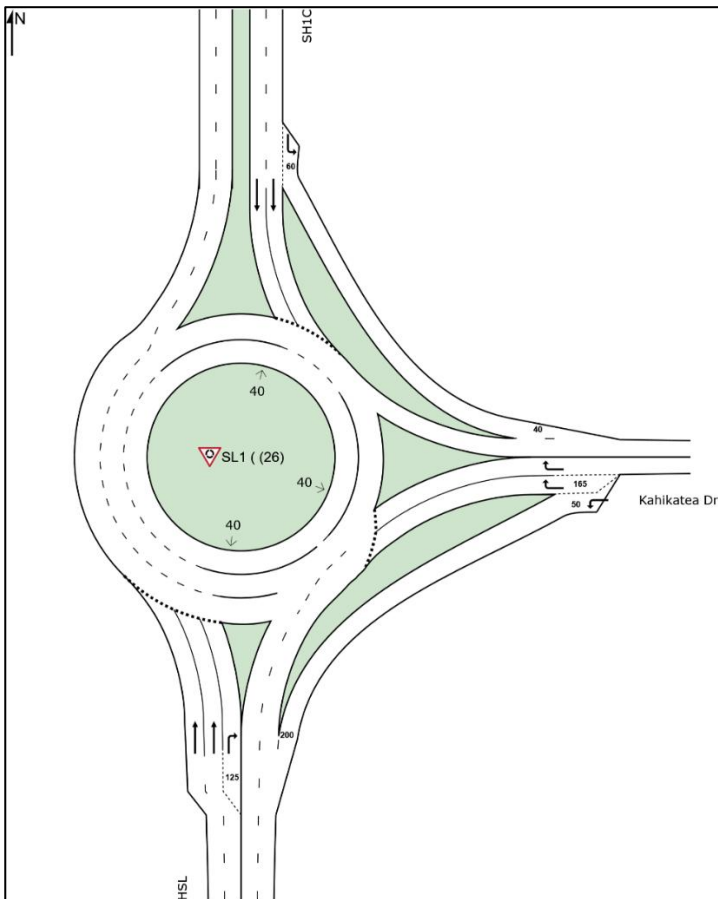


Figure 45: Greenwood St (SH1C) / Kahikatea Dr Roundabout Indicative Layout – NZTA Concept

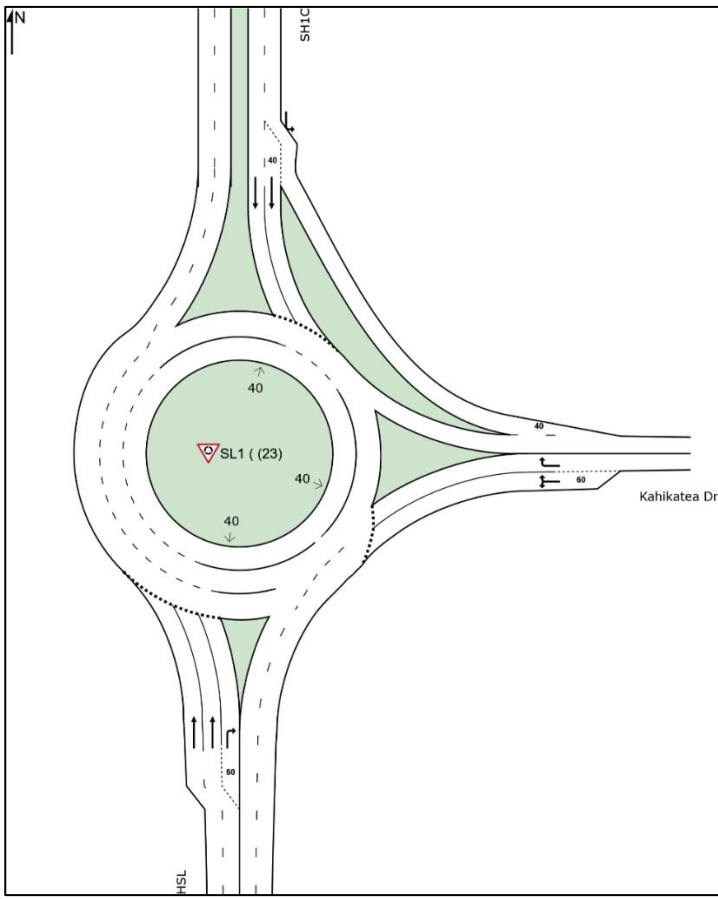


Figure 46: Greenwood St (SH1C) / Kahikatea Dr Roundabout Indicative Layout – SL1 Recommended Design



The SL1 recommended roundabout layout in Figure 46 was modelled using SIDRA for the AM and PM peak periods. It is modelled as a network with the proposed HSL / SL1 roundabout in all options. The performance results for the various model scenarios are presented in Table No: 24.

Table No: 24

Option A - Future Greenwood St / Kahikatea Dr Roundabout Recommended Design									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	Average Queue (m)	LOS	Movement	Ave Delay (s)	Average Queue (m)	LOS
2	AM	0.78	6.5	9.9 Kahikatea Dr (E)	A	RT from HSL (S)	17.1	0.7	B
	PM	0.58	6.8	12.4 Kahikatea Dr (E)	A	RT from HSL (S)	16.2	2.7	B
3	AM	0.62	8.1	13.5 Kahikatea Dr (E)	A	RT from HSL (S)	15.0	3.5	B
	PM	0.85	10.2	29.2 Kahikatea Dr (E)	B	RT from Kahikatea Dr (E)	18.7	29.2	B
4	AM	0.77	9.0	21.5 Kahikatea Dr (E)	A	RT from HSL (S)	16.8	3.3	B
	PM	0.75	9.1	20.1 Kahikatea Dr (E)	A	RT from Kahikatea Dr (E)	16.5	20.1	B
5	AM	0.90	12.1	37.5 Kahikatea Dr (E)	B	RT from Kahikatea Dr (E)	24.1	37.5	C
	PM	0.74	8.9	20.0 Kahikatea Dr (E)	A	RT from HSL (S)	15.1	4.1	B

The results show that the alternative proposed concept layout of the Greenwood Street / Kahikatea Drive three-arm roundabout operates efficiently without NZTA's proposed continuous southbound left turn lane exiting the Greenwood Street / Kahikatea Drive roundabout. The results indicate:

- Acceptable operational performance is achieved across all assessed scenarios, with intersection average delays ranging from 6.5 to 12.1 seconds per vehicle and LOS A to B overall.
- The assessed design continues to accommodate forecast traffic demand through to the 2055 scenario, although higher levels of utilisation are observed in the most demanding future year scenarios.
- Queue lengths remain manageable on all approaches, with the highest average queue of 37.5 m occurring on the Kahikatea Drive eastbound approach in the 2055 AM peak scenario.
- Enhances safety by minimising weaving effects that an added southbound lane could potentially introduce.

A sensitivity test has also been undertaken using NZTA HSL Scenario 31 2055 traffic volumes to test the proposed spacing between the future Greenwood Street / Kahikatea Drive roundabout and the proposed HSL / SL1 roundabout. This represents a conservative sensitivity test because NZTA HSL Scenario 31 includes a higher level of wider land use growth, including a higher level of residential development than the core assessment scenarios relied upon in this ITA.



The results indicate that the future Greenwood Street / Kahikatea Drive roundabout would operate with an overall LOS B in both peak periods. The PM peak hour is the critical period, with a degree of saturation of approximately 0.95 and the worst movement operating at LOS D, indicating that the roundabout would operate close to practical capacity under the conservative 2055 sensitivity demand. However, the modelled average queue remains approximately 49 m and does not indicate unacceptable queuing interaction between the Greenwood Street / Kahikatea Drive roundabout and the proposed HSL / SL1 roundabout.

The high degree of saturation in the PM peak should also be interpreted in the context of the conservative Scenario 31 2055 land use assumptions and is not representative of the core staging scenarios used to determine the development triggers in this ITA.

Accordingly, the sensitivity test does not identify a spacing-related constraint that would preclude the proposed 520 m separation under the assessed Scenario 31 2055 traffic demands. The final spacing and detailed form of the HSL corridor infrastructure would remain subject to NZTA's future design development, modelling and approval processes.

Table No: 25

NZTA HSL Scenario 31 – Future Greenwood St / Kahikatea Dr Roundabout Recommended Design									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	Average Queue (m)	LOS	Movement	Ave Delay (s)	Average Queue (m)	LOS
2055 Volumes	AM	0.82	10.8	24.1 Kahikatea Dr (E)	B	RT from Kahikatea Dr (E)	17.5	24.1	B
	PM	0.95	14.3	49.2 Kahikatea Dr (E)	B	RT from Kahikatea Dr (E)	38.4	49.2	D

Option B: Preferred Interim Option

Aside from the fourth arm, the key difference between this option and the three-arm roundabout proposed as part of HSL (Figure 46) is that three approach lanes are required on the eastern arm of Kahikatea Drive. While right-turn volumes from Kahikatea Drive remain similar to those forecast under the ultimate HSL layout (Option A), the interim arrangement introduces an additional movement to the access road and increases total demand on the eastern approach. The third lane is therefore required to accommodate the additional movement and maintain acceptable lane utilisation, queueing and overall roundabout performance.

The modelling indicates that Option B can accommodate the completed Industrial Development under the 2035 pre-HSL scenario.

The peak period intersection performance results for the 2035 scenario (excluding HSL) are presented in Table No: 26.



Table No: 26

Option B - Greenwood St / Kahikatea Dr Four-arm Roundabout									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2035 baseline + 40 ha Industrial Dev	AM	0.82	9.2	47.8 Kahikatea Dr (W)	A	RT from Industrial Dev Access Rd (S)	26.9	5.8	C
	PM	0.71	10.1	55.8 Kahikatea Dr (E)	B	RT from Kahikatea Dr (W)	39.4	42.5	D

Option C: Interim Option

Option C has a developable area limitation of 23 ha (net developable area) due to capacity constraints with the three-arm roundabout, evident by the intersection degree of saturation exceeding 0.90.

The three-arm Greenwood Street / Kahikatea Drive roundabout that was modelled in SIDRA is presented in Figure 47.

The peak period modelling result for the three-arm roundabout under the 2035 scenario with 23 ha of Industrial Development are presented in Table No: 27.

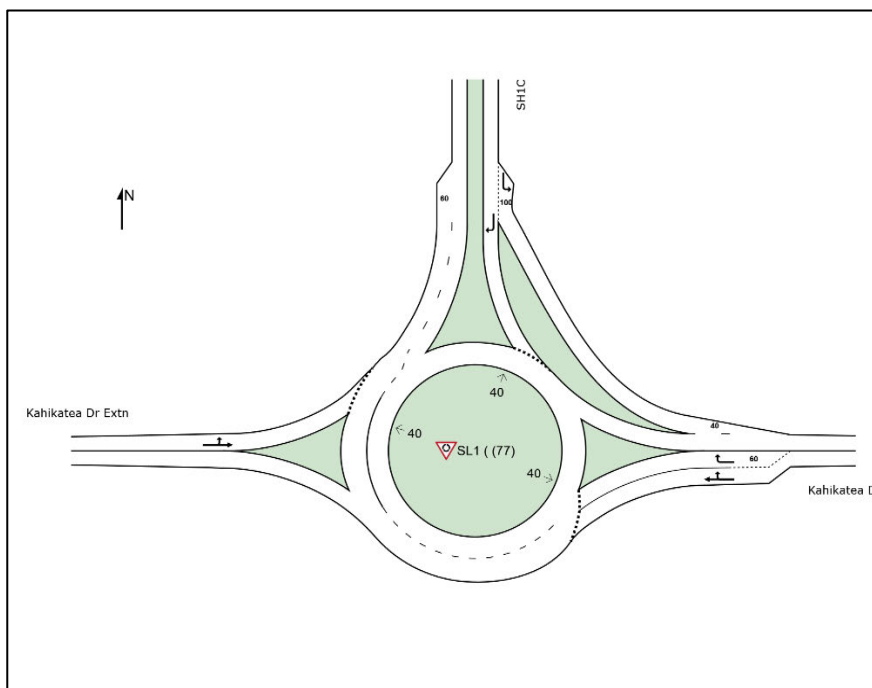


Figure 47: Option C - Greenwood St (SH1C) / Kahikatea Dr Three-arm Roundabout Indicative Layout



Table No: 27

Interim Option C - Greenwood St / Kahikatea Dr Three-arm Roundabout									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2035 baseline + 23 ha Industrial Dev	AM	0.82	8.2	17.4 Kahikatea Dr (E)	A	Thru from Kahikatea Dr (W)	22.3	17.2	C
	PM	0.90	10.3	34.8 Kahikatea Dr (W)	B	LT from Kahikatea Dr (W)	38.2	34.8	D

For the interim access assessments, the development area quantum was varied to identify the scale of development that could be accommodated under each access arrangement.

The background and wider network traffic demands remained unchanged, including the Residential Development assumption adopted in Scenario 2 (543 dwellings). This approach isolates the operational effect of Industrial Development staging while retaining robust surrounding network traffic demands.

The interim assessments demonstrate that Industrial Development can progress independently of HSL delivery, subject to the implementation of the recommended interim access arrangement and associated staging triggers.

Recommended / Preferred Interim Access Strategy

The interim access option assessments indicate that both Option B and Option C can accommodate Industrial Development under pre-HSL conditions.

However, Option B is recommended as the preferred interim access strategy because it enables a greater extent of Industrial Development to proceed prior to HSL delivery while maintaining acceptable intersection performance under the assessed traffic demands.

Given the uncertainty regarding HSL delivery timing, Option B provides the most practical and flexible interim access solution for SL1 Industrial. The timing and staging of Industrial Development are therefore not dependent on HSL delivery, provided the recommended transport infrastructure staging framework set out in Table No: 43 is implemented.

15.1.2 HSL / SL1 Roundabout Connection

The HSL / SL1 roundabout layout depends on the extent of HSL delivered at each stage. Scenario 2 assumes only HSL Stage 1 is delivered, so the intersection operates as a three-arm roundabout, per Figure 48.



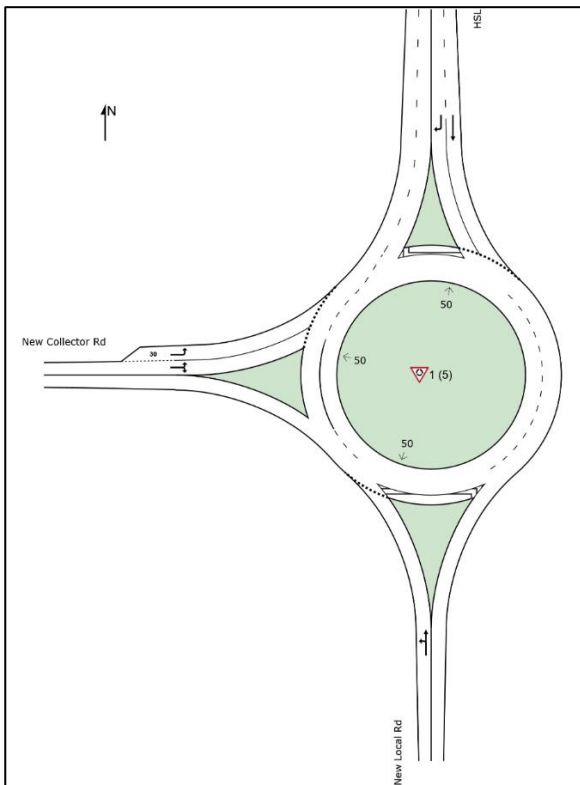


Figure 48: Proposed SL1 Roundabout Connection Scenario 2

When HSL Stage 3 is delivered, the eastern arm at the roundabout will provide access to the eastern side of the Industrial Development while HSL extends south of the SL1 collector road. at which point the intersection operates as a four-arm roundabout (Figure 49).

It is to be noted that the HSL / SL1 roundabout was modelled in SIDRA as part of a network with the proposed layout for future Greenwood Street / Kahikatea Drive three-arm roundabout (Figure 46). The results of the intersection performance for the various modelling scenarios during the peak periods are presented in Table No: 28.



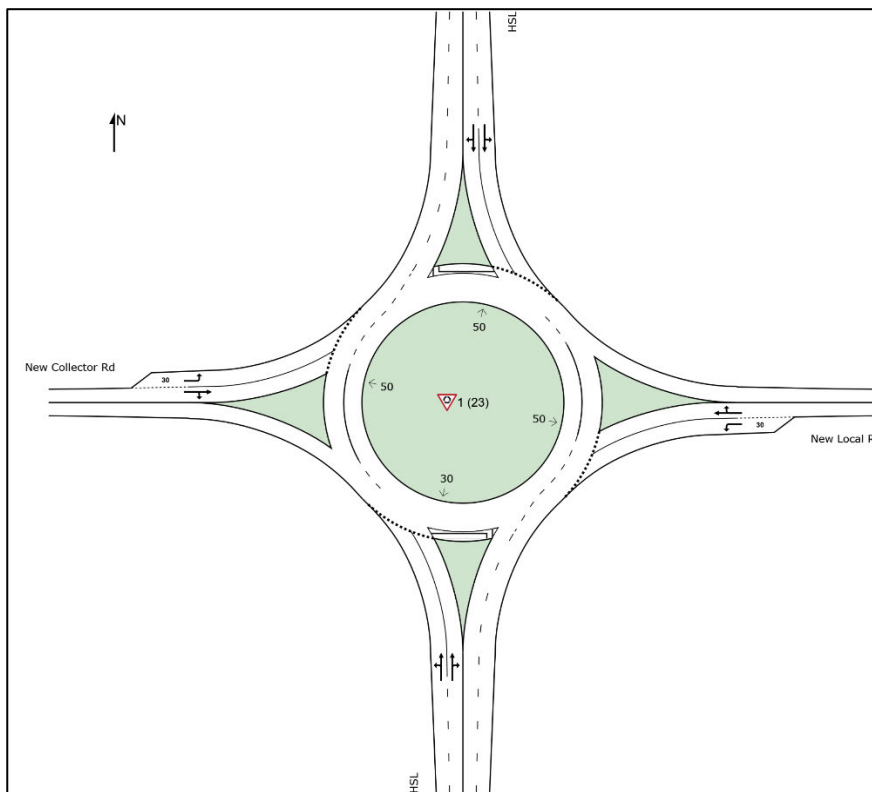


Figure 49: Proposed SL1 Roundabout Connection Scenarios 3 - 5

Table No: 28

Proposed SL1 Roundabout Connection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	Ave Queue (m)	LOS	Movement	Ave Delay (s)	Ave Queue (m)	LOS
2	AM	0.14	5.9	2.3 HSL (N)	A	RT from HSL (N)	13.0	2.2	B
	PM	0.14	2.6	2.2 Access Rd (S)	A	RT from HSL (N)	13.0	0.8	B
3	AM	0.36	7.4	7.2 HSL (S)	A	RT from HSL (S)	16.2	7.0	B
	PM	0.46	6.6	11.1 HSL (N)	A	RT from HSL (S)	16.1	6.3	B
4	AM	0.37	7.2	7.7 HSL (N)	A	RT from HSL (S)	16.2	7.4	B
	PM	0.53	6.8	14.2 HSL (N)	A	RT from HSL (S)	16.2	7.7	B
5	AM	0.69	10.6	24.7 HSL (S)	B	RT from HSL (S)	20.4	24.1	C
	PM	0.59	9.2	13.7 Collector Rd (W)	A	RT from HSL (S)	18.5	12.9	B

Overall, the model results demonstrate that the proposed HSL / SL1 roundabout performs satisfactorily with the three-arm roundabout layout of the Greenwood Street / Kahikatea Drive.



15.1.3 Kahikatea Drive / Higgins Road Intersection

The existing crossroads intersection was modelled in SIDRA as shown in Figure 50. The results of the intersection performance for all various modelling scenarios during the peak periods are presented in Table No: 29.

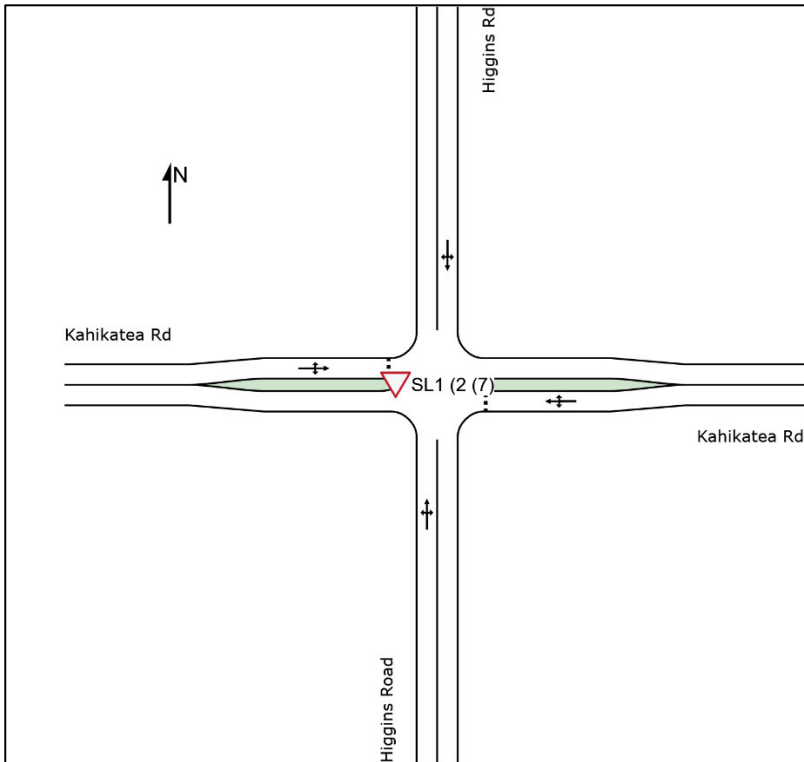


Figure 50: Existing Kahikatea Dr / Higgins Rd Intersection Layout

Table No: 29

Existing Kahikatea Dr / Higgins Rd Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2035 Baseline	AM	0.33	5.1	11.8 Kahikatea Dr (W)	NA	RT from Kahikatea Dr (E)	10.8	10.2	B
	PM	0.68	7.1	57.0 Kahikatea Dr (E)	NA	RT from Kahikatea Dr (E)	13.2	57.0	B
2	AM	0.21	4.7	7.1 Kahikatea Dr (W)	NA	RT from Kahikatea Dr (E)	9.0	1.7	A
	PM	0.23	5.1	8.9 Higgins Rd (N)	NA	RT from Kahikatea Dr (E)	9.3	6.4	A
3	AM	0.20	4.8	7.0 Higgins Rd (N)	NA	RT from Kahikatea Dr (E)	9.8	1.9	A



Existing Kahikatea Dr / Higgins Rd Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
4	PM	0.32	5.7	13.9 Higgins Rd (N)	NA	RT from Kahikatea Dr (E)	14.1	10.6	B
	AM	0.24	4.9	8.6 Kahikatea Dr (W)	NA	RT from Kahikatea Dr (E)	11.0	2.2	B
	PM	0.34	5.9	14.0 Higgins Rd (N)	NA	RT from Kahikatea Dr (E)	14.7	12.4	B
5	AM	0.34	4.7	11.8 Kahikatea Dr (W)	NA	RT from Kahikatea Dr (E)	8.3	1.9	A
	PM	0.52	6.3	17.3 Kahikatea Dr (E)	NA	RT from Kahikatea Dr (W)	25.9	13.8	D

The assessment indicates that the existing Higgins Road / Kahikatea Drive intersection continues to operate with a high level of service under all assessed future year scenarios. Intersection average delays remain low, ranging from 4.7 to 6.3 seconds per vehicle.

While some increases in queue lengths and delays are observed as traffic volumes increase, the results indicate that the intersection retains substantial operational capacity. The highest degree of saturation occurs in Scenario 5 during the PM peak period (V/C = 0.52), which remains well below practical capacity.

The results therefore indicate that the Higgins Road / Kahikatea Drive intersection is expected to continue operating acceptably under the assessed growth scenarios, including the wider network growth represented by Scenarios 4 and 5. No upgrade of the intersection is identified as being required based on the modelling undertaken.

15.2 Residential Development

15.2.1 Ohaupo Road / Collins Road Intersection

The existing intersection layout modelled within SIDRA is shown in Figure 51. The results of the intersection performance for the modelling scenarios during the peak periods are presented in Table No: 30.



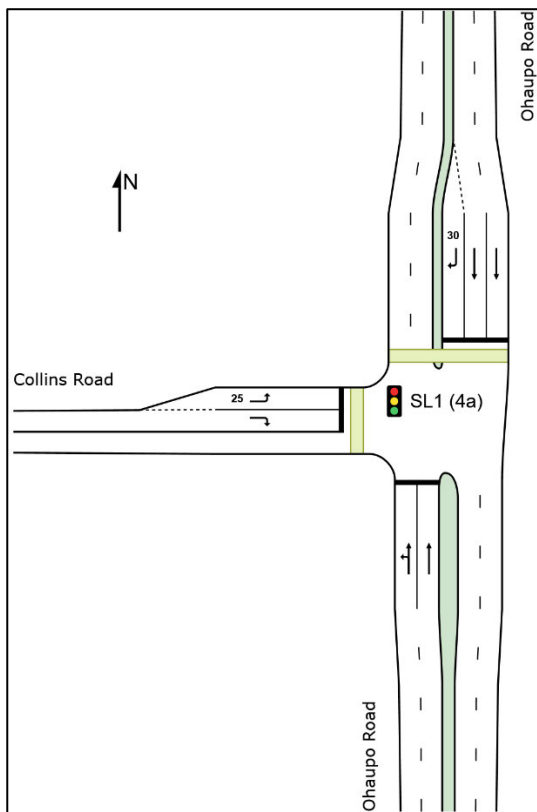


Figure 51: Existing Ohaupo Rd / Collins Rd Signalised Intersection Layout

Table No: 30

Ohaupo Rd / Collins Rd Signalised Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2030 Baseline	AM	0.88	22.0	132 Ohaupo Rd (S)	C	RT from Collins Rd	37.2	49.0	D
	PM	0.91	17.5	83.5 Ohaupo Rd (S)	B	RT from Collins Rd	41.1	36.9	D
1A	AM	0.88	22.5	136 Ohaupo Rd (S)	C	RT from Collins Rd	37.0	50.0	D
	PM	0.92	17.7	85 Ohaupo Rd (S)	B	RT from Collins Rd	43.9	39.1	D
1B	AM	0.88	22.9	140 Ohaupo Rd (S)	C	RT from Collins Rd	37.5	51.2	D
	PM	0.93	17.9	85.9 Ohaupo Rd (S)	B	RT from Collins Rd	45.5	40.2	D
1C	AM	0.88	23.4	146 Ohaupo Rd (S)	C	RT from Collins Rd	38.3	53.0	D
	PM	0.95	18.4	87.3 Ohaupo Rd (S)	B	RT from Collins Rd	53.2	45.7	D
1D	AM	0.89	24.1	153 Ohaupo Rd (S)	C	RT from Ohaupo Rd (N)	39.6	73.8	D
	PM	0.97	18.8	88.3 Ohaupo Rd (S)	B	RT from Collins Rd	58.0	49.0	E



Ohaupo Rd / Collins Rd Signalised Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
1E	AM	0.89	24.5	156 Ohaupo Rd (S)	C	RT from Ohaupo Rd (N)	40.7	75.3	D
	PM	0.93	19.1	93.7 Ohaupo Rd (S)	B	RT from Collins Rd	46.2	43.7	D
2035 Baseline	AM	0.76	15.5	187 Ohaupo Rd (S)	B	RT from Collins Rd	39.0	37.3	D
	PM	0.81	15.8	114 Ohaupo Rd (S)	B	RT from Collins Rd	32.1	27.3	C
2	AM	0.79	16.2	125 Ohaupo Rd (S)	B	RT from Collins Rd	40.5	22.7	D
	PM	0.58	19.7	108 Ohaupo Rd (N)	B	RT from Ohaupo Rd (N)	47.2	10.1	D
3	AM	0.76	19.1	113 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	39.4	18.6	D
	PM	0.76	18.0	62.6 Ohaupo Rd (N)	B	RT from Ohaupo Rd (N)	33.5	5.7	C
4	AM	0.83	22.6	128 Ohaupo Rd (S)	C	RT from Collins Rd	42.0	37.2	D
	PM	0.75	22.0	82.8 Ohaupo Rd (N)	C	RT from Ohaupo Rd (N)	39..8	6.6	D
5	AM	0.84	20.8	133 Ohaupo Rd (S)	C	RT from Ohaupo Rd (N)	38.2	17.1	D
	PM	0.60	17.4	102 Ohaupo Rd (N)	B	RT from Ohaupo Rd (N)	37.9	7.5	D

The SIDRA modelling indicates that the Ohaupo Road / Collins Road signalised intersection operates with acceptable performance across all modelled scenarios, typically achieving LOS B to C with intersection average delays generally in the order of 15 to 25 seconds per vehicle in both peak periods.

The results also indicate that right turn movements from Ohaupo Road and Collins Road consistently perform at LOS D, with the Collins Road right-turn movement operating at LOS E in Scenario 1D during the PM peak period. However, the average delay per vehicle on each approach to the intersection is no greater than 55 seconds during peak periods which aligns with the ODP Appendix 15 Table 15-2b guidance on efficiency.

Additionally, the 95th percentile queue length results for Ohaupo Road (south approach) are significant in several scenarios, however, there is no queue spillback to the Ohaupo Road / Saxbys Road / Tomin Road roundabout. On this basis, the modelling demonstrates that the intersection can accommodate the forecast traffic demand associated with the assessed development scenarios without requiring physical upgrades.



15.2.2 Ohaupo Road (SH3) / Saxbys Road / Tomin Road Roundabout

The existing roundabout layout modelled within SIDRA is shown in Figure 52. The results of the intersection performance for the modelling scenarios during the peak periods are presented in Table No: 31.

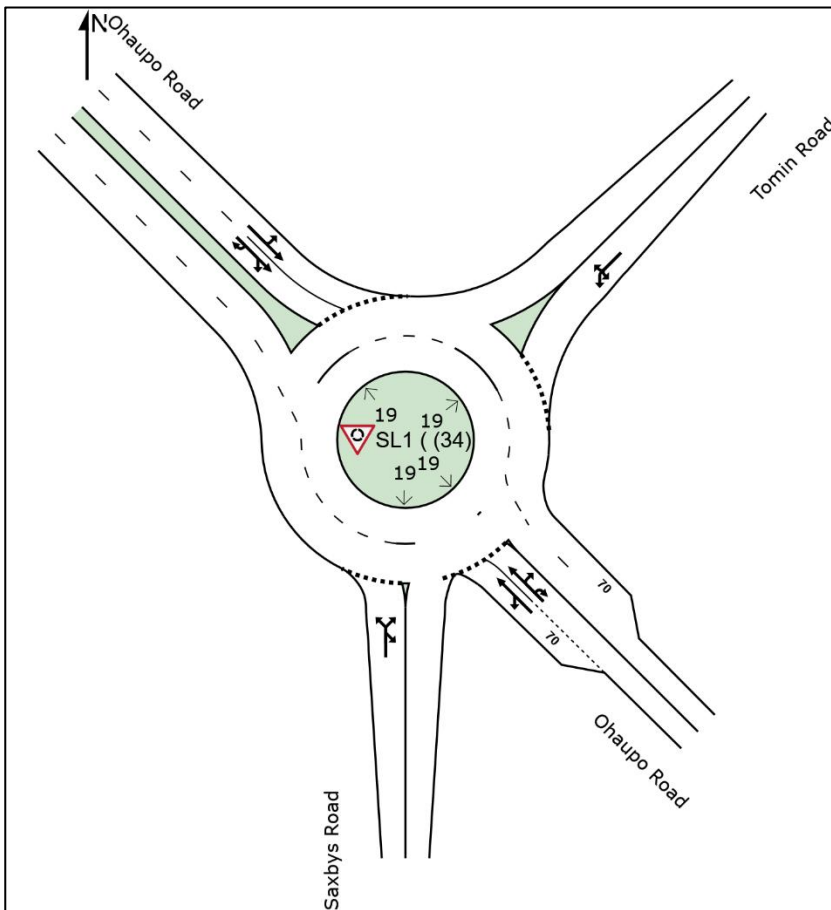


Figure 52: Existing Ohaupo Rd / Saxbys Rd / Tomin Rd Roundabout Layout

Table No: 31

Existing Ohaupo Rd / Saxbys Rd / Tomin Rd Roundabout									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2030 Baseline	AM	0.84	10.3	49.5 Tomin Rd	B	RT from Saxbys Rd	30.5	31.4	C
	PM	0.78	8.4	38.5 Tomin Rd	A	RT from Tomin Rd	38.2	38.5	D
1A	AM	0.84	10.7	50.8 Tomin Rd	B	RT from Saxbys Rd	32.9	33.9	C
	PM	0.80	8.7	41.1 Tomin Rd	A	RT from Tomin Rd	41.3	41.1	D
1B	AM	0.85	11.1	51.8 Tomin Rd	B	RT from Saxbys Rd	35.7	36.7	D
	PM	0.82	9.2	44.4 Tomin Rd	A	RT from Tomin Rd	45.3	44.4	D



Existing Ohaupo Rd / Saxbys Rd / Tomin Rd Roundabout									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
1C	AM	0.88	11.8	53.4 Tomin Rd	B	RT from Saxbys Rd	40.9	41.8	D
	PM	0.85	9.8	48.8 Tomin Rd	A	RT from Tomin Rd	50.8	48.8	E
1D	AM	0.92	12.7	55.4 Tomin Rd	B	RT from Saxbys Rd	47.9	48.3	D
	PM	0.88	10.5	55.2 Tomin Rd	B	RT from Tomin Rd	58.7	55.2	E

In Scenario 1C (198 dwellings), the average delay for right turning vehicles from Tomin Rd has increased by more than 10 seconds per vehicle (i.e. approximately 13seconds) during the PM peak period resulting in the LoS to deteriorate to E. However, the average delay per vehicle is 55 seconds during peak periods on the approaches to the intersection which aligns with the maximum desirable delay in the ODP Appendix 15 Table 15-2b guidance on intersection movement efficiency.

In Scenario 1D (271 dwellings), the average delay per vehicle on Tomin Road approach exceeds 55 seconds during the PM peak period which exceeds the ODP Appendix 15 Table 15-2b guidance for minimum efficiency. The primary capacity constraint in this case is the two-to-one lane merge on the Ohaupo Road southbound exit for the roundabout.

Therefore, the capacity of the roundabout is proposed to be increased by upgrading the southbound exit to two full length lanes from the roundabout to Ohaupo Road / Lambert Court intersection, as shown in Figure 53.



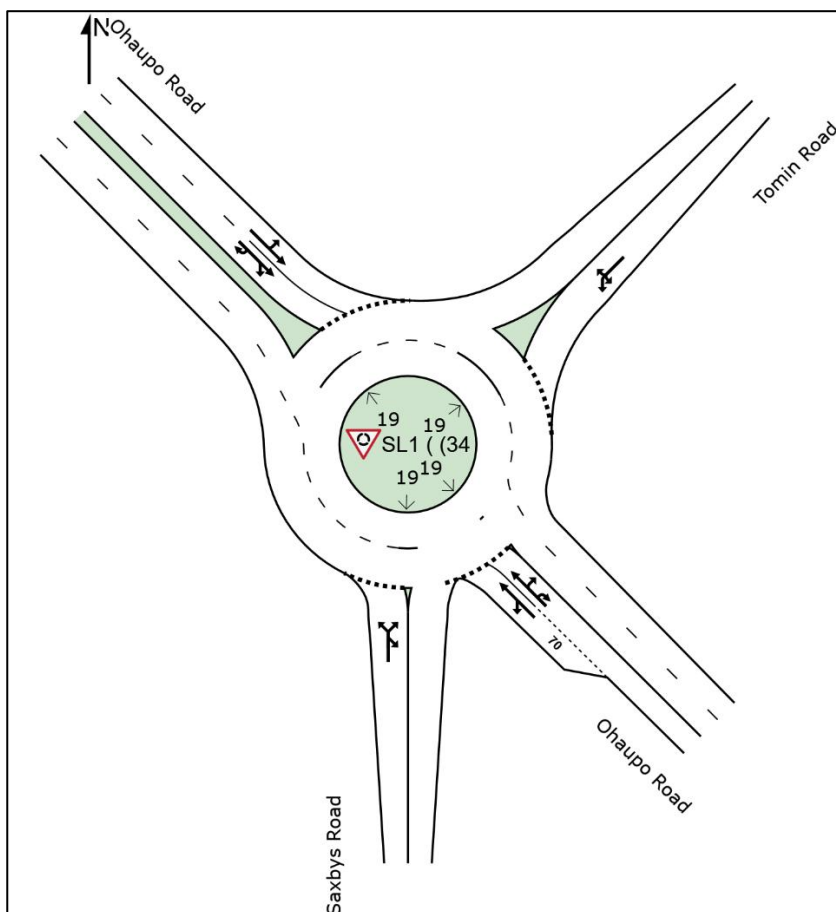


Figure 53: Ohaupo Rd / Saxbys Rd / Tomin Rd Roundabout with Proposed Dual Southbound Exit Lanes on Ohaupo Rd

Table No: 32

Proposed Ohaupo Rd / Saxbys Rd / Tomin Rd Roundabout – 2 Southbound Exit Lanes									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
1D	AM	0.92	11.5	47.9 Ohaupo Rd (S)	B	RT from Saxbys Rd	47.4	47.9	D
	PM	0.79	7.7	29.0 Saxbys Rd	A	RT from Saxbys Rd	31.2	29.0	C
1E	AM	0.95	12.3	54.6 Saxbys Rd	B	RT from Saxbys Rd	54.5	54.6	E
	PM	0.80	7.9	30.5 Saxbys Rd	A	RT from Saxbys Rd	32.4	30.5	C
2	AM	2.97	273	1,381 Saxbys Rd	F	RT from Saxbys Rd	1,801	1,381	F
	PM	1.32	30.3	271 Saxbys Rd	C	RT from Saxbys Rd	318	271	F

The additional southbound exit lane improves roundabout performance through Scenarios 1D and 1E. However, the modelling indicates that the roundabout returns to an unacceptable level of performance under Scenario 2 (543 dwellings). Under this scenario, average intersection delay increases to approximately



273 seconds per vehicle during the AM peak period, with 95th percentile queues increasing to approximately 1,381 m.

It is important to note the modelling shows the roundabout could experience significant congestion by 2035 even without traffic generated by the Residential Development. The SIDRA modelling indicates that both the Saxbys Road and Tomin Road approaches are forecast to experience high delays under future background traffic conditions. This suggests that some form of upgrade is likely to be required irrespective of the Residential Development, with the Residential Development primarily influencing the timing at which those upgrades become necessary. To address this constraint, an alternative roundabout configuration has been assessed comprising:

- Four-laning of Ohaupo Road between Saxbys Road and Lambert Court.
- Additional approach lanes on Saxbys Road and Tomin Road.
- Metering of the Ohaupo Road southbound approach during the AM peak period.

The assessed layout is shown in Figure 54, with the modelling results presented in Table No: 33.

The primary constraint at the roundabout is the high northbound traffic demand on Ohaupo Road during the AM peak period, which restricts opportunities for vehicles from Saxbys Road to enter the circulating carriageway. Metering of the southbound Ohaupo Road approach creates gaps within the circulating traffic stream, improving entry opportunities for vehicles from Tomin Road. This in turn increases opportunities for vehicles from Saxbys Road to enter the roundabout as northbound vehicles on Ohaupo Road will have to give way to the right (i.e. Tomin Road approach). The additional approach lanes on Saxbys Road and Tomin Road, together with four-laning of Ohaupo Road between Saxbys Road and Lambert Court, further improve the capacity and operation of the intersection.

The SIDRA modelling indicates that metering is only required during the AM peak period when southbound traffic demand on Ohaupo Road is highest. The PM peak period continues to operate at an acceptable level without requiring metering.

The metering arrangement assessed in SIDRA represents a conceptual operational treatment intended to create acceptable gaps in the circulating traffic stream. The detailed signal phasing, timing parameters, detection strategy and operational settings would be determined through subsequent design and consultation with NZTA.



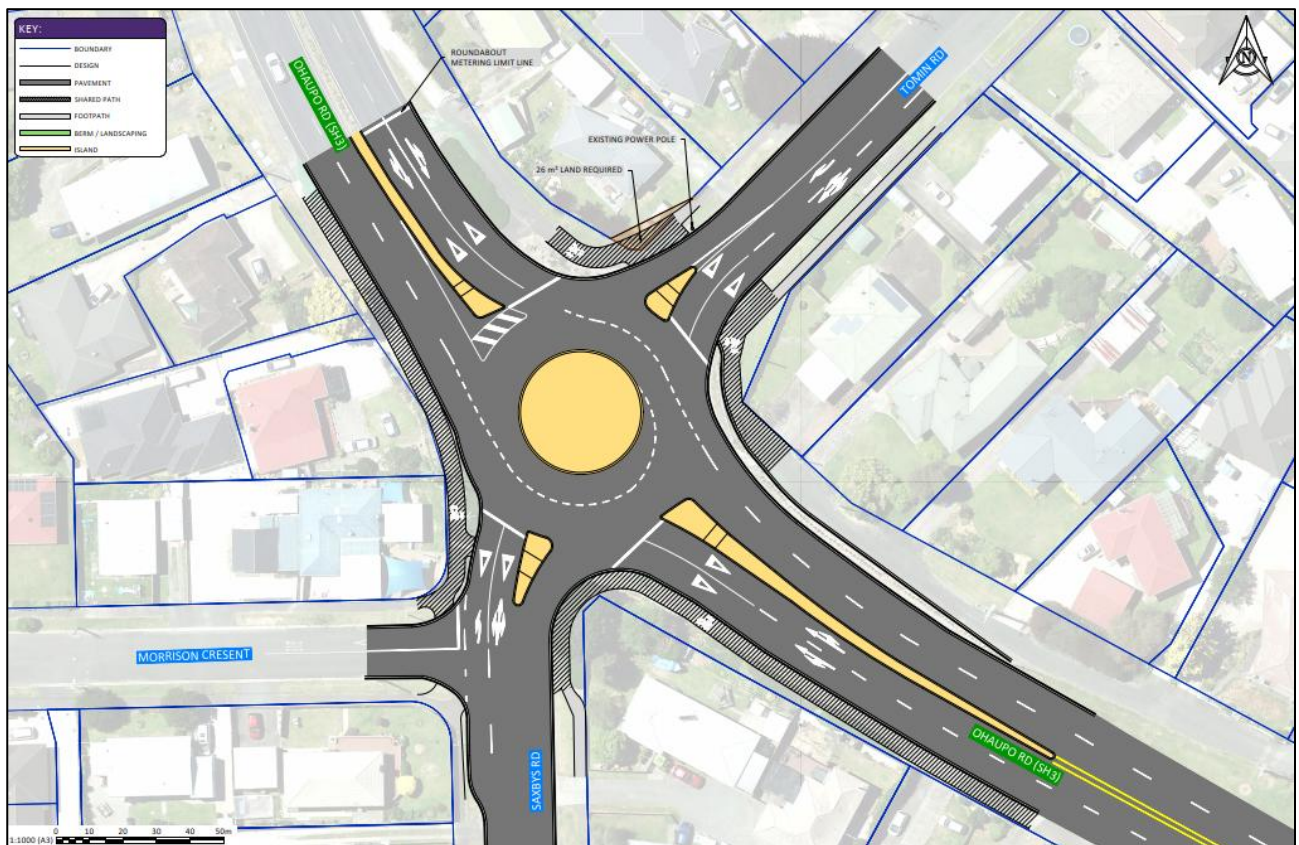


Figure 54: Ohaupo Rd / Saxbys Rd / Tomin Rd Alternative Roundabout Layout with Four Lanes on Ohaupo Rd (South), Additional Lanes on Saxbys Rd and Tomin Rd and Metering on Northern Approach

Table No: 33

Ohaupo Rd / Saxbys Rd / Tomin Rd Roundabout Metering ()									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2	AM	1.04	19.3	126 Ohaupo Rd (N)	B	RT from Saxbys Rd	49.6	50	D
	PM	0.78	9.7	63.7 Ohaupo Rd (S)	A	RT from Tomin Rd	26.1	14.2	C
3	AM	0.86	8.6	46.9 Ohaupo Rd (N)	A	RT from Ohaupo Rd (N)	19.3	46.9	B
	PM	0.52	7.4	12.5 Ohaupo Rd (S)	A	RT from Ohaupo Rd (S)	16.4	12.1	B
4	AM	1.19	45.1	96.3 Saxbys Rd	D	RT from Saxbys Rd	182	96.3	F
	PM	0.57	7.9	15.4 Ohaupo Rd (S)	A	RT from Saxbys Rd	17.6	5.7	B
5	AM	1.39	88.2	175 Saxbys Rd	F	RT from Saxbys Rd	360	175	F
	PM	0.66	9.5	22.3 Ohaupo Rd (S)	A	RT from Ohaupo Rd (S)	24.3	20.9	C



The metered roundabout substantially improves performance under Scenario 2 in addition to the two southbound exit lane option assessed in Table No: 32. The average intersection delay reduces from approximately 273 seconds to 19 seconds per vehicle and the 95th percentile queue reduces from approximately 1,381 m to 126 m. This demonstrates that the identified capacity constraint can be effectively managed through the proposed metering and lane improvements.

The modelling indicates that the upgraded roundabout continues to operate at an acceptable level under Scenario 2. While the Saxbys Road approach experiences unacceptable delays in Scenarios 4 and 5 during the AM peak period, these scenarios either assume that HSL is operational or represent development levels beyond those assessed under a without-HSL network scenario. The PM peak period continues to operate at an acceptable level in all assessed scenarios.

Based on the assessment undertaken, the Residential Development can be demonstrated to operate with acceptable transport effects up to approximately 543 dwellings (Scenario 2) under a network scenario that does not rely on the delivery of HSL, subject to the transport infrastructure upgrades identified in this ITA being delivered. The modelling indicates that the identified roundabout constraint can be managed through the proposed upgrades at this level of development.

While Scenario 3 (730 dwellings) demonstrates that the wider transport network can continue to operate efficiently, this scenario assumes that HSL is in place and therefore does not provide a direct assessment of higher residential yields under a without-HSL network scenario.

The WRTM scenarios assessed as part of this ITA demonstrate that the operation of Ohaupo Road intersections is influenced by broader land use, transport infrastructure and travel behaviour assumptions. These include the scale and timing of development within the Airport Business Zone, Peacocke Structure Plan area and other growth areas, together with assumptions regarding HSL delivery, public transport uptake and active mode uptake. Further discussion of these matters is provided in Table No: 45 in Section 15.5.2.

Accordingly, the results of this assessment should not be interpreted as indicating that development cannot proceed beyond 543 dwellings prior to HSL being delivered. Rather, the assessment demonstrates that development up to approximately 543 dwellings can be accommodated under a without-HSL scenario based on the assumptions adopted for the current modelling.

To ensure that those assumptions remain representative of the receiving transport environment as development progresses, a further ITA should be prepared before development exceeds approximately 543 dwellings. The purpose of that assessment would be to reassess the operation of the Ohaupo Road corridor, having regard to the transport network conditions, land use development, travel behaviour and transport infrastructure (existing and committed at the time (including HSL)), and to identify any further mitigation measures available to support development beyond 543 dwellings if HSL delivery remains uncertain.

This assessment requirement should be regarded as a transport reassessment trigger rather than a permanent development limit. Its purpose is to provide a mechanism for confirming whether the assumptions underpinning the current assessment remain appropriate as development progresses and whether any additional transport mitigation is required.

The reassessment trigger relates specifically to the performance of the Ohaupo Road (SH3) corridor and should not be interpreted as a constraint on the operation of the recommended Industrial Development access arrangements, or the wider strategic transport network.



15.2.3 Ohaupo Road / Lambert Court Intersection

The modelling of this intersection was based on the existing priority-controlled crossroads intersection as shown in Figure 55. The modelling results are presented in the table below.

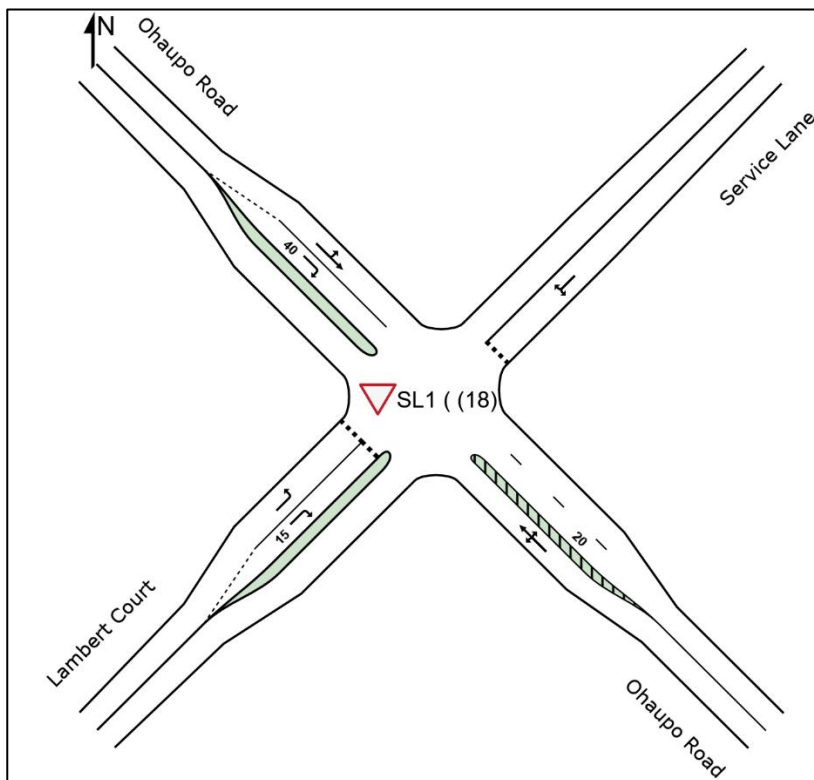


Figure 55: Existing Ohaupo Rd / Lambert Ct Intersection Layout

Table No: 34

Ohaupo Rd / Lambert Court Existing Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2030 Baseline	AM	0.63	6.1	15.8 Lambert Ct	NA	RT from Lambert Ct	109	10.6	F
	PM	0.80	8.3	26.3 Lambert Ct	NA	RT from Service Ln	495	15.6	F
1A	AM	0.90	10.3	33.2 Lambert Ct	NA	RT from Lambert Ct	154	17.6	F
	PM	0.82	8.7	28.0 Lambert Ct	NA	RT from Service Ln	514	16.2	F

Scenario 1A represents the initial stage of Residential Development and comprises approximately 59 dwellings. This scenario was assessed because these dwellings are expected to utilise the Ohaupo Road / Lambert Court intersection from the commencement of development. The assessment was undertaken to determine whether the existing priority-controlled intersection could continue to operate with less than minor effects on intersection performance once Residential Development commences and traffic is introduced via the Lambert Court corridor.



The right turn movements from Lambert Court and the residential service lane fail (LOS F) in the 2030 baseline scenario. The average delay experience by these movements only worsens in Scenario 1A when the development traffic (59 dwellings) is added to the adjoining road network. Accordingly, an upgrade of the intersection to signal control is necessary before trips are generated by the first stage of Residential Development. Figure 56 presents the upgraded intersection layout.

The separation distance between the proposed Ohaupo Road / Lambert Court intersection and the existing signalised mid-block crossing is approximately 105 m. It is not unusual to have closely spaced signal-controlled intersections as these can operate with coordinated signal timings. Below are some examples of reduced separation distances²⁵ between other signalised intersections in Auckland and Hamilton:

- Teed Street to Remuera Road (Newmarket, Auckland) = 53 m
- Ward Street to Bryce Street (Hamilton Central, Hamilton) = 115 m
- Sky City Hamilton to Collingwood Street (Hamilton Central, Hamilton) = 144 m

The close spacing between the proposed signalised intersection and the existing pedestrian crossing can be managed through coordinated signal operation. The pedestrian crossing is demand responsive and only interrupts traffic flow when activated.

Table No: 35 presents the modelled performance results and Figure 59 presents the optimised phase sequence.

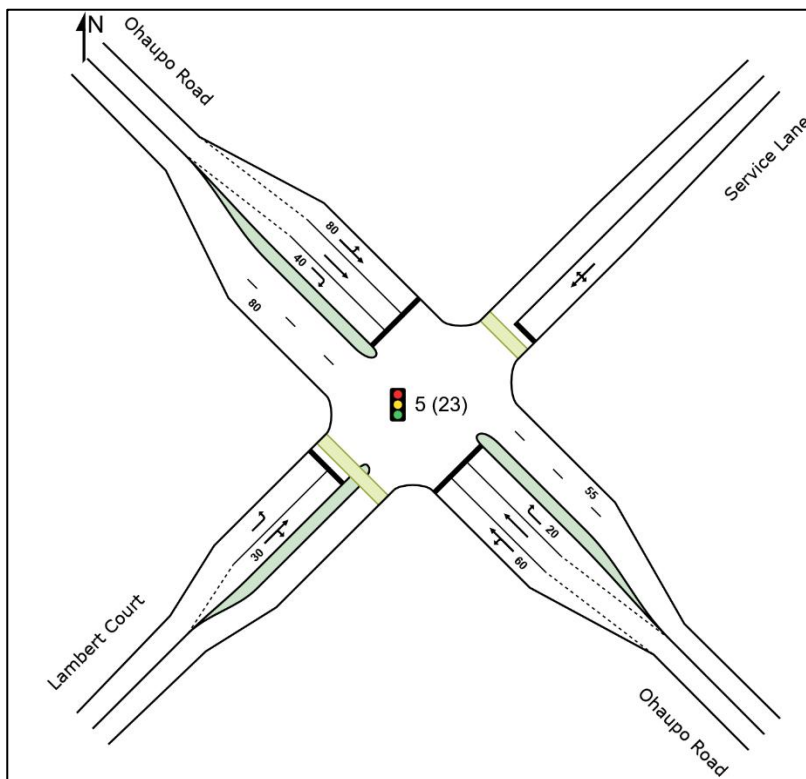


Figure 56: Proposed Ohaupo Rd / Lambert Ct Signalised Intersection Layout – Scenario 1A to 1C

²⁵ Separation distance is measured between primary signal displays of both the upstream and downstream signalised intersections in the same approach.



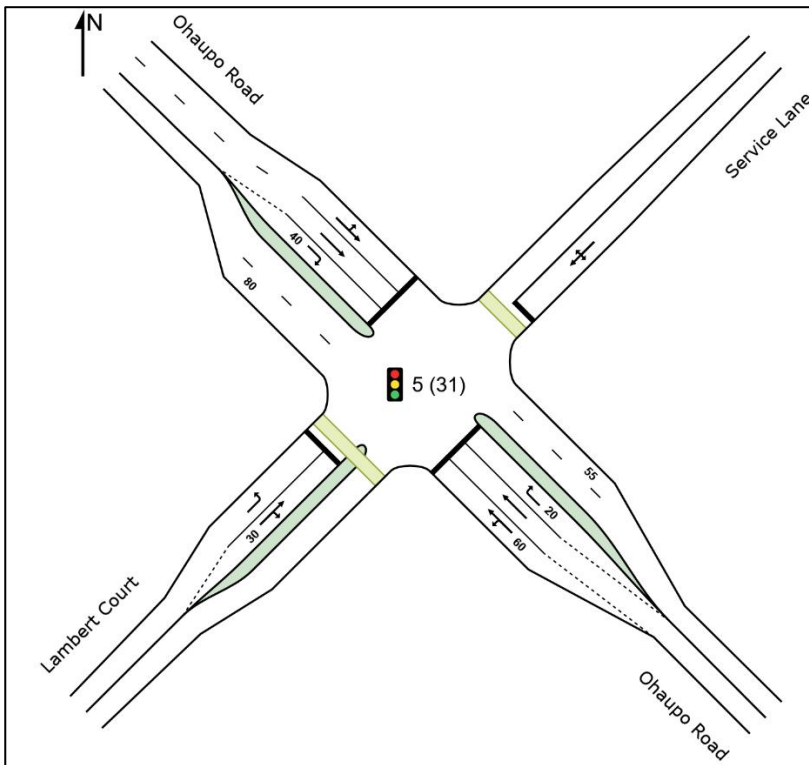


Figure 57: Proposed Ohaupo Rd / Lambert Ct Signalised Intersection Layout – Scenario 1D

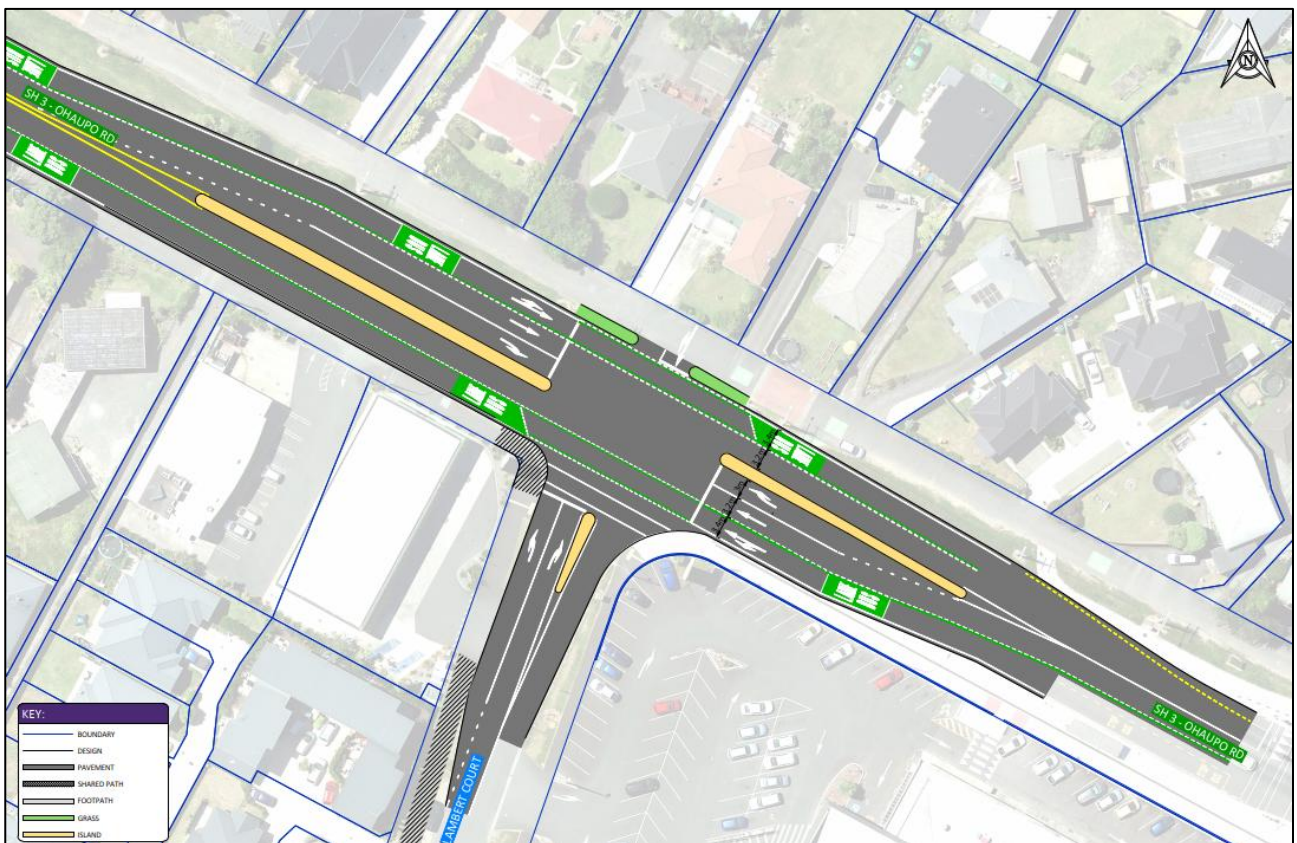


Figure 58: Proposed Ohaupo Rd / Lambert Ct Signalised Intersection Layout – Scenarios 2 to 5



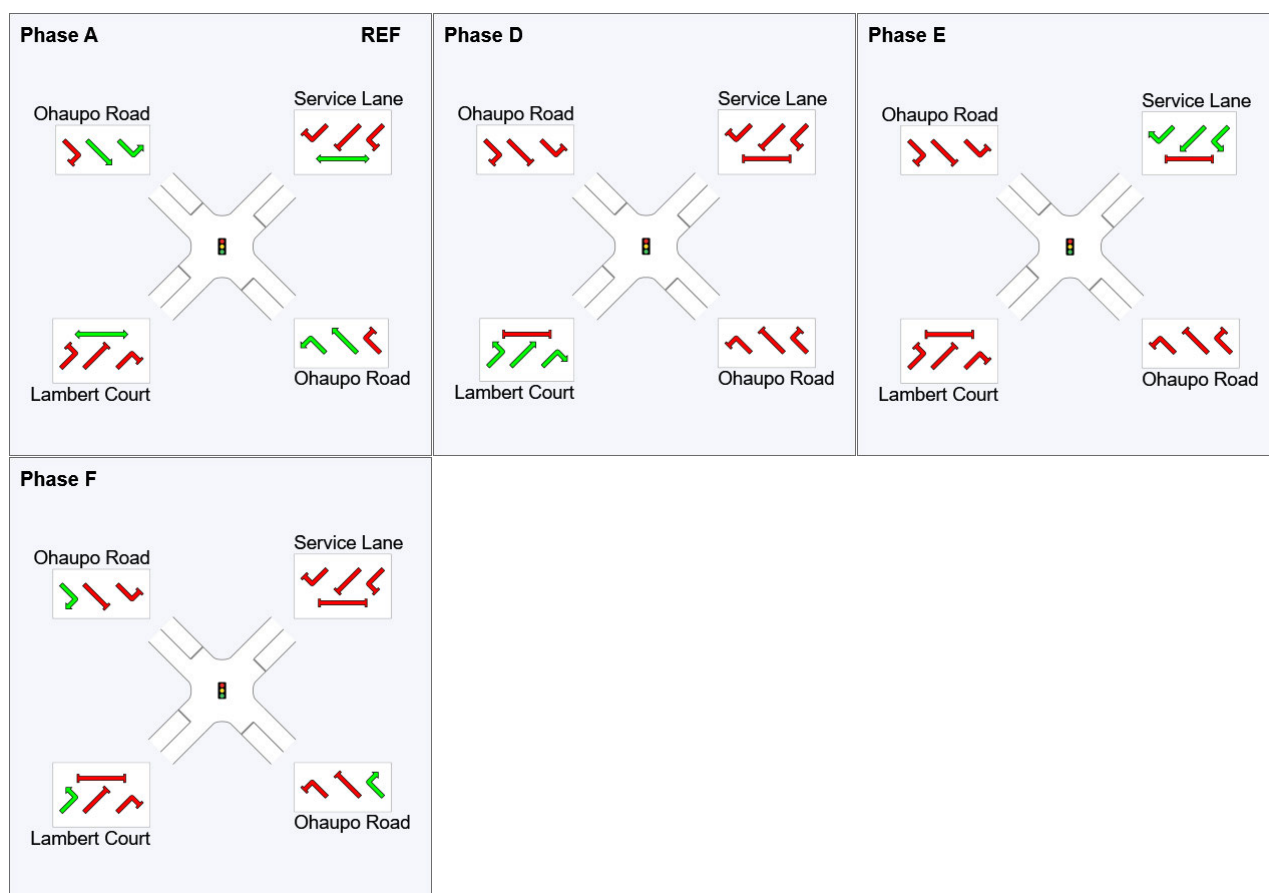


Figure 59: Proposed Ohaupo Rd / Lambert Ct Signalised Intersection Phase Sequence

Table No: 35

Ohaupo Rd / Lambert Ct Signalised Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2030 Baseline	AM	0.53	14.9	118 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	55.9	21.8	E
	PM	0.75	23.6	169 Ohaupo Rd (N)	C	RT from Lambert Ct	48.0	10.5	D
1A	AM	0.54	15.5	118 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	54.5	21.5	D
	PM	0.76	23.7	169 Ohaupo Rd (N)	C	RT from Lambert Ct	48.1	10.8	D
1B	AM	0.54	16.0	118 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	53.9	21.7	D
	PM	0.76	23.8	169 Ohaupo Rd (N)	C	RT from Lambert Ct	48.2	11.5	D
1C	AM	0.55	16.6	118 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	53.4	21.8	D
	PM	0.76	23.9	169 Ohaupo Rd (N)	C	RT from Lambert Ct	48.3	12.5	D



Ohaupo Rd / Lambert Ct Signalised Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
1D	AM	0.56	17.3	118 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	51.8	22.1	D
	PM	0.72	22.2	169 Ohaupo Rd (N)	C	RT from Lambert Ct	53.6	14.2	D
1E	AM	0.56	17.7	118 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	51.2	22.2	D
	PM	0.75	24.0	170 Ohaupo Rd (N)	C	RT from Lambert Ct	49.0	13.6	D
2	AM	0.60	21.4	59.8 Ohaupo Rd (S)	C	RT from Ohaupo Rd (N)	37.5	12.7	D
	PM	0.92	32.8	170 Ohaupo Rd (N)	C	RT from Lambert Ct	54.2	34.1	D
3	AM	0.44	22.8	42.5 Ohaupo Rd (S)	C	RT from Ohaupo Rd (N)	35.8	12.4	D
	PM	0.77	17.3	59.7 Ohaupo Rd (N)	B	RT from Lambert Ct	33.7	23.1	C
4	AM	0.61	12.5	33.1 Ohaupo Rd (N)	B	RT from Lambert Ct	30.0	16.8	C
	PM	0.89	24.6	104 Ohaupo Rd (N)	C	RT from Lambert Ct	42.6	33.7	D
5	AM	0.62	19.8	38.8 Ohaupo Rd (S)	B	RT from Lambert Ct	28.6	10.1	C
	PM	0.83	28.6	130 Ohaupo Rd (N)	C	RT from Ohaupo Rd (N)	57.7	14.9	E

The modelling results are based on the right turn movement from Resthill Crescent being banned in Scenario 2 (as discussed in Section 15.2.4). The SIDRA modelling indicates that the proposed Ohaupo Road / Lambert Court signalised intersection would operate at an acceptable level across all modelled scenarios, achieving LOS B to C with intersection-average delays generally ranging from approximately 14 to 33 seconds per vehicle in both the AM and PM peak periods. Degrees of saturation remain below capacity in all scenarios, indicating sufficient practical spare capacity at the proposed signalised intersection.

The analysis shows that the worst-performing movements are typically right-turn movements from Ohaupo Road (northern approach) or Lambert Court, which operate predominantly at LOS D and, in isolated PM peak scenario (i.e. Scenario 5), at LOS E (i.e. average delay greater than 55 seconds per vehicle). Notwithstanding this, the average delay per vehicle on each approach remains below 55 seconds during peak periods, consistent with the efficiency criteria set out in ODP Appendix 15, Table 15-2b.

The 95th percentile queue lengths achieved on all approaches do not extend to or spill back to adjacent intersections. However, the 95th percentile queue length achieved on the southern approach of Ohaupo Road reaches approximately 120 m in Scenarios 1A to 1E, extending beyond the existing mid-block signalised crossing which is 105 m from the Ohaupo Road / Lambert Court intersection. While the modelled 95th percentile queue extends beyond the pedestrian crossing in some scenarios, the average queue length is



approximately 75 m, indicating that such occurrences are infrequent and not representative of typical operating conditions. On this basis, the modelling demonstrates that the proposed Ohaupo Road / Lambert Court signalised intersection can accommodate the forecast traffic demand.

It is noted that a signalised intersection form supports Ohaupo Road being a bus priority corridor in the future. Detailed signal phasing, pedestrian crossing arrangements, geometric design and visibility requirements will be confirmed during subsequent engineering design phases.

Consideration has been given to removing access to the Ohaupo Road service lane (northern leg of the Ohaupo Road / Lambert Court intersection), since an alternative is already provided further north on Ohaupo Road. However, it is expected that the likelihood of crashes at the alternative northern access could potentially increase as vehicles exiting and heading north will have to cut across two lanes (i.e. one southbound lane + flush medium existing arrangement and two southbound lanes future arrangement) to merge with through traffic. Similarly, vehicles turning right into the access will have to cut across two lanes.

To mitigate the safety risk, a central median island could be introduced on Ohaupo Rd at the alternative northern access limiting movements at the access to left-in-left-out. However, this could in return increase unsafe U-turn movements at both signalised intersections (i.e. Saxbys Rd and Lambert Ct) on either end of this section of road.

On balance, retaining the service lane as the fourth leg of the signalised intersection is considered preferable to closing the access, having regard to the operational and safety implications associated with diverting movements to the alternative northern access.

15.2.4 Ohaupo Road / Resthill Crescent Intersection

The existing intersection layout modelled within SIDRA is shown in Figure 60. The results of the intersection performance during the peak periods are presented in Table No: 36.

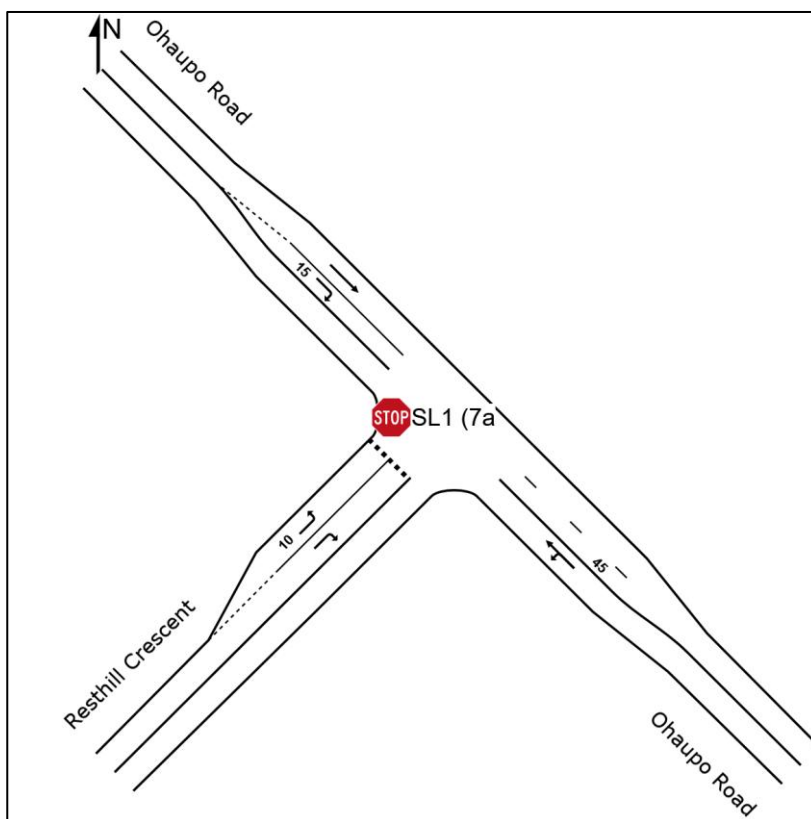


Figure 60: Existing Ohaupo Rd / Resthill Cres Intersection Layout



Table No: 36

Existing Ohaupo Rd / Resthill Cres Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2030 Baseline	AM	0.54	3.2	9.3 Resthill Cres	NA	LT from Resthill Cres	140	9.3	F
	PM	0.66	4.0	18.2 Resthill Cres	NA	LT from Resthill Cres	89.5	18.2	F
1A	AM	0.54	3.3	9.3 Resthill Cres	NA	LT from Resthill Cres	140	9.3	F
	PM	0.66	4.1	18.3 Resthill Cres	NA	LT from Resthill Cres	90.2	18.3	F
1E	AM	0.55	3.8	9.3 Resthill Cres	NA	LT from Resthill Cres	140	9.3	F
	PM	0.69	4.7	19.2 Resthill Cres	NA	LT from Resthill Cres	96.8	19.2	F

Although the left turn movement from Resthill Crescent fails in the 2030 baseline scenario, there is negligible increase in the average delay (i.e. less than 10 seconds per vehicle) for all movements for Scenarios 1A to 1E. Therefore, the Ohaupo Road / Resthill Crescent intersection is proposed to be upgraded (i.e. right turn movement out removed) prior to Scenario 2 as shown in Figure 61.

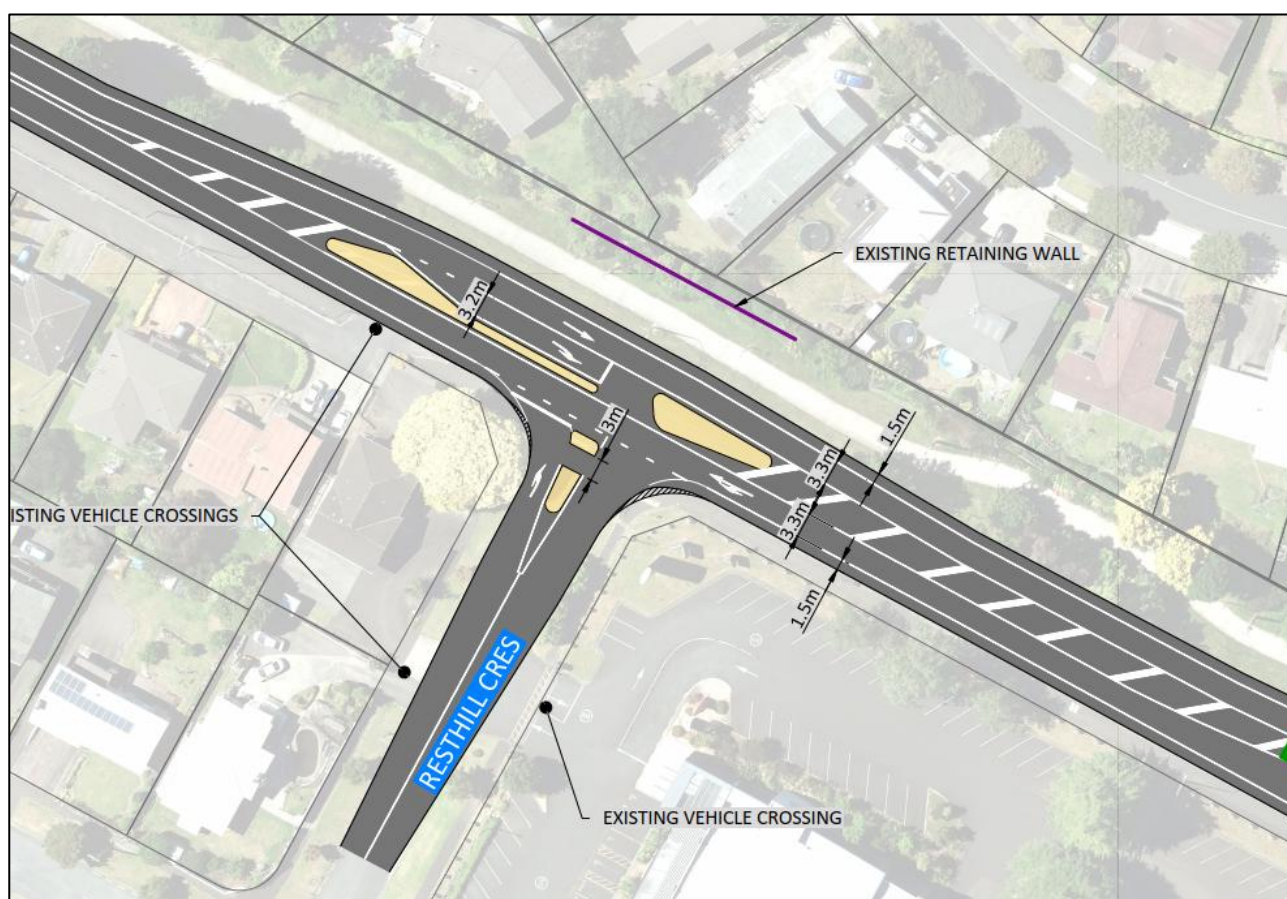


Figure 61: Proposed Ohaupo Rd / Resthill Cres Intersection Upgrade



Table No: 37

Ohaupo Rd / Resthill Cres Intersection – RT from Resthill Cres Removed									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2	AM	0.54	1.4	1.9 Ohaupo Rd (N)	NA	LT from Resthill Cres	168	1.3	F
	PM	0.58	1.6	3.2 Ohaupo Rd (N)	NA	RT from Ohaupo Rd (N)	57.2	3.2	F
3	AM	0.35	0.7	0.5 Ohaupo Rd (N)	NA	LT from Resthill Cres	29.7	0.2	D
	PM	0.37	1.0	1.1 Ohaupo Rd (N)	NA	LT from Resthill Cres	21.8	0.3	C
4	AM	0.44	0.7	0.4 Ohaupo Rd (N)	NA	LT from Resthill Cres	49.8	0.4	E
	PM	0.47	1.0	0.8 Ohaupo Rd (N)	NA	RT from Ohaupo Rd (N)	32.5	0.8	D
5	AM	0.41	0.6	0.3 Ohaupo Rd (N)	NA	LT from Resthill Cres	43.8	0.3	E
	PM	0.56	0.7	0.7 Ohaupo Rd (N)	NA	LT from Resthill Cres	23.6	0.4	C

The SIDRA modelling indicates that the Ohaupo Road / Resthill Crescent intersection, with the right-turn movement from Resthill Crescent removed, operates with low intersection-average delays, generally less than 2 seconds per vehicle in both the AM and PM peak periods. Degree of saturation remain well below capacity in all scenarios, confirming substantial practical spare capacity on the Ohaupo Road approaches.

The analysis shows that the worst-performing movements are left-turn movement from Resthill Crescent or right-turn movement from Ohaupo Road. While these movements achieve LOS D to F in some scenarios, the associated traffic volumes are low, with the left-turn movement from Resthill Crescent carrying approximately 3 to 7 vehicles per hour and the right-turn movement from the northern Ohaupo Road approach carrying approximately 10 to 35 vehicles per hour. Accordingly, the movement-specific delays reflect limited gap availability for a small number of vehicles rather than a broader operational constraint affecting intersection performance.

The 95th percentile queue lengths achieved on all approaches are considered negligible, generally less than 3 m following removal of the right-turn movement from Resthill Crescent. The modelling therefore indicates that the intersection can accommodate the forecast traffic demand without adverse operational effects on the surrounding transport network.

It is also noted that the right-turn movement from Resthill Crescent, which is removed as part of the proposed upgrade, carries approximately 20 vehicles per hour during the AM peak period and approximately 120 vehicles per hour during the PM peak period. These movements are reassigned through the proposed Ohaupo Road / Lambert Court signalised intersection, which has been demonstrated through the modelling presented in Section 15.2.3 to operate at an acceptable level under the assessed development scenarios.



15.2.5 Ohaupo Road (SH3) / Houchens Road Intersection

The existing intersection layout modelled within SIDRA is shown in Figure 62. The results of the intersection performance during the peak periods are presented in Table No: 38.

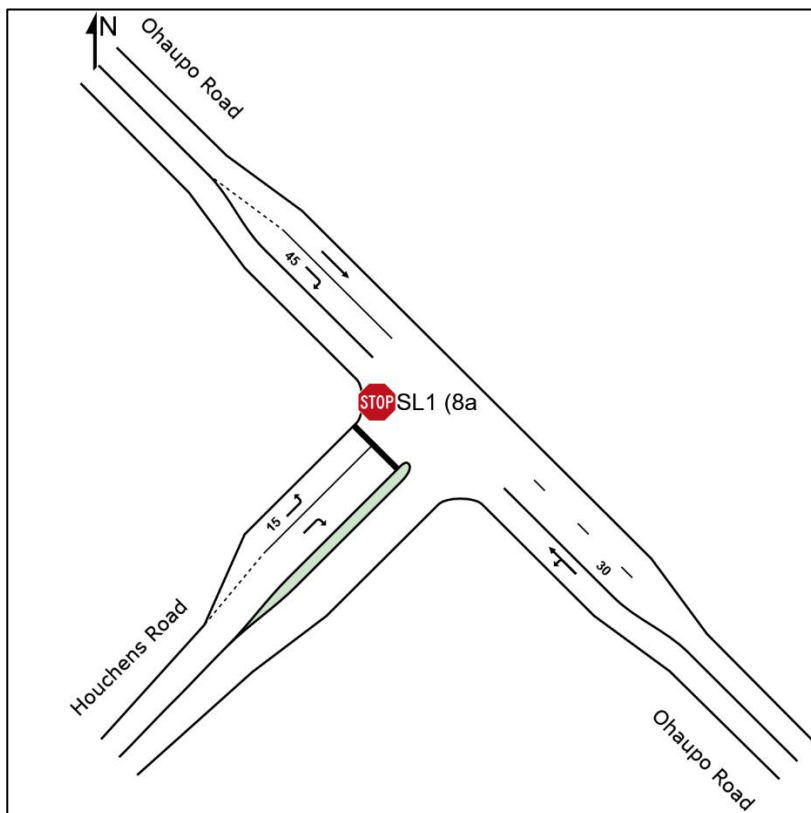


Figure 62: Existing Ohaupo Rd / Houchens Rd Intersection Layout

Table No: 38

Existing Ohaupo Rd / Houchens Rd Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
2030 Baseline	AM	0.70	7.2	25.8 Houchens Rd	NA	RT from Houchens Rd	61.2	16.6	F
	PM	0.63	5.9	23.6 Ohaupo Rd (N)	NA	RT from Houchens Rd	107	11.5	F
1A	AM	0.71	7.3	26.0 Houchens Rd	NA	RT from Houchens Rd	64.4	17.2	F
	PM	0.65	6.1	24.2 Ohaupo Rd (N)	NA	RT from Houchens Rd	110	11.8	F
1B	AM	0.71	7.4	26.3 Houchens Rd	NA	RT from Houchens Rd	67.9	17.9	F



Existing Ohaupo Rd / Houchens Rd Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
1C	PM	0.66	6.2	24.8 Ohaupo Rd (N)	NA	RT from Houchens Rd	115	12.2	F
	AM	0.74	7.7	26.8 Houchens Rd	NA	RT from Houchens Rd	73.0	18.8	F
	PM	0.67	6.5	25.6 Ohaupo Rd (N)	NA	RT from Houchens Rd	121	12.6	F

Although the right turn movement from Houchens Road operates at LOS F in the 2030 baseline scenario, there is negligible increase in the average delay (i.e. less than 10 seconds per vehicle) for Scenarios 1A and 1B. However, in Scenario 1C, the average delay for right turning vehicles from Houchens Rd increases by more than 10 seconds per vehicle during the peak periods. Therefore, the intersection is recommended to be upgraded to a signalised intersection prior to Scenario 1C (i.e. 198 dwellings).

The signalised intersection layout modelled within SIDRA is shown in Figure 63. The results of the intersection performance for Scenarios 2 to 5 during the peak periods are presented in Table No: 39.



Figure 63: Proposed Ohaupo Rd / Houchens Rd Signalised Intersection Layout



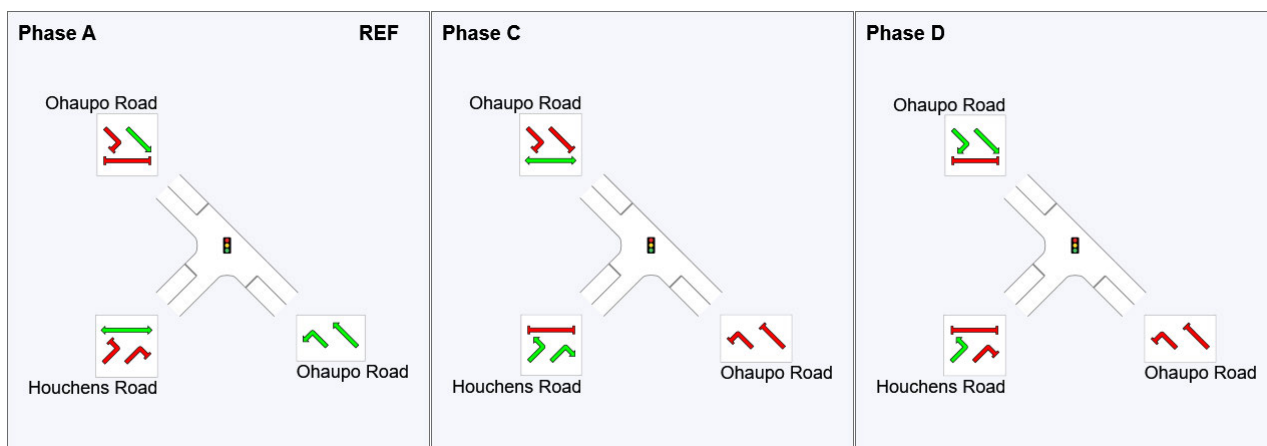


Figure 64: Proposed Ohaupo Rd / Houchens Rd Phase Sequence.

Table No: 39

Proposed Ohaupo Rd / Houchens Rd Signalised Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
1C	AM	0.42	11.7	69.1 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	42.7	8.1	D
	PM	0.58	12.8	83.0 Ohaupo Rd (N)	B	RT from Ohaupo Rd (N)	30.0	29.8	C
1D	AM	0.42	11.6	69.5 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	42.7	8.1	D
	PM	0.58	12.8	83.2 Ohaupo Rd (N)	B	RT from Ohaupo Rd (N)	30.0	29.8	C
1E	AM	0.65	12.8	119 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	41.5	7.8	D
	PM	0.67	13.1	95.2 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	35.7	34.3	D
2	AM	0.50	11.1	45.3 Ohaupo Rd (S)	B	RT from Houchens Rd	31.9	8.5	C
	PM	0.58	10.3	54.5 Ohaupo Rd (S)	B	RT from Houchens Rd	34.3	5.6	C
3	AM	0.42	16.1	33.6 Ohaupo Rd (S)	B	RT from Houchens Rd	35.5	14.3	D
	PM	0.60	17.0	31.3 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	31.7	26.7	C



Proposed Ohaupo Rd / Houchens Rd Signalised Intersection									
Scenario	Peak	Intersection Average				Worst Movements (based on delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
4	AM	0.61	15.3	36.4 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	32.5	21.8	C
	PM	0.67	16.7	45.0 Ohaupo Rd (S)	B	RT from Ohaupo Rd (N)	35.1	29.4	D
5	AM	0.61	14.3	36.0 Ohaupo Rd (S)	B	RT from Houchens Rd	25.3	17.2	C
	PM	0.61	17.8	55.4 Ohaupo Rd (S)	B	RT from Houchens Rd	45.5	30.5	D

The SIDRA modelling indicates that the proposed Ohaupo Road / Houchens Road signalised intersection operates at an acceptable level across all modelled scenarios, achieving LOS B with average delays generally in the order of approximately 12 to 18 seconds per vehicle in both the AM and PM peak periods. Degree of saturation remain below capacity in all scenarios, indicating that the intersection provides sufficient practical spare capacity to accommodate the forecast traffic demand.

The worst-performing movements are identified as right turn movements from Ohaupo Road and Houchens Road, which operate predominantly at LOS C to D across the assessed scenarios. However, the associated average delays for these movements remain moderate, and the average delay per vehicle on each approach to the intersection remains well below 55 seconds during peak periods, consistent with the efficiency criteria set out in ODP Appendix 15, Table 15-2b.

The 95th percentile queue lengths on the Ohaupo Road approaches are relatively modest, and do not give rise to any queue spillback or interaction with adjacent intersections.

15.2.6 Future Houchens Road Full-Diamond Interchange

The suggested Houchens Road full-diamond interchange is not part of this Project. It has been assessed because it is a potential future network intervention that could materially influence traffic distribution and long-term network performance for the Residential Development area and the wider SL1 growth cell. Its inclusion is therefore for scenario-testing purposes only and does not form part of the works proposed on for this Project.

The suggested Houchens Road full-diamond interchange was analysed as a network in SIDRA with a pair of roundabouts as illustrated in Figure 56. The interchange performance results for all modelling scenarios 3 to 5 during peak periods are presented in Table No: 40 and Table No: 41.



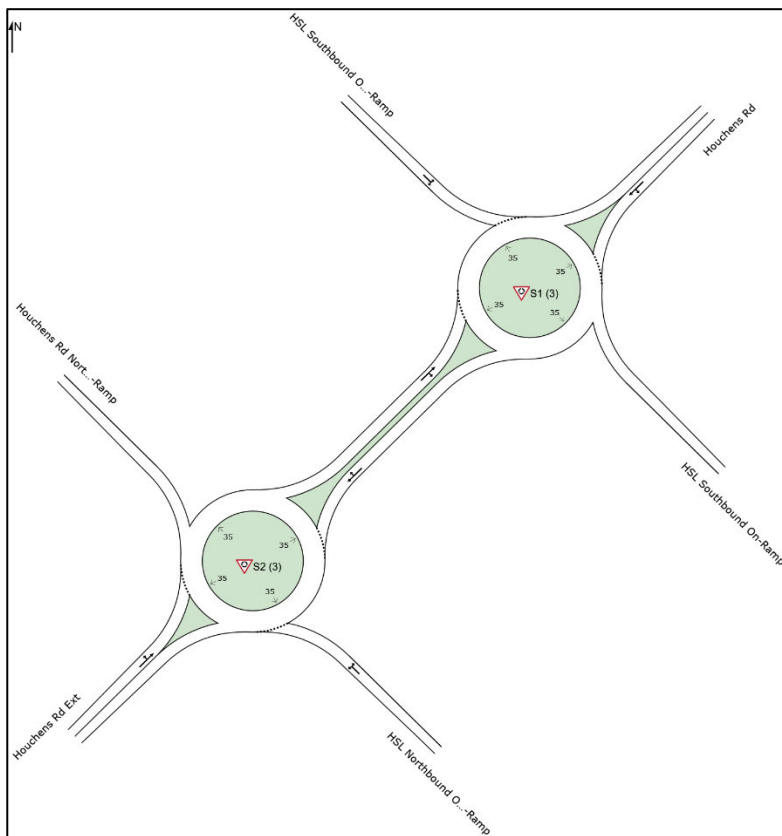


Figure 65: Future Houchens Rd Full-Diamond Interchange Layout

Table No: 40

Houchens Rd Interchange – Northern Roundabout									
Infrastructure Scenarios	Peak	Intersection Average				Worst Movements (in terms of delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
3	AM	0.18	3.0	2.9 Houchens Rd	A	RT from HSL SB Off-ramp	12.9	1.1	B
	PM	0.22	3.8	3.6 HSL SB Off-ramp	A	RT from HSL SB Off-ramp	13.2	3.6	B
4	AM	0.15	3.5	2.1 Houchens Rd	A	RT from HSL SB Off-ramp	12.6	1.1	B
	PM	0.26	4.3	4.4 HSL SB Off-ramp	A	RT from HSL SB Off-ramp	12.9	4.4	B
5	AM	0.69	3.5	25.6 Houchens Rd	A	RT from HSL SB Off-ramp	14.1	7.1	B
	PM	0.67	5.7	22.9 HSL SB Off-ramp	A	RT from HSL SB Off-ramp	21.1	22.9	C



Table No: 41

Houchens Rd Interchange – Southern Roundabout									
Infrastructure Scenarios	Peak	Intersection Average				Worst Movements (in terms of delay)			
		V/C	Ave Delay (s)	95 th % Queue (m)	LOS	Movement	Ave Delay (s)	95 th % Queue (m)	LOS
3	AM	0.14	7.4	2.0 HSL NB Off-ramp	A	RT from HSL NB Off-ramp	12.6	2.0	B
	PM	0.16	8.2	2.5 HSL NB Off-ramp	A	RT from HSL NB Off-ramp	12.5	2.5	B
4	AM	0.09	6.7	1.3 HSL NB Off-ramp	A	RT from HSL NB Off-ramp	12.5	1.3	B
	PM	0.12	7.5	1.8 HSL NB Off-ramp	A	RT from HSL NB Off-ramp	12.5	1.8	B
5	AM	0.37	8.2	6.1 HSL NB Off-ramp	A	RT from HSL NB Off-ramp	16.4	6.1	B
	PM	0.49	10.5	10.6 HSL NB Off-ramp	A	RT from HSL NB Off-ramp	13.9	10.6	B

The SIDRA modelling indicates that both roundabouts forming the suggested Houchens Road full-diamond interchange operate at a high level of service across all assessed scenarios. The northern roundabout achieves intersection average delays of approximately 3 to 6 seconds per vehicle, while the southern roundabout achieves intersection average delays of approximately 7 to 11 seconds per vehicle during the peak periods.

Degrees of saturation remain well below practical capacity at both roundabouts in all scenarios, indicating substantial spare capacity is available. The worst-performing movements generally operate at LOS B, with isolated LOS C conditions occurring at the northern roundabout in Scenario 5 during the PM peak period. Notwithstanding this, movement delays remain low and do not indicate any operational constraints.

The 95th percentile queue lengths are also modest, remaining below approximately 26 m at the northern roundabout and 11 m at the southern roundabout across all assessed scenarios. The modelling therefore indicates that the future Houchens Road full-diamond interchange would operate efficiently and accommodate the forecast traffic demand associated with the assessed development scenarios.

15.3 Bus Route Modelling

Bus route modelling has been undertaken to assess the operational performance of future public transport services operating along Ohaupo Road corridor under the 2035 and 2045 modelled network conditions (i.e. Scenarios 2 to 4).

This assessment is important because the future Comet service is expected to operate as a frequent public transport corridor serving Glenview, the Residential Development and the wider southern Hamilton growth area. The assessment provides an indication of the relative performance of buses, light vehicles and heavy commercial vehicles under the future transport network scenarios considered within this ITA.



Figure 66 illustrates the future 2035 and 2045 Comet bus routes, aligned with the WRC 2028 and 2037 Network Plans (refer to Figure 23 and Figure 24). Table No: 42 compares route performance for buses, light vehicles and heavy commercial vehicles using four indicators: average travel speed, average control delay, degree of saturation and effective stop rate. These indicators collectively describe travel efficiency, delay exposure, capacity resilience and stop-start operating conditions along the corridor.

The modelling indicates that bus services generally achieve travel performance comparable to, and in many cases better than, light vehicles and heavy commercial vehicles across the assessed scenarios. Bus movements typically experience lower average control delays and lower effective stop rates than other vehicle classes, indicating reduced exposure to stop-start conditions and supporting improved service reliability.

In Scenario 2 (2035 without HSL), the corridor experiences its most constrained operating conditions, particularly in the Houchens Road to Saxbys Road direction during the AM peak and the Saxbys Road to Houchens Road direction during the PM peak. Despite these conditions, buses continue to achieve comparable or higher travel speeds than general traffic and generally experience lower delays.

The introduction of HSL in Scenarios 3 and 4 generally reduces corridor degrees of saturation and provides additional network capacity, reflecting the redistribution of traffic across the wider transport network. While changes in travel speed and delay vary by direction and time period, buses continue to perform competitively relative to light vehicles and heavy commercial vehicles under all assessed scenarios.

The effective stop-rate results also indicate that buses generally experience fewer stop-start events than other vehicle classes across most scenarios. This supports smoother progression through the corridor and contributes to travel time reliability for future public transport services.

It is noted that the assessed network includes transport interventions that support public transport operation at key locations along the corridor. However, the purpose of this assessment is not to confirm the detailed design of future bus-priority measures. Rather, it is to assess the relative performance of future bus services within the wider transport network scenarios considered by the ITA.

Overall, the route travel performance results indicate that future public transport services can operate efficiently within the assessed transport network. While HSL provides additional network capacity and generally reduces corridor saturation, the modelling demonstrates that bus services remain a competitive transport option across all assessed scenarios, achieving travel speeds and operating conditions that are comparable to, and often better than, general traffic.



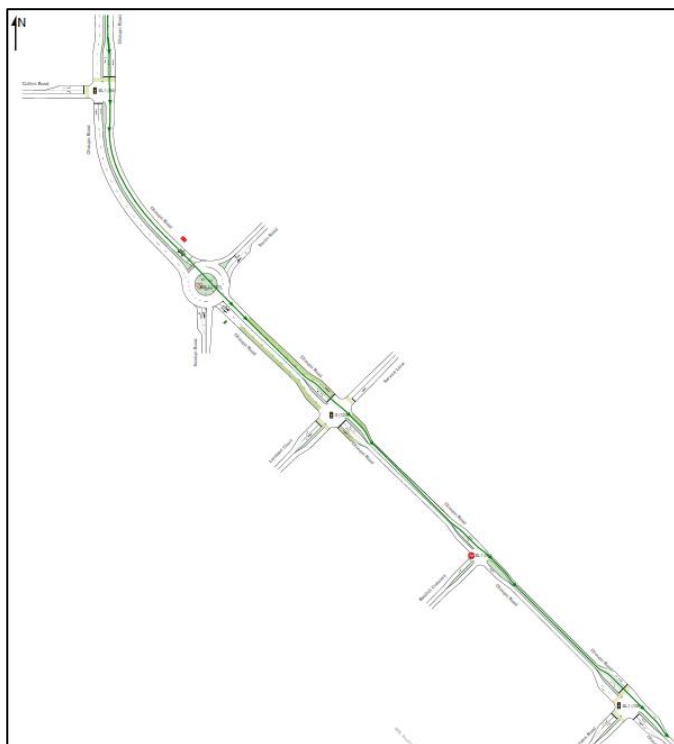


Figure 66: 2035 / 2045 Comet Bus Route – Based on WRC Network Plans

Table No: 42

Route Travel Performance												
Performance Indicators	Average Travel Speed (km/h)			Average Control Delay (seconds)			Degree of Saturation			Effective stop rate		
Vehicle Class	Buses	LV	HCV	Buses	LV	HCV	Buses	LV	HCV	Buses	LV	HCV
Scenario 2: 2035 AM Peak Saxbys Rd to Houchens Rd	36	35	35	7.9	8.5	10.4	0.81	0.81	0.81	0.38	0.47	0.46
Scenario 2: 2035 AM Peak Houchens Rd to Saxbys Rd	33	29	29	8.5	14.5	14.8	0.87	0.87	0.87	0.50	0.72	0.74
Scenario 2: 2035 PM Peak Saxbys Rd to Houchens Rd	38	27	27	6.4	17.1	18.8	0.57	0.97	0.97	0.29	0.51	0.52
Scenario 2: 2035 PM Peak Houchens Rd to Saxbys Rd	30	27	27	12.1	16.7	17.9	0.94	0.94	0.94	0.52	0.66	0.64
Scenario 3: 2035 AM Peak Saxbys Rd to Houchens Rd – With HSL	31	36	36	13.4	8.0	9.7	0.66	0.66	0.66	0.61	0.46	0.46
Scenario 3: 2035 AM Peak Houchens Rd to	33	32	32	11.8	13.9	13.9	0.79	0.82	0.82	0.74	0.70	0.71



Route Travel Performance												
Performance Indicators	Average Travel Speed (km/h)			Average Control Delay (seconds)			Degree of Saturation			Effective stop rate		
Vehicle Class	Buses	LV	HCV	Buses	LV	HCV	Buses	LV	HCV	Buses	LV	HCV
Saxbys Rd – With HSL												
Scenario 3: 2035 PM Peak Saxbys Rd to Houchens Rd – With HSL	35	32	32	6.6	12.6	12.9	0.49	0.86	0.86	0.32	0.55	0.55
Scenario 3: 2035 PM Peak Houchens Rd to Saxbys Rd – With HSL	34	28	28	9.2	17.7	18.7	0.67	0.79	0.79	0.47	0.69	0.69
Scenario 4: 2045 AM Peak Saxbys Rd to Houchens Rd – With HSL	36	35	35	7.9	8.4	10.0	0.64	0.72	0.72	0.35	0.46	0.46
Scenario 4: 2045 AM Peak Houchens Rd to Saxbys Rd – With HSL	35	30	30	8.1	16.7	16.8	0.84	0.92	0.92	0.48	0.77	0.78
Scenario 4: 2045 PM Peak Saxbys Rd to Houchens Rd – With HSL	35	29	29	7.3	16.1	17.0	0.54	0.95	0.95	0.31	0.54	0.54
Scenario 4: 2045 PM Peak Houchens Rd to Saxbys Rd – With HSL	31	27	27	12.9	20.0	21.1	0.76	0.76	0.76	0.50	0.69	0.69

15.4 Summary of Traffic Modelling

The intersection modelling indicates that development accessing Ohaupo Road (SH3) will progressively increase demand on the surrounding transport network, particularly during the peak periods. Except for the Ohaupo Road / Saxbys Road / Tomin Road roundabout, the assessed intersections are expected to continue operating at acceptable levels of service in the future year scenarios, provided the recommended intersection upgrades are implemented. These upgrades are required to maintain acceptable operational performance, support efficient movement along the corridor, and accommodate future growth within the wider SL1 area.

The modelling identifies the Ohaupo Road / Saxbys Road / Tomin Road roundabout as the principal transport constraint within the assessed network. The assessment demonstrates that Residential Development can be accommodated with acceptable transport effects up to 543 dwellings under a network scenario that does not rely on delivery of HSL, subject to the transport infrastructure upgrades identified in this ITA being



implemented. As discussed in Sections 15.2.2 and 15.5.2, development beyond this level should be subject to a future transport reassessment.

The assessment also demonstrates the importance of a coordinated transport strategy incorporating targeted intersection upgrades, improvements for public transport, and connected walking and cycling infrastructure. While the future form and extent of public transport priority measures will be subject to further investigation and design, the route performance assessment indicates that public transport services can operate efficiently within the assessed transport network and achieve reliable route performance under the assessed scenarios.

HSL remains an important component of the long-term strategic transport context for southern Hamilton. The modelling demonstrates that HSL improves corridor performance by redistributing a proportion of through-traffic away from Ohaupo Road and improving the efficiency of the wider transport network. However, the transport strategy adopted for this Project does not rely on HSL being delivered within a specific timeframe. Instead, the assessment identifies interim and staged mitigation measures capable of managing transport effects as development progresses.

The assessment also reinforces the importance of delivering a connected walking and cycling network. As outlined elsewhere in this ITA, the proposed active mode improvements are intended to provide safe and efficient connections between the proposed developments and the wider transport network, supporting both local trips and longer-distance journeys.

15.5 Staging of Transportation Infrastructure Improvements

Table No: 43 and Table No: 44 provide a summary of the recommended infrastructure improvements and development triggers / staging from the preceding section.

Development staging has been informed by both road network capacity and the timing of public transport and active mode infrastructure. Delivery of walking, cycling, and public transport-enabling infrastructure is a core component of the staging framework and is fundamental to supporting development without disproportionate reliance on further road capacity expansion.

Given the uncertainty surrounding the timing of HSL delivery, the transport staging framework distinguishes between infrastructure that is dependent on HSL and infrastructure that can be delivered independently of HSL. Where HSL delivery has not occurred, interim access arrangements have been identified and assessed.

15.5.1 Industrial Development Transport Infrastructure Improvements

Table No: 43

Interim Option B (Pre-HSL) - Intersections		
Intersection	Infrastructure Upgrade	When?
Greenwood St / Kahikatea Dr Interim 4-arm Roundabout (Interim Option B)	Upgrade to a four-arm roundabout Interim Option B assumes a similar Greenwood St / Kahikatea Dr roundabout footprint as the ultimate arrangement. Final staging, cross-section and transition arrangements to be confirmed	To be completed prior to completion of any subdivision beyond 1 ha within SL1 Industrial Development area.



	through detailed design and NZTA review / approval.	
Interim Option B (Pre-HSL) - Transport Corridors		
Road	Infrastructure Upgrade	When?
North-South Access Rd between Greenwood St / Kahikatea Dr intersection and east-west collector road	A new access road between Kahikatea Dr and east-west collector road to be designed and constructed, including the intersection of the access road with the east-west collector road. The interim access road should be designed to be compatible with the ultimate HSL corridor. Initially, only a two-lane carriageway is required, with the final cross-section and staging to be confirmed through detailed design and NZTA review / approval.	To be completed prior to completion of any subdivision beyond 1 ha within SL1 Industrial Development area.
East-West Collector Rd	A new public road constructed in general accordance with the typical cross-section in Figure 33, including the intersection of the east-west collector road with Wickham St extension.	To be completed prior to any industrial activity being able to generate traffic within the Industrial Development.
Walking and Cycling Connection	Provide a connection between the Road 3 turning head and the existing ROW connecting to Wickham Street.	To be completed prior to any industrial activity being able to generate traffic within the Industrial Development.

15.5.2 Residential Development Transport Infrastructure Improvements

The Residential Development infrastructure staging framework is summarised below. The timing of these upgrades reflects the assessed development staging so that the transport network continues to operate at an acceptable level of service (performance) as development progresses.

Table No: 44

Staging of Transportation Infrastructure Improvements - Intersections		
Intersection	Infrastructure Upgrade	When?
Ohaupo Rd / Saxbys Rd / Tomin Rd Roundabout	Provide southbound dual exit lanes on Ohaupo Rd from Saxbys Rd roundabout to Lambert Ct signalised intersection.	To be completed prior to Stage 1D (271 dwellings)
	Four laning of Ohaupo Rd between Saxbys Rd and Lambert Ct.	To be completed prior to Stage 2 (543 dwellings)



	Additional lanes on Saxbys Rd and Tomin Rd approaches in general accordance with Drawing 149240-00-0215. Ohaupo Rd southbound approach Signal Meter for the AM peak period.	
Ohaupo Rd / Lambert Ct	Upgrade to a four-arm signalised intersection in general accordance with Drawing 149240-00-0220.	To be completed prior to completion of residential lot subdivision.
Ohaupo Rd / Resthill Cres	Upgrade to remove right turn movement out of Resthill Cres in general accordance with Drawing 149240-00-0230.	To be completed prior to Stage 2 (543 dwellings)
Ohaupo Rd / Houchens Rd	Upgrade to a signalised T-intersection in general accordance with Drawing 149240-00-0240.	To be completed prior to Stage 1C (198 dwellings)

Staging of Transportation Infrastructure Improvements – Transport Corridors

Road	Infrastructure Upgrade	When?
MacMurdo Avenue	Extension of MacMurdo Ave providing access to the Residential Development. To be designed and constructed in general accordance with the typical cross-section in Figure 21.	To be completed prior to any residential activity being able to generate traffic that gains access off MacMurdo Ave.
Forth Crescent	Extension of Forth Cres providing access to the to the Residential Development. To be designed and constructed in general accordance with the typical cross-section in Figure 22.	To be completed prior to any residential activity being able to generate traffic that gains access off Forth Cres.
MacMurdo Ave, MacDonald Rd and Lambert Ct	Provide a shared walking and cycling path and separated bi-directional cycle path in general accordance with Drawing 149240-00-0270 to 0275.	To be completed prior to Stage 1C (198 dwellings)
Saxbys Rd	Provide a minimum 3m wide shared walking and cycling path on southern side of Saxbys Road between Site and Deanwell Ave, a safe road crossing facility near Saxbys Rd /Deanwell Ave intersection and a pedestrian refuge island east of Saxbys Rd/Leslie Pl in general accordance with Drawing 149240-00-0250.	To be completed prior to Stage 1A.
Deanwell Ave, Saxbys Rd	Provide a minimum 3 m wide separated bi-directional cycle path on the western side of	To be completed prior to Stage 3 (730 dwellings)



	the road in general accordance with Drawing 149240-00-0260 - 0267.	
Prisk St, Mount View Rd	Provide cycle sharrow markings to highlight the shared low speed environment.	To be completed prior to Stage 3 (730 dwellings)

Sections 15.2.2 and 15.4 of this ITA demonstrate that Residential Development of up to 543 dwellings can be accommodated, with acceptable transport effects and without HSL delivery provided the transport infrastructure upgrades identified in the above table are implemented per the timing criteria. Subdivision exceeding 543 dwellings should be subject to a further ITA having regard to the transport environment at that time and implementation of any further identified mitigation and/or development caps recommended in the ITA.

The reassessment requirement recognises that future network performance may be influenced by a range of variables affecting other developments and land use, future transport infrastructure delivery and travel behaviour assumptions. Illustrative examples of such variables are provided in Table No: 45.

Table No: 45

Illustrative Variables for Residential Development Reassessment Beyond 543 Dwellings			
Variable	Current Assessment Assumption in Scenario 2	Example Alternative Assumption	Indicative Change to Assessment
Residential vehicle trip generation	Scenario 2 (543 dwellings) generates approximately 345 vehicle trips per peak hour (0.66 veh / low density dwelling and 0.62 veh / medium density dwelling)	If the lower range of vehicle trip rates were adopted from the NSW Guide: low density dwelling = 0.83 veh / dwelling Medium density dwelling = 0.41 veh / dwelling A lower vehicle trip rate is likely to capture some combination of higher PT use, higher active mode use, trip chaining, internal trip, and lower vehicle ownership.	By way of illustration, if lower vehicle trip generation rates were realised in practice, the Residential Development could generate materially fewer peak-hour vehicle trips than assumed in Scenario 2. This could increase the number of dwellings accommodated before the development generates the same peak-hour traffic demand (345 vph) assessed for Scenario 2. Indicatively, this difference is equivalent to approximately 94 additional medium-density dwellings based on vehicle trip generation alone, and assuming the same trip distribution patterns as adopted in the current assessment. This does not represent a reassessment of network capacity or intersection performance.
Airport Business Zone ("ABZ") Development	Land use / employment assumptions in the ABZ is based on HSL Scenario 31 model runs undertaken by NZTA.	Development does not progress as assumed in WRTM Scenarios 2-5.	Potential reduction or increase in traffic volumes on Ohaupo Rd and change in traffic distribution at critical intersections.
Peacocke Structure Plan Development	Land use / employment assumptions in the Peacocke Structure Plan area is based on HSL Scenario 31 model runs undertaken by NZTA.	Development does not progress as assumed in WRTM Scenarios 2-5.	Potential reduction or increase in traffic volumes on Ohaupo Rd and change in traffic distribution at critical intersections.



HSL delivery	Stage 1 of HSL (section between Kahikatea Dr and Killarney Rd) is assumed to be completed in Scenario 2.	HSL fully delivered and operational.	Potential change in route choice, traffic distribution and demand on the Ohaupo Rd corridor
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The examples presented in Table No: 45 are provided to illustrate how changes in key assumptions may influence the transport effects associated with future stages of the Residential Development.

For example, if the lower residential vehicle trip generation rates identified in Table No: 45 were realised, the Residential Development would generate materially fewer peak-hour vehicle trips than assumed in Scenario 2. On a trip-generation basis only, and assuming the same trip distribution patterns adopted in the current assessment, the equivalent peak-hour vehicle demand assessed in Scenario 2 would not be reached until approximately 640 dwellings.

It is also noted that the traffic forecasts adopted in the WRTM scenarios are influenced by assumptions regarding the scale and timing of development within the Airport Business Zone and Peacocke Structure Plan area. If development within these areas were to occur at a slower rate than assumed in the WRTM scenarios, traffic demand on the Ohaupo Road corridor may be lower than that adopted in the current assessment. While the magnitude of any reduction cannot be reliably quantified without further strategic transport modelling, such changes could improve the operation of the Ohaupo Road / Saxbys Road / Tomin Road roundabout, thereby potentially enabling more SL1 Residential Development before HSL is delivered.

Accordingly, the examples presented in Table No: 45 should not be interpreted as defining a fixed development limit or a fixed measure of network capacity. Rather, they illustrate how changes in key assumptions may influence the transport effects associated with future stages of development and reinforce the importance of reviewing the transport environment at the time development progresses beyond 543 dwellings.

Accordingly, a consent condition aligned with the following, is recommended:

“Prior to the construction of development exceeding 543 dwellings within the Residential Development, the Consent Holder shall submit an updated Integrated Transport Assessment (ITA) prepared by a suitably qualified and experienced transport engineer.

No dwelling above the 543-dwelling threshold shall be constructed until the updated ITA has been certified by NZ Transport Agency Waka Kotahi, Hamilton City Council and Waipā District Council and any required mitigation or staging controls identified through that assessment have been confirmed

The updated ITA shall assess the transport effects of further development having regard to the best reasonably available transport information at the time, including, where relevant:

- actual residential development yield, dwelling typology, land use and trip generation;*
- observed and forecast traffic volumes on Ohaupo Road, Collins Road, Saxbys Road, Lambert Court, Resthill Crescent and Houchens Road;*
- updated turning movement volumes, heavy vehicle proportions, crash history and observed congestion;*
- development completed or committed within relevant surrounding growth areas;*
- committed or constructed transport infrastructure upgrades on Ohaupo Road since preparation of 2026 ITA;*



- the status, timing and form of HSL, including any relevant connections to SH3 or the local transport network, and any resulting changes to route choice and network capacity;
- public transport provision, mode share, and any implemented public transport priority measures;
- walking and cycling network delivery and active mode uptake;
- whether the right-turn restriction at Ohaupo Road / Resthill Crescent identified in the 2026 ITA remains necessary and, if so, its appropriate timing; and
- updated intersection modelling and safety effects, including average delay, 95th percentile queue lengths and degree of saturation.

Where actual land use, infrastructure delivery, traffic growth, trip generation or travel behaviour differs from the assumptions adopted in the 2026 ITA, the updated ITA shall identify whether those differences materially increase or reduce available network capacity and confirm whether any additional mitigation or staging controls are required before further dwellings are constructed.”

16. District Plan Compliance

While the Project is presently located within the Waipā District, the ITA has focused on the Hamilton City ODP transport rules and requirements given the Project's intended urban form, its direct integration with the Hamilton transport network, and because it is identified within the future southern Hamilton growth area.

The Project has been assessed against the transport rules relevant to the transport network, subdivision, use and development in Section 25.14 of the ODP. The rules are listed below with comments on compliance of the Project with each rule. Where there is non-compliance, further assessment has been undertaken against the criteria set out in the ODP.

Several ODP transport rules are ultimately applied at the individual lot and vehicle crossing level and therefore cannot be fully confirmed until detailed engineering and land use design has been completed. Accordingly, this assessment focuses on those transport rules most likely to influence the subdivision layout or result in transport-related non-compliances at the subdivision stage, including vehicle crossing separation distances, sight distance requirements and access design considerations.

The exceptions involve access design for ROWs / JOALs, sight distances at vehicle crossing, and location of vehicle crossings. Overall, the planned road network is designed to create a slower-speed urban setting, and the required housing density makes it impractical for the Development layout to avoid every instance of non-compliance.

Table No: 46

District Plan Compliance		
Transport Rule in District Plan	Compliance	Comments
Vehicle Crossings and Internal Vehicle Access		
25.14.4.1 a. Distance between vehicle crossings on the same transport corridor frontage i. Where the posted speed of the adjoining road is 60km/h or less the distance between vehicle crossings on the same side of the road shall be either: A. Less than 2m (provided no more than 2 vehicle crossings adjoin each other); or B. More than 7.5m	Yes	Both the Industrial and Residential Developments are expected to comply with this rule. There is reliance on the ODP exemption that where the separation requirements cannot be achieved the vehicle crossing shall be separated as far as possible from any other proposed vehicle crossing. This will be confirmed during detailed design stage.



iii. On local roads with a posted speed of 50km/h or less where compliance with i. or ii. above cannot be achieved as part of any land use activity the proposed vehicle crossing shall be separated as far as possible from any other existing or proposed crossing.		
25.14.4.1 c. Minimum distance between any vehicle crossing and a transport corridor intersection. Vehicle crossings shall meet the following relevant separation requirements in the tables below. The distance should be measured in accordance with the figure below. For vehicle access onto local roads with a posted speed limit of 50km/h or less and serving a listed permitted activity where the separation requirements cannot be achieved the vehicle crossing shall be located as close as reasonably practicable to the furthest site boundary from the intersection (as relevant to the property boundary indicated in the figure below). Note: The examples of exceptions can include where the property boundary frontage is less than 30m and there is no other available access point, or the topography would make it impractical to construct an access in a complying location.	No	Refer to Section 16.1.
25.14.4.1 d. Minimum distance from a dedicated pedestrian crossing facility (e.g. pedestrian crossing, mid-block pedestrian signals, refuge islands, kea crossings) The closest edge of the vehicle crossing shall be at least 7m from the centre of the pedestrian crossing facility measured in accordance with the diagram below.	Yes	Both the Industrial and Residential Developments are expected to comply with this rule. This will be confirmed during detailed design stage.
25.14.4.1 e. Minimum sight distance from any vehicle crossing Vehicle crossings shall meet and be measured in accordance with the relevant sight distance requirements below. On local roads with a posted speed limit of 50km/h or less where compliance with the sight distance is not possible, the proposed vehicle crossing shall be located to achieve the maximum sight distance possible.	No	Refer to Section 16.2
Quantity		
25.14.4.1 f. Maximum number of vehicle crossings to the transport corridor any site within a Residential Zone One, or nil where vehicle access is provided by a rear lane	Yes	The Residential Development is expected to comply with this rule. This will be confirmed during detailed design stage and addressed at land use development.
25.14.4.1 g. Maximum number of vehicle crossings to the transport corridor for any site, not within a Residential Zone i. One per frontage that is equal to or less than 20 m wide	Yes	Industrial Development is expected to comply with this rule. This will be confirmed during detailed design stage and addressed at land use development.



ii. Two per frontage that is more than 20 m wide (excluding frontages to the strategic network or arterial transport corridor) iii. One per frontage to a strategic network or arterial transport corridor		
Design and Access Width		
25.14.4.1 h. Vehicle crossing and internal vehicle access shall: i. Comply with the relevant dimensions identified in the Tables below. ii. Be formed and drained with a permanent sealed or paved all weather, dust-free surface and in a manner suitable for the type and quantity of vehicles using the site. iii. Be designed and configured to meet the relevant requirements of Table 15-5ai and Table 15-6b in Appendix 15. iv. For fee simple subdivision, any internal vehicle access, other than a rear lane, serving 10 or more residential units will be required to be formed and vested in Hamilton City Council as a public road.	Yes	The widths of vehicle crossings to individual lots, vehicle access from a private way and rear lanes are expected to comply with this rule. This will be confirmed during detailed design and addressed at land use development.
25.14.4.1 i. Any internal vehicle access shall: i. Have a minimum unobstructed width at vehicle entrances and between buildings of no less than 3.5m. ii. Not be used for carparking or storage of materials, landscaping, fencing or other obstructions that would restrict access by emergency vehicles. iii. Have a minimum height clear of buildings and other obstructions of 4.0m. iv. Have splays of 2m x 2m which are clear of structures higher than 1m at any vehicle entranceway or where vision of pedestrians or oncoming vehicles is restricted.	Yes	Both the Industrial and Residential Developments are expected to comply with this rule. This will be confirmed during detailed design stage and addressed at land use development.
25.14.4.1 j. Any rear lane must: i. Have a minimum legal width of 7m and provide for a two-way vehicle movements. ii. Have a minimum unobstructed width at vehicle entrances and between buildings or structures of no less than 3.5m. iii. Not be used for carparking or storage of materials, landscaping, fencing or other obstructions that would restrict access by emergency vehicles. iv. Have a minimum height clear of buildings and other obstructions of 4.0m. v. Be connected by unrestricted access to a transport corridor in at least two locations. vi. Have a legal mechanism for ownership and ongoing maintenance of the rear lane. vii. Have a maximum length of 250m. viii. Have a maximum longitudinal grade of 1:5.	Yes	This rule applies to the Residential Development only and is expected to be complied with. This will be confirmed during detailed design stage and addressed at land use development.
25.14.4.1 m. To ensure that drivers exiting the site have clear visibility to pedestrians, cyclists, and micro-mobility users, splays	Yes	Both the Industrial and Residential Developments are expected to comply with this rule. This will be confirmed



of 5m by 2m which are clear of structures higher than 1.2m must be provided at all vehicle crossings.		during detailed design stage and addressed at land use development.
25.14.4.1 n. Where a driveway joins a transport corridor it must have an on-site platform at least 6m long and with gradient no steeper than 1 in 20 (5 per cent) so that vehicles can stop safely and check for pedestrians, cyclists, micro-mobility users, and other vehicles before entering the transport corridor.	Yes	Both the Industrial and Residential Developments are expected to comply with this rule. This will be confirmed during detailed design stage and addressed at land use development.
25.14.4.2 Parking, Loading Spaces, On-Site Drop-off Car Spaces and Manoeuvring Areas 25.14.4.2a End-of-Journey Facilities 24.14.4.2b EV Charging	N/A	These rules will be addressed at land use development.
25.14.4.3 Integrated Transport Assessment Requirements Any activity that requires an ITA under this rule is also subject to Rule 25.14.3.a. (a) A Simple or Broad Integrated Transport Assessment (ITA) shall be prepared for activities as required by this rule, in accordance with the following trigger thresholds.	Yes	Traffic generation exceeds thresholds and hence the Broad ITA has been prepared.
24.14.4.3a Travel Plan Requirements A Travel Plan must be prepared and implemented for industrial activities (including warehouses) (excluding trade and industry training facilities) where the activity status is other than permitted and the GFA is >2,500m ² GFA.	N/A	This rule will be addressed at land use development of the Industrial Development.

16.1 Rule 25.14.4.1 (c) Minimum Distance between any Vehicle Crossing and a Transport Corridor Intersection

The identified non-compliances generally arise on corner lots, and lots located adjacent to intersections, where achieving the specified separation distances is inherently difficult within a higher-density urban subdivision form.

The ODP requires the following minimum separation distances in a posted speed limit of 60 km/h or less environment:

- Local road frontage: 15 m separation from vehicle crossing to intersecting collector road
- Local road frontage: 20 m separation from vehicle crossing to intersecting minor arterial road
- Collector road frontage: 15 m separation from vehicle crossing to intersecting local road

These requirements are not fulfilled within the proposed Residential Development. In a development of the density proposed, it is not practical to develop a subdivision with lots that can fully comply with the rule at the outset. That would necessitate significant use of rear lots anywhere near intersections. There is reliance on the ODP exemption that where the separation requirements cannot be achieved the vehicle crossing shall be located as close as reasonably practicable to the furthest site boundary from the intersection.



16.2 Rule 25.14.4.1 (e) Minimum Sight Distance from any Vehicle Crossing

The ODP requires the following minimum sight distances:

- 45 m on a 40 km/h posted speed limit local road.
- 60 m on a 50 km/h posted speed limit local road.
- 70 m on a 50 km/h posted speed limit collector road.

Potential non-compliances with this rule are generally associated with lots located adjacent to intersections, on the inside of horizontal curves, or on corner sites where achieving the minimum sight distance requirements can be challenging within a higher-density urban subdivision layout. The precise compliance position for individual vehicle crossings will depend on their final location and detailed engineering design.

Table 15-5a of the ODP specifies target operating and design speeds of 40 km/h or lower for all local and collector roads. For this reason, the rule appears to mandate a sight distance that exceeds what is necessary given the proposed operating speed.

A more practical approach is to reference the stopping sight distance (“SSD”) specified in Austroads Guide to Road Design Part 3: Geometric Design (“AGR Part 3”). A minimum SSD of 22 m and 34 m are required for 30 km/h and 40 km/h operating speed environment based on 1.5 seconds reaction time. These minimum requirements are expected to be fulfilled by the proposed development scheme layouts.

The sight distance from a vehicle crossing on a minor road downstream from an intersection is mainly influenced by turning speed, which depends on the kerb corner radius and carriageway widths. Based on Austroads GTRD Part 3, a turning speed of 15–20 km/h corresponds to a stopping sight distance of 9–13 m. This sight distance requirement is generally expected to be achieved, or alternatively the location of the vehicle crossing can be optimised through detailed design.

Similarly, vehicle crossings located adjacent to horizontal curves are expected to operate safely due to the reduced vehicle operating speeds typically associated with curved alignments. Any reduction in operating speed correspondingly reduces the stopping sight distance required.

The identified non-compliances are generally associated with urban subdivision design rather than locations where material safety concerns are anticipated. The ODP specifically recognises that compliance may not always be achievable on local roads and provides an exception pathway requiring vehicle crossings to be located to achieve the maximum sight distance possible. Having regard to the proposed low-speed road environment, the anticipated departures are not expected to result in material safety or operational effects and can be appropriately managed through detailed engineering design.

16.3 Reversing onto Local Roads

The proposed front-loaded terrace, duplex and detached typologies within the Residential Development will, in some instances, result in vehicles reversing from residential lots onto adjoining roads. This is a typical and accepted outcome for higher-density residential development and is common within the Hamilton urban environment.

The potential effects of reversing manoeuvres have been assessed in the context of the receiving road environment. The majority of affected lots will access low-speed local roads, where traffic volumes and operating speeds are expected to be low, and where driver awareness of frontage activity is high. In this context, occasional reversing movements can be undertaken safely and do not give rise to significant transport effects.



It is recognised that reversing manoeuvres are generally avoided on higher-order roads. However, the Residential Development scheme plan and access arrangements are primarily oriented to local roads, with no reliance on direct access to arterial routes. The Project is therefore consistent with the intent of the ODP in managing vehicle manoeuvring effects.

Overall, the proposed access arrangements are considered appropriate for the scale and typology of development and are not expected to result in adverse safety or operational effects on the surrounding road network.

17. Construction Traffic

The sites are currently vacant. To facilitate bulk earthworks and associated construction traffic, further assessment will be undertaken following resource consent to confirm staging arrangements and access points for construction vehicles, including heavy vehicle movements.

The proposed development will be undertaken in stages. Detailed design and construction sequencing will be confirmed following resource consent approval and appointment of a construction contractor.

As is typical for developments of this scale, a Construction Traffic Management Plan (“CTMP”) will be required as a condition of consent. The CTMP will be prepared as part of the Construction and Earthworks Management Plan (“CEMP”) and submitted to the relevant road controlling authorities for approval or certification, as required by consent conditions. The CTMP will outline construction staging, access arrangements, haul routes, anticipated construction traffic volumes for each stage, and the associated traffic management measures.

It is anticipated that construction access to the Industrial Development will primarily be provided via the proposed Greenwood Street / Kahikatea Drive interim four-arm roundabout and associated north-south access road. Wickham Street and the existing right-of-way may be used as a secondary construction access where required, subject to confirmation through the final CTMP and any necessary approvals. Construction access to the Residential Development is anticipated to be provided via Saxbys Road, Forth Crescent and MacMurdo Avenue.

The site will be managed to enable vehicles, where practicable, to enter and exit in a forward direction without reversing onto the adjoining road network. Where site constraints or delivery requirements necessitate temporary traffic management measures, these will be implemented in accordance with approved procedures and to the satisfaction of NZTA and HCC. The CTMP will include, but not be limited to:

- timing and sequencing of construction activities
- anticipated traffic volumes and access arrangements for each stage
- haul routes and heavy vehicle routing arrangements
- measures to maintain safe and efficient pedestrian and vehicle movements
- wheel washing and debris management
- route management for heavy and over-dimension vehicles
- temporary traffic management arrangements, including impacts on parking, servicing and adjacent land uses
- contact details for key site personnel.



All temporary traffic management measures will be designed and implemented in accordance with the *New Zealand Guide to Temporary Traffic Management* (“NZGTTM”). Appropriate signage and traffic control will be provided to safely manage construction impacts on the surrounding network.

It is to be noted that construction activities are temporary in nature and, with the implementation of appropriate management measures through the CEMP and CTMP, potential construction-related effects on the surrounding transport network are expected to be appropriately managed such that any adverse effects are no more than minor.

18. Transport Strategies and Policy

18.1 Government Policy Statement on Land Transport 2024 – 34

GPS 2024 was confirmed in June 2024, and it outlines the coalition Government’s priorities for expenditure from the National Land Transport Fund over the next 10 years. It also provides guidance to decision-makers about where the Government will focus resources, consistent with the purpose of the Land Transport Management Act 2003, which is:

“To contribute to an effective, efficient, and safe land transport system in the public interest.”²⁶

The four Strategic Priorities of GPS 2024 are:

- Economic Growth and Productivity
- Increased maintenance and resilience
- Safety
- Value for Money

The expected outcomes of the GPS 2024 are defined further as follows:

- Economic Growth and Productivity:
 - Reduced journey times and increased travel time reliability.
 - Less congestion and increased patronage on public transport.
 - Improved access to markets, employment and areas that contribute to economic growth.
 - More efficient supply chains for freight.
 - Unlocked access to greenfield land for housing development and supporting greater intensification.
- Increased Maintenance and Resilience:
 - More kilometres of the road network resealed and rehabilitated each year.
 - Fewer potholes.
 - A more resilient road and rail network.
- Improved Safety:
 - Reduction in deaths and serious injuries.

²⁶ Section 3 of the Land Transport Management Act 2003



- Increased enforcement.
- The primary focus of this priority is to make transport substantially safer for all.
- Value for money:
 - Better use of existing capacity.
 - Less expenditure on temporary traffic management.

The Project is generally consistent with the GPS 2024, particularly the strategic priorities of Economic Growth and Productivity, Safety, and Value for Money. It supports the release of industrial and residential land within an identified future growth area, enables improved access to employment and freight networks, and incorporates a staged transport response that focuses on targeted upgrades, mode shift, and efficient use of existing and planned infrastructure including interim transport solutions that enable development to proceed independently of HSL delivery. The Project also aligns with the resilience objectives of GPS 2024 by maintaining flexibility to integrate with future strategic transport improvements, including HSL, should those improvements proceed.

18.2 NZ Transport Agency Waka Kotahi Statement of Intent 2024 – 2028

This statement of intent (“SOI”) presents a new strategic direction for NZTA and sets out how it will respond to the expectations of GPS 2024 for the next four years. The following system outcomes are the long-term changes to the transport system that NZTA is focusing on to realise its vision:

- *Meeting current and future needs - Enabler of other system outcomes and is about ensuring that the way NZTA works enables it to meet the needs of current and future users and aligns to the priorities of GPS 2024.*
- *Effectively and efficiently moving people and freight - Ensuring networks are available and reliable at consistent levels of service with a focus on increasing the uptake of efficient, cost-effective, low carbon transport options.*
- *Safe - Ensuring no one is killed or seriously injured when using or working on the transport system.*
- *Environmentally sustainable - Reducing harm to and improving the environment, with a focus on reducing greenhouse gas emissions and climate change adaptation, including reflecting expectations on NZTA set by the Carbon Neutral Government Programme.*

The Project is consistent with the SOI by supporting the outcomes of meeting current and future needs, effectively and efficiently moving people and freight, safety, and environmental sustainability. The Project provides for planned residential and industrial growth within an identified future growth area, while adopting a staged transport response that integrates with existing and planned strategic infrastructure, including HSL. It also supports improved travel choice through provision for public transport, walking and cycling, and identifies the transport upgrades required to maintain safe and efficient network operation as development occurs over time.

18.3 Waikato Regional Land Transport Plan 2024 – 2054

The Waikato Regional Land Transport Plan (2024 – 2054) (“WRLTP”) sets out the strategic direction for land transport in the Waikato region over the next 30 years. The WRLTP is built around the region’s key transport issues, namely:

- *Climate Change: an environmentally sustainable, energy efficient and low-carbon transport system that delivers emissions reductions and enhances communities’ long-term resilience to the effects of climate change.*



- *Resilience: an efficient and resilient land transport system that ensures communities have route security and access to essential services.*
- *Growth and Economic Development: an integrated transport system that supports compact urban form and planned future growth; AND an efficient and resilient strategic corridor network that advances regional economic and social wellbeing.*
- *Accessibility and Transport Options: an integrated transport system that provides transport options for differing community access and mobility needs.*
- *Safety: a safe, accessible transport system in the Waikato region where no one is killed or seriously injured.*

The Project is aligned with the WRLTP because it supports planned growth in a way that integrates with the strategic transport network, improves travel choice, responds to identified safety and resilience issues, and supports a gradual shift toward public transport and active modes over time.

19. Stakeholder Engagement

To date, engagement with NZTA has been undertaken around the extent of assessment required to understand the traffic impacts arising from the proposed developments' traffic on the operation of the adjacent state highway corridor, trip generation calculation and assumptions as well as form and design of the proposed intersection upgrades. These discussions have informed the scope of the traffic analysis reported in this ITA. Comments from NZTA on the draft ITA (dated 19 March 2026 and 23 June 2026) are attached as Appendix C.

Similarly, discussions have also been held with HCC, Waipā District Council and WRC to ensure this ITA appropriately addresses the key transport matters.

Continued liaison with all stakeholders is expected during the Fast-track process and subsequently as the detailed design for the proposed transport infrastructure is refined.

20. Conclusions

This ITA has assessed the transport effects of the proposed Industrial and Residential Developments with regard to existing transport conditions, committed and planned network upgrades, and the relevant national, regional and local transport policy framework.

The assessment is informed by site access design, staged trip generation analysis, strategic transport modelling using the WRTM, and detailed intersection capacity assessments using SIDRA Intersection software.

The key conclusions of the assessment are as follows:

- Industrial Development
 - The preferred interim access strategy is Interim Option B. This arrangement enables the full assessed Industrial Development to proceed independently of HSL delivery through provision of a four-arm Greenwood Street / Kahikatea Drive roundabout, an interim access road on the HSL corridor, and delivery of the proposed internal collector road network.
 - The assessed interim access arrangement provides a practical and flexible transport solution given the uncertainty surrounding the timing of HSL delivery.



- When HSL is delivered in future, the Industrial Development transitions to the ultimate access arrangement via the proposed HSL / SL1 roundabout and east-west collector road.
- Residential Development
 - The Residential Development can be accommodated through a staged transport infrastructure framework comprising intersection upgrades, walking and cycling improvements, and provision for future public transport services.
 - The assessment indicates that Residential Development can be accommodated with acceptable transport effects up to 543 dwellings under a network scenario that excludes HSL delivery, subject to implementation of the transport infrastructure upgrades identified in this ITA.
 - Subdivision exceeding 543 dwellings should be supported by a further / updated ITA to confirm the assumptions underpinning this ITA (2026 ITA) remain relevant for the receiving transport environment and to determine whether any additional mitigation measures or factors exist to enable further development if HSL delivery remains uncertain.
- Multi-modal transport network
 - The proposed transport network has been designed to support increased travel choice and reduce reliance on private vehicle travel over time.
 - The proposed walking, cycling and public transport infrastructure provides a high level of connectivity in and between the Development areas with the surrounding transport network. The infrastructure proposed is comprehensive and necessary to support the increasing mode share rates that support the effects assessment.
- Hamilton Southern Links
 - HSL remains an important long-term component of the future transport network for southern Hamilton. Modelling shows it will improve the distribution of traffic through southern Hamilton, provide network resilience and spare capacity on Ohaupo Road through Glenview.
 - However, the transport strategy adopted for the Project does not rely on HSL being delivered within a specific timeframe. Interim access arrangements, transport infrastructure upgrades and staging measures have been identified to manage transport effects under both interim and future network conditions.

Subject to implementation of the recommended transport infrastructure upgrades, staging measures and reassessment provisions identified in this ITA, the proposed Industrial and Residential Developments can proceed without resulting in unacceptable transport effects.

21. Recommendations

The following recommendations are made based on the findings of this ITA. Detailed infrastructure staging and upgrade requirements are summarised in Table No: 43 and Table No: 44.

- Development should proceed in accordance with the staged transport infrastructure framework assessed in this ITA, with the access, intersection and corridor upgrades identified in Table No: 43 and Table No: 44 delivered at the relevant development stages.
- Up to 1 ha of Industrial Development may be occupied prior to any upgrade at the existing Greenwood Street / Kahikatea Drive intersection, relying on the existing local industrial road network and existing access arrangements.



- Where HSL Stage 1A has not been delivered, occupation of Industrial Development beyond the initial 1 ha threshold should be supported by Interim Option B. Prior to occupation beyond this threshold, the following infrastructure should be delivered and operational:
 - an interim four-arm Greenwood Street / Kahikatea Drive roundabout;
 - an east-west collector road forming the primary internal movement corridor through the site.
 - an interim access road between Greenwood Street / Kahikatea Drive and the east-west collector road; and
 - the interim access road / east-west collector road connection required to serve the Industrial Development.
- Interim Option B should be designed and staged to remain compatible with the ultimate HSL-integrated transport network and not preclude future implementation of the HSL / Greenwood Street layout.
- Residential Development should proceed generally in accordance with the infrastructure staging framework identified in Table No: 44, including delivery of the identified intersection, corridor and active mode improvements at the relevant stages of development.
- Prior to construction of any dwelling that would result in more than 543 dwellings being established within the Residential Development, an updated ITA should be prepared by a suitably qualified and experienced transport engineer in accordance with the reassessment framework outlined in Section 15.5.2. The updated ITA should confirm whether further Residential Development can be accommodated within the receiving transport environment at that time and identify any additional mitigation measures or staging controls that may be required.
- Walking and cycling infrastructure, public transport-enabling road cross-sections, and provision for future bus routing and in-lane stops should be delivered in accordance with the staging framework relied on in this ITA.
- Detailed design should be undertaken in consultation with the relevant road controlling authorities to confirm the final form, timing and layout of the identified transport improvements, while maintaining consistency with the infrastructure and staging framework assessed in this ITA.
- A CTMP should be prepared for the relevant stages of works to manage temporary access arrangements, construction vehicle routing, effects on the surrounding road network, and protection of vulnerable road users.



Appendix A – Intersection Upgrade and Walking and Cycling Wider Connectivity Concept Plans



Appendix B – SIDRA Movement Summaries



Appendix C – Responses to NZTA and MPDC Comments

Responses in Table No: 47 and Table No: 48, are superseded by the information provided in the ITA.

Table No: 47

NZTA Comments dated 19 March 2026		
S/No	Comment	BBO Response
1	BBO scenarios modelled are significantly different to NZTA/Future Proof Scenario across all the SL1/Rogerson Blocks (especially households – order of 1500 households less under BBO scenario). Currently unresolved issue around significant differences in the traffic flows being predicted by WRTM for the different scenarios.	The land use within the proposed SL1 Industrial Development, Residential Development, Rogerson Block and Houchens development area are more refined now that comprehensive Masterplans have been prepared for each of these areas. As with all Masterplans, they will continue to evolve to respond to opportunities and constraints as they are identified through subsequent resource consent processes. Please refer to Attachment 1 for the WRTM land use input differences between futureproof projections and BBO's assumptions. The main differences being the Rogerson Block change of land use (previously assumed to be residential and now assumed predominantly to be industrial) and the broader refined yield within the SL1 Consortium (not the entire growth cell).
2.	Under several scenarios, Hamilton Southern Links is assumed to be operational by 2025. There is currently no construction funding so this cannot be assumed. Any mitigation (especially as it relates to SH3) may be deficient on that basis; we would expect that any infrastructure triggers will need to be framed in way whereby beyond a certain yield development cannot proceed unless Hamilton Southern Links is in place.	It is to be noted that no 2025 scenarios were modelled in the WRTM. Four development scenarios were tested for the future year 2035: 1) Year 2035 with Stage 1 HSL • SL1 Residential Development: Stages 1 and 2 (575 dwellings) • SL1 Industrial Development: Full development (approx. 36ha developable area) 2) Year 2035 with Stage 1 HSL • SL1 Residential Development: Stages 1 and 2 (575 dwellings) • SL1 Industrial Development: Full development (approx. 36ha developable area) • Rogerson Block: 90 dwellings + 7.8ha industrial • SL1 Houchens: 400 dwellings + 400 retirement village units 3) Year 2035 with Full HSL • SL1 Residential Development: Stages 1 to 3 (776 dwellings) • SL1 Industrial Development: Full development (approx. 36ha developable area) 4) Year 2035 with Full HSL • SL1 Residential Development: Stages 1 to 3 (776 dwellings) • SL1 Industrial Development: Full development (approx. 36ha developable area) • Rogerson Block: 90 dwellings + 7.8ha industrial • SL1 Houchens: 400 dwellings + 400 retirement village units + 13ha industrial Although HSL remains an important long-term strategic transport improvement, its implementation timing is



NZTA Comments dated 19 March 2026		
S/No	Comment	BBO Response
		currently uncertain and remains subject to future funding decisions and NLTP priorities. The 2035 WRTM modelling included scenarios with different assumed HSL network stages, including Stage 1 of HSL and the full HSL network, to test the sensitivity of the Project's transport effects under different future network conditions. For that reason, the ITA does not rely on HSL being delivered by a specific year. Rather, the assessment identifies both interim and future network scenarios and recommends staging controls, infrastructure triggers and further assessment requirements to manage transport effects as development progresses.
3.	Section 11.1.1 of the ITA states that the residential trip rate has been derived from the RTA Trip Generation Guide, taking the average for medium density flats and "dwelling houses". The above average is due to the lack of knowledge, currently, about the likely residential types. Therefore, we are unclear if the average is OK – if we end up with greater numbers of persons per household than currently assumed, the trip rate may be higher. More fundamentally, the RTA trip rates used were for vehicles, whereas the ITA assumes them to be person trips. Given the subsequent corrections for mode change over time, this means that the residential trip predictions currently included in the ITA significantly underestimate the likely outcome.	Following the meeting on 26th March 2026, BBO has undertaken trip generation calculations for the SL1 Residential Development using person-trip rates. Now that the number of low-, medium- and high-density lots can be estimated, person-trip rates for each residential land use were adopted from the NSW Government <i>Guide to Transport Impact Assessment</i> (NSW Guide). For the purposes of trip generation, the proposed high-density lots have been assessed using the medium-density person-trip rate, as they do not meet the NSW Guide definition of high-density residential dwellings. Refer to trip generation calculations in Attachment 2. Please note this is based on refined yield in the latest Masterplan. The trip generation calculation indicates that WRTM loaded networks underestimates the trips generated by the residential zones by approximately 20-60 vph in the various scenarios. BBO will increase the traffic volumes in the respective SIDRA models by 10% to address the shortfall.
4.	Section 11.1.2 states that the observed trip rates for the Hamilton Airport central precinct have been used for the employment uses. Presumably these trip rates were based on traffic counts, which will give vehicle trip rates, not person trip rates. If our assumption is correct, the subsequent corrections for mode change will again mean that the trip predictions are underestimates.	The vehicle trip rate, established through surveys in the Central Precinct of the Airport Business Zone (Hamilton Airport – Titanium Park), is deemed representative and suitable for the proposed industrial land use. BBO recognises that the adopted trip generation rate pertains specifically to vehicles. It should be noted, however, that public transport accessibility as well as walking and cycling infrastructure are currently limited within the surveyed Central Precinct. As such, BBO considers that a proportion of these vehicle trips could transition to public transport or active modes, particularly in the context of the proposed Industrial Development area where new walking and cycling infrastructure linking to existing bus stops is recommended. Person-trip rates as outlined in the NSW Guide have not been adopted, as these are based on gross floor area (GFA) and the site coverage details for the Industrial Development remain unconfirmed at this time. Please refer to Attachment 3 which includes trip generation calculations and assumed travel mode distributions.
5.	Some mode change (relative to the existing situation) is likely to be very reasonable.	Travel mode splits for Residential Development:



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S/No	Comment	BBO Response
	However, while the future (2055) trip rate for the industrial components is predicted to be around 86% of the existing (2023) trip rate, the figure for the residential components is around 59%. The more significant reductions are based around the assumptions that the PT mode share for this part of Hamilton will be equivalent to the existing mode share in central Wellington – this seems to be overly optimistic. Resolving the traffic generation rates will have a flow on effects on the traffic modelling presented in the ITA. As a result, the proposed mitigation measures presented in the ITA may change.	2035 PT and active mode shares are based on 2023 Census data from Peachgrove-Greensboro, Hamilton East and Hillcrest (all in Hamilton). These areas currently densely populated (approximately 7,000 to 10,000 population) with good accessibility to PT and walking and cycling connections 2045 PT and active mode shares have now been updated to 13.9% (PT) and 11.4% (active mode). The draft ITA indicated 13% (PT) and 13% (active mode). These splits are based on statistical areas within Wellington that consist of medium density residential land use and high frequency routes currently servicing the areas (i.e. Island Bay, Lyall Bay and Miramar East). These areas are not in central Wellington. 2055 PT and active mode shares have now been updated to 30% (PT) and 10% (active mode). This is an aspirational mode-shift from car dependence during commuter peaks, but it is supported by the proposed medium-density residential in SL1 (restricted car parking and garaging) and aligns with the “transformational” shift to PT enabled by the Rapid Transit Network key moves envisaged in the Waikato Metro Spatial Plan. The MSP Programme Business Case states in Section 1.8 that <i>“The assessment of the public transport and active modes share in 2051, and based upon the preferred land use scenario 2a, has concluded that the region wide mode shift would be 20%; with the ability to achieve up to 44% (forecast as 32% for public transport and 12% for walking/cycling and micromobility) in the identified key BRT corridors of Hamilton City.”</i>. Travel mode splits for Industrial Development: 2055 PT and active mode shares are lower than those assumed for residential land use. This is based on statistical areas within Wellington that consist of industrial land use and high frequency routes currently servicing the areas (i.e. Rongotai and Miramar South). This is also aligned with Waikato Regional Transport Plan that indicates a frequent bus route is envisioned at the Kahikatea / Frankton area.
6.	<u>SL1 Roundabout and SH1C Intersection Spacing</u> - The modelling by BBO for the SL1 developers concludes that the roundabouts will operate satisfactorily without free flow left turn lanes - The modelling by Aecom for NZTA concluded that free flow left turn lanes will be required. This introduces a merge and weave movement on the midblock between Kahikatea Drive and SL1, leading NZTA to conclude that the current spacing is inadequate.	We consider the following as key reasons for the volume differences between our model runs and the NZTA Scenario 31 model runs: - The presence of the half-diamond interchange at Colins Road in the NZTA S31 WRTM model runs compared with the full diamond interchange further south at Houchens Road in the BBO WRTM model runs. The Collins Road half diamond draws a significant volume of traffic through the northern part of SL1 development via Rhonda Ave and Colins Road, which is not present in the BBO WRTM model runs. - The difference in quantum of trips generated by SL1 Industrial Development, Residential Development and Rogerson Block. The difference is due to refined



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S/No	Comment	BBO Response
	- The spacing issue relates to weaving, for example (for southbound traffic): - Vehicles turning left from SH1C onto HSL will merge with mainline traffic between the intersections, with some traffic then changing lanes to enter the centre lane to turn right at the SL1 roundabout - Some southbound vehicles on SH1C passing straight through the Kahikatea roundabout will have to change lanes to enter the left turn lane to turn left at the SL1 roundabout - As a result, the predicted operation of the two roundabouts is critical, as this determines the need for free flow left turn lanes. - Our recent comparisons between the 2018 modelled flows and observed flows indicates that the modelled flows are high during the critical weekday evening peak. Addressing the land use/trip generations is critical. - At the current time, NZTA is unable to confirm the acceptability of the free flow left turn lanes or the current separation distance presented. - Please also note that NZTA is working through whether a 4th leg may be feasible at the Kahikatea Drive/SH1C proposed roundabout for a period prior to the current investment case design (3 leg arrangement). Addressing trip and land use assumptions (see earlier comments) will factor into this analysis.	and reduced development areas that is achievable in these areas based on further assessments that have been undertaken as part of this substantive Project. Also, some of that difference is likely due to our target PT and active mode shares adopted in the BBO WRTM model runs. This is explained in the earlier responses. The modelling undertaken by us indicates that the HSL / Kahikatea Dr roundabout operates effectively without requiring an additional southbound acceleration lane between the HSL / Kahikatea Dr roundabout and the SL1 roundabout. However, we have also undertaken a sensitivity check using the volumes obtained from the NZTA Scenario 31 model runs. The results indicate that both roundabouts perform satisfactorily with all movements performing no worse than LOS D (i.e. average delay less than 40s/veh). 95th percentile queue on Kahikatea Drive reaches approximately 120 m while 95th percentile queue on the northern approach to SL1 roundabout (i.e. HSL section between two roundabouts) reaches approximately 175 m during the PM peak period. In our opinion, the queue length on HSL is not significant considering the separation distance of 520m between both roundabouts. The queue length achieved on Kahikatea Dr will extend beyond Latham Ct. However, Latham Ct is a no-exit, low volume local road and the effects at the intersection is not expected to be more than minor. There are a few reasons why the SL1 roundabout connection is proposed approximately 520 m from the HSL / Kahikatea Dr 3-arm roundabout. - Shifting the SL1 roundabout connection further south is likely to result in trips from SL1 industrial area heading south before getting onto HSL to head north. This has the potential to add more industrial traffic to Higgins Rd which is a local road providing access to residential land use further north and therefore was not preferred. - The proposed location of the SL1 roundabout connection allows the new east-west collector road to be a straight through road from Tuhikarama Rd to HSL. This is considered a positive for the key collector industrial connector between the western fringe and the urban Hamilton industrial environment of Frankton. If the SL1 roundabout connection is proposed further south, then the east-west collector alignment will be convoluted considering that it needs to run through Rogerson Block to provide access to industrial and residential land use. - The proposed location of the SL1 roundabout connection allows the east-west collector road to be aligned strategically between two landowners' lots without dissecting a single landowner's lot into two. This provides important continuity for how both applicants can progress with their land use aspirations.
7.	Figure 8 of the ITA indicates that in the short term, before the rest of HSL is constructed, the Application site to the east of the HSL designation is proposed to be connected via	The current position indicates that the timing of HSL delivery remains uncertain and may extend beyond the assessment period considered in this ITA. Accordingly, Industrial Development should not be prevented from proceeding



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	a short section of HSL arterial (ultimate form or sacrificial interim form). A local road connection east to the north / south road in the eastern development area is shown. In the long term that road is proposed to become a cul-de-sac when NZTA completes HSL (which is Stage 3). We are unclear how this proposal will transition from a “sacrificial road” to the ultimate HSL solution. In theory this situation could be avoided if the ultimate HSL cross section is provided at the outset, rather than a sacrificial form, but this would still appear to lead to problems as the intersection forms transition from short to long term. This is a concern for NZTA; we want to avoid a future scenario whereby we end up funding the relocation of a portion of the internal roading network.	solely because HSL has not been funded or programmed for delivery within a defined timeframe. On this basis, the ITA identifies Interim Option B as the preferred interim access strategy, enabling Industrial Development to proceed independently of HSL delivery while retaining the ability to transition to the ultimate HSL-based network arrangement if and when HSL is implemented.
8.	Ideally, U turn restrictions should be implemented at all intersections proposing to be signalised on Ohaupo Road (SH3).	This will be included as recommendations in the ITA if the proposed phase sequence at intersections prohibits U-turn movements.
9.	<u>Wickham St Access</u> - The proposed cross section (Figure 12 of the ITA) shows a 1.8 m wide shared user path on the western side of Wickham Street. - For the path to function as a shared path, it should be widened to be at least 2.5m (minimum) or 3m (desirable). - If widening of the path is not feasible due to the existing road reserve, the path should function as a footpath only, with cyclists mixing with general traffic.	The typical section was incorrect and has since been updated as shown below. There is no shared path proposed on Wickham St.
10.	<u>Ohaupo Rd / Resthill Cres</u> - The proposed concept plan will force westbound cyclists on Ohaupo Road to merge into the adjacent traffic lane at the intersection of Ohaupo Road / Resthill Crescent, which create a safety risk. - Consider shifting the proposed traffic island on Resthill Crescent south to allow sufficient room for a cyclist to travel across the intersection without merging with general traffic. - In addition to the above, it is recommended that green painted pavement markings with cycle symbols across the intersection as per the	The concept designs shared are draft versions and are still a work in progress. Westbound cyclists are expected to use the off-road shared path on both sides of Ohaupo Rd (between Saxbys Rd and Houchens Rd). Cycle on and off-ramps will be proposed on either end. This accommodates the proposed intersection upgrades along this corridor which typically involve adding more lanes within the road reserve.



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	Lambert Court / Ohaupo Road intersection (refer to the screenshot below).	
11.	<u>Ohaupo Rd / Saxbys Rd</u> - Section 14.2.2 of the ITA states that the intersection would be upgraded in two stages: - The first stage to upgrade the existing roundabout to include a second through departure lane on the southern leg - The second stage is to upgrade the existing roundabout to a set of signals. - However, the ITA indicates that the signals would fail under Scenarios 2 to 5 and it suggests that this may be OK as the intersection has been designed to support Ohaupo Road as a bus priority corridor. However, we note that the traffic assumptions already include a high proportion of public transport trips (see yesterday's email). The ITA suggests that a further mitigation measure would be to add additional traffic lanes to increase intersection capacity. To our knowledge, no traffic modelling has been undertaken to determine an appropriate intersection layout. - Undertake additional traffic modelling to confirm an appropriate layout for the signals. The provision of additional traffic lanes may require land acquisition.	The matter has been assessed in Section 15.2.2 of the ITA.
12.	<u>Ohaupo Rd / Saxbys Rd</u> - The proposed length of the dedicated right turn lane at the Saxbys Road approach will only provide storage for one vehicle. This could result in vehicles overflowing into the adjacent traffic lane, and blocking right turns into Morrison Crescent. - Consider lengthening the length of the dedicated right turn lane on Saxbys Road – however this would still appear likely to lead to challenges for vehicles exiting the signalised intersection and turning into Morrison Crescent.	The concept designs shared are draft versions and are still a work in progress. The concept design has been updated to address this matter and the revised arrangement is reflected in the current application drawings and ITA.
13.	<u>Ohaupo Rd / Saxbys Rd</u>	Westbound cyclists are expected to use the off-road shared path on both sides of Ohaupo Rd (between Saxbys Rd and Houchens Rd). Cycle on and off-ramps will be proposed on



NZTA Comments dated 19 March 2026		
S/No	Comment	BBO Response
	- The proposed concept plan removes the on-road cycle lanes on Ohaupo Road at the Ohaupo Road / Saxbys Road intersection. - Consider installing cycle ramps in advance of the intersection to allow non-confident cyclists to use the shared user path on Ohaupo Road.	either end. This accommodates the proposed intersection upgrades along this corridor which typically involve adding more lanes within the road reserve.
14.	<u>Ohaupo Rd / Lambert Ct</u> - The proposed concept design includes converting the existing unsignalised intersection to signals, maintaining access to service lane which provides access to residential properties as the northern leg of the intersection. - Consideration should be given to closing the access to and from the service lane at this location, since queueing will extend both to the north and south. - Consider removing access to the Ohaupo Road service lane (northern leg of the Ohaupo Road / Lambert Court intersection), since an alternative is already provided (see below).	This has been considered. However, it is expected that the likelihood of crashes at the alternative northern access could potentially increase as vehicles exiting and heading north will have to cut across two lanes (i.e. one southbound lane + flush medium existing arrangement and two southbound lanes future arrangement) to merge with through traffic. Similarly, vehicles turning right into the access will have to cut across two lanes. To mitigate the safety risk, a central median island could be introduced on Ohaupo Rd at the alternative northern access limiting movements at the access to left-in-left-out. However, this could in return increase unsafe U-turn movements at both signalised intersections (i.e. Saxbys Rd and Lambert Ct) on either end of this section of road. Hence, this assessment considered maintaining this intersection as a four-arm intersection safer than closing the service lane access.
15.	The ITA has undertaken intersection modelling using SIDRA Intersection software, analysing each intersection in isolation without considering corridor wide impacts. Consider undertaking a network-wide model using microsimulation or SIDRA Network, for situations with closely spaced intersections, to allow the assessment to identify the potential for queueing back.	We do not consider it necessary to undertake a network-wide model. The SIDRA models have been calibrated using surveyed peak hour traffic flows and observed 95th percentile queue lengths at intersections. This ensures that the intersections are modelled as closely as possible to how they currently operate in the existing network.
16.	<u>Ohaupo Rd / Lambert Ct</u> - The proposed merge in the southbound direction after the proposed signals is very short, and within the queuing area for the pedestrian signals [may need to consider moving the pedestrian signals to the proposed traffic signal location – this will need to be considered in the context of the location of the bus stop(s). - At closely spaced signalised intersections queues can form back to the previous signals and block them, and there is a high risk of drivers missing a red light at the first signalised intersection because they can see the	- As stated in the ITA, the separation distance between the proposed Ohaupo Road / Lambert Court intersection and the existing signalised mid-block crossing is approximately 105 m. This equates to approximately 7 seconds of travel time based on a 50 km/h operating speed. It is unlikely that speed between both intersection will be more than 40 km/h given the proximity which increases the travel time to 9 seconds. In comparison, the separation distance between Bryce St and Claudelands Rd signalised intersections on Victoria St is approximately 60 m. - Cyclists are expected to use the off-road alternatives on either side of Ohaupo Rd (between Saxbys Rd and Houchens Rd).



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S/No	Comment	BBO Response
	green light at the next signalised intersection. - Guidance provided in Austroads suggests that intersections should be separated by at least five seconds of travel time at the design speed to provide time for drivers to process information. - The proposed signalised intersection does not appear to cater for cyclists.	
17.	Can the applicant please give consideration to providing another road link from the site to Saxbys Road, so more of the development traffic can use the SH3 Ohaupo Road/Saxbys Road intersection instead of adding additional traffic to the SH3 Ohaupo Road/Lambert Court intersection? Please see red line in the below picture	We do not support another vehicle link from the site to Saxbys Rd for the following reasons: - The intersection modelling that has been undertaken indicate that the existing Ohaupo Rd / Saxbys Rd roundabout and the future signalised intersection perform worse in comparison to the proposed Ohaupo Rd / Lambert Ct signalised intersection based on current WRTM trip distribution to both intersections. Adding more traffic to the Saxbys Rd roundabout will only exacerbate the effects. - Adding a vehicle link will result in multiple closely spaced intersections which increases the number of conflicting movements within a short section of Saxbys Rd. This increases the likelihood of crashes. Therefore, we consider a single access to Saxbys Road as a practical solution from a safety and network capacity / efficiency perspective. However, the ITA does recommend this link to be an active mode connection from the site.



Table No: 48

NZTA Comments dated 23 June 2026 – from FLOW Transportation Specialists		
S/No	Comment	BBO Response
1	Modified mode split assumptions, including not making a correction for work from home trips (for the industrial uses)	The ITA distinguishes between residential and industrial trip generation. A work-from-home (WFH) correction has been applied only to residential trip generation, as set out in Section 12.2.2. This is appropriate because WFH primarily affects home-based work travel associated with residential land use. No WFH correction has been applied to industrial land uses. This is appropriate because the adopted industrial trip generation rate is vehicle-based and was derived from comparable industrial activity, where trips are associated with on-site employment, servicing, freight and business activity rather than home-based trip generation. Accordingly, applying a WFH reduction to the industrial vehicle trip rate would not be appropriate.
2.	We are unclear about the wording on page 58, which appears to imply that work from home corrections should be made, but they have not.	A WFH correction has been applied only to residential trip generation, as shown in Table No: 13 to Table No: 17. The residential mode split components for private vehicles, public transport and active modes do not sum to 100% because a 10.8% WFH allowance has been included separately in all residential scenarios.
3.	We retain our view that a 2055 scenario with higher traffic flows (i.e. with some, but not significant mode change) needs to be assessed, to ensure suitable roundabout spacing	The ITA's 2055 scenario already includes substantial future land use beyond the Applicant's developments, including future SL1 residential areas, the Rogerson Block and SL1 Houchens land uses. NZTA has also acknowledged that it may not be the developer's responsibility to demonstrate the operation of the transport network with other uncommitted land use changes. The ITA assesses Scenarios 2 to 5 using WRTM outputs. Scenario 5 includes future land use well beyond the Industrial and Residential Developments and therefore provides a broad strategic assessment of future network conditions. Subsequent to NZTA's comment, a sensitivity assessment has been undertaken using NZTA Scenario 31 Year 2055 traffic volumes to test the operation of the proposed SH1C/HSL and HSL/SL1 roundabout arrangement under a materially higher traffic demand scenario than that adopted in the Project modelling. The NZTA Scenario 31 model includes approximately 1,500 additional households within the wider SL1 growth area and also captures a level of future development beyond the proposed Developments, including growth that may proceed through other referred projects and future growth areas within the wider SL1 growth cell. Therefore, the NZTA Scenario 31 model represents a conservative assessment of the proposed roundabout spacing relative to the proposed Developments. The results of the sensitivity assessment confirm that the proposed roundabout spacing remains appropriate under this higher-demand scenario. Accordingly, no further strategic traffic modelling is considered necessary for the purposes of assessing the Project.
4.	The report refers to the difference between the new trip predictions and the earlier	As set out in Sections 12.2.1 and 12.2.2 of the ITA, the WRTM outputs were reviewed against the refined trip generation



NZTA Comments dated 23 June 2026 – from FLOW Transportation Specialists		
S/No	Comment	BBO Response
	WRTM outputs. It claims that corrections have then been made, but we have not seen how these have been applied. Also, the report summarises the results of SIDRA analysis, but no SIDRA printouts are provided within Appendix C.	estimates for Industrial and Residential Developments. The comparison identified that the WRTM outputs represented slightly lower development traffic than the refined trip generation calculations. To address this, the intersection modelling incorporated a 13% increase over the WRTM Industrial Development volumes and a 10% increase over the WRTM Residential Development volumes. These adjustments were applied to the relevant development-related turning movements at key intersections, with distribution based on the movement patterns observed in the WRTM outputs. SIDRA movement summaries have now been included in Appendix B.
5.	Have the delays in the base SIDRA model been calibrated to existing conditions?	Yes. The base SIDRA models have been calibrated with reference to observed queue lengths from the traffic surveys. This calibration process was used to confirm that the base models reasonably reflect existing intersection operating conditions before applying future year traffic demands.
6.	There is a safety concern around any increase in traffic turning into or out from Kahikatea Drive west, with the existing layout	The ITA's existing-layout assessment relates only to a very limited initial development quantum. The assessment indicates that 1 ha of industrial development would increase traffic at the intersection by approximately 16 vehicle trips in the peak hour. This represents a minor increase in turning movement exposure relative to existing traffic volumes. On this basis, the additional operational and safety effect associated with 1 ha of industrial development is considered marginal and would not justify requiring an upgrade to the intersection at that early development stage.
7.	Through our recent work for NZTA we have recognized the potential for significant U turning at this roundabout, due to the proposed ban on right turns at the Greenwood Street/Duke Street intersection. It now appears that the WRTM run carried out for BBO did not allow U turns at the SH1C/HSL intersection, and this will adversely affect the operation of the roundabout.	BBO did not restrict U-turn movements at the SH1C / HSL intersection in the project modelling. The project model runs were developed using NZTA's Scenario 31 model outputs as the base. Accordingly, any U-turn movements included in the NZTA Scenario 31 model coding would have been carried through into the project assessment. NZTA's concern regarding potential U-turning associated with the proposed right-turn ban at Greenwood St/Duke St relates to the wider HSL network strategy rather than being a direct consequence of the Applicants' development.
8.	We accept that there does not appear to be much benefit in the proposed free flow left turn lane from Kahikatea Drive east, as vehicles are likely to be inhibited from reaching this lane, due to queueing in adjacent lanes.	Noted. No further response is required.
9.	The report considers a number of interim layouts, with and then without access to the SL1 Industrial North area from the southern leg (the future HSL). These have been assessed for the year 2035, with the scenario without a connection via the southern leg at the HSL/SH1C roundabout tested up to 23 hectares of development, at which time a volume/capacity ratio of 90% is predicted to be reached.	SIDRA movement summaries have now been included in Appendix B. For the interim layout assessments, the development quantum for Industrial Development has been varied to test the level of industrial development that can be accommodated under each access arrangement. The background traffic volumes on SH1C have been retained on a conservative basis, reflecting the Residential Development assumption of 575 dwellings. Only the Industrial Development trip generation and associated access



NZTA Comments dated 23 June 2026 – from FLOW Transportation Specialists		
S/No	Comment	BBO Response
	We would like to see the traffic flow calculations, and the SIDRA runs, to allow us to consider these proposed layouts, as the 2035 scenario with HSL Stage 1 only that was run through WRTM was based on 36 ha for SL1 North Industrial and 575 dwellings at the Mexted development	arrangements have been updated to reflect the revised development quantum and layout being tested.
10.	The ITA indicates that the existing signalized layout will continue to operate with satisfactory delays. However, the volume/capacity (V/C) ratios are stated as being quite high, i.e. very close to 100%. It is interesting to note that the V/C ratio in the 2030 PM peak is predicted to be 97% with scenario 1D (280 households), but 93% with scenario 1E (320 households). It is then predicted to improve further by 2035 (scenario 2, with 575 households), presumably due to the assumed completion of the first phase of HSL.	All 2030 scenarios are based on surveyed traffic volumes, with appropriate growth and development traffic added to the current road network. The 2035 scenarios have been assessed using WRTM outputs and include different network assumptions. In particular, Scenario 2 assumes delivery of Stage 1 HSL, while later scenarios include wider HSL-related changes, including the full length of HSL. Accordingly, variations in V/C ratios between scenarios are not inherently inconsistent. They reflect differences in network configuration, route choice and traffic redistribution between the modelled scenarios.
11.	The new ITA considers the level of upgrade required, but the layout shown in Figure 56 is fairly remarkable, with four through lanes in each direction on Ohaupo Road, but no widening on the two side roads. It seems highly unlikely that such a layout would be progressed. The ITA accepts this, noting that “this solution is not practical or operationally viable”. We therefore respectfully question why such a layout was included in the ITA	The layout was included as a sensitivity test to understand the scale of intervention that would theoretically be required to accommodate the modelled traffic demand at the Ohaupo Rd/Collins Rd intersection. NZTA had requested clarity on the level of upgrade that would be required, and the layout was presented to inform that discussion. Its inclusion in the ITA does not mean BBO recommends the layout. The ITA expressly notes that the layout is not practical.
12.	We note that the other intersections along SH3 have been tested for scenarios beyond this 320 threshold, and we wonder if the predicted outcome at Ohaupo Road/Collins Road invalidates the assessment of these other intersections (as presumably the poor levels of service at the Ohaupo Road/Collins Road intersection could affect the assignment of traffic in this area	The comment appears to be under the Ohaupo Rd/Saxbys Rd section but refers to the Ohaupo Rd / Collins Rd intersection. Please confirm whether the comment is intended to refer to Ohaupo Rd/Collins Rd or Ohaupo Rd / Saxbys Rd. If the comment relates to Ohaupo Rd / Collins Rd, Section 15.2.1 of the ITA indicates that the signalised intersection operates at an acceptable level across the modelled scenarios. If the comment relates to Ohaupo Rd/Saxbys Rd, BBO considers that the WRTM assignment accounts for network conditions at a strategic level. The Residential Development is primarily served by the Ohaupo Rd corridor, with limited alternative access options available to redistribute traffic. The performance of the Ohaupo Rd/Saxbys Rd intersection therefore represents a genuine network constraint rather than an outcome of the modelling process. The ITA addresses this constraint through a transport reassessment trigger currently identified at approximately 543 dwellings. The purpose of the trigger is not to establish a permanent development cap, but rather to identify the point at which further transport assessment of the Ohaupo Rd corridor is required having regard to the network conditions, transport improvements and travel behaviour existing at that time. This approach ensures that



NZTA Comments dated 23 June 2026 – from FLOW Transportation Specialists		
S/No	Comment	BBO Response
		development beyond the currently demonstrated threshold is subject to reassessment of transport effects and consideration of any further mitigation that may be available or reasonably practicable at that time. On that basis, the identified constraint does not invalidate the assessment of other intersections, rather, it informs the staging and mitigation framework recommended in the ITA.C
13.	Also, we wonder how this 320 threshold affects the conclusions for the HSL/SH1C roundabout, as the 2035 scenario used for the intersections of relevance to the SL1 North Industrial development is based on 575 households.	The transport reassessment trigger has been updated to 543 dwellings. It is a localised staging control associated with the Residential Development and the performance of the Ohaupo Rd corridor. It does not govern the operation of the SH1C/HSL roundabout or the staging of the Industrial Development. The current transport reassessment trigger associated with the Ohaupo Rd corridor does not undermine or invalidate the SH1C/HSL roundabout assessment.
14.	This second version of the ITA still retains access from the service road into the intersection. As advised previously, there appear to be significant design challenges with this, including tight U turns, and an inability for drivers using the service road to see the signal heads when approaching from the east or west. This intersection is one of those assessed where future signalized layouts have not included full pedestrian crossings. These should be assumed to be essential.	The Ohaupo Rd/Lambert Ct intersection currently operates as an unsignalised cross-road intersection, with multiple conflict points and reliance on gap acceptance for side-road movements. The proposed signalisation of the intersection would provide a materially greater level of control by formalising vehicle movements, reducing conflict uncertainty and providing controlled pedestrian crossing opportunities where appropriate. The detailed geometric design, including the service road arrangement, U-turn movements and signal head visibility, will be resolved through the detailed design process. However, from a transport safety and operational perspective, signalisation in principle represents an improvement over the existing priority-controlled layout. Section 15.2.3 of the ITA also identifies potential safety concerns associated with removing access to the Ohaupo Rd service lane, given that an alternative access is available further north on Ohaupo Road. BBO does not agree that full pedestrian crossings on all legs of every future signalised intersection must be assumed at this stage. There is an existing signalised mid-block pedestrian crossing approximately 100 m east of the intersection. Pedestrian provision at the intersection will be confirmed through detailed design, having regard to pedestrian desire lines, safety, spacing and the existing crossing provision.
15.	Section 15.3 considers bus priority modelling, indicating that this is likely to adversely affect the operation of the route for other vehicles. This is to be expected, but without being able to review the analysis (i.e. with no SIDRA printouts provided), it is unclear if the high V/C ratios of around 140% at several locations, which implies significant spill back, will adversely affect buses.	SIDRA movement summaries have now been included in Appendix C. The purpose of the bus priority modelling is to understand the trade-off between improved bus movement and the effect on general traffic operation. The ITA recognises that reallocating road space to support bus priority is likely to increase delay for some general traffic movements. That outcome is not unexpected where priority is being given to higher-occupancy public transport movements. High V/C ratios for general traffic do not, in themselves, undermine the public transport strategy, provided that future bus priority measures are designed to protect bus travel time and reliability. The ITA adopts this approach by embedding public transport through future bus routing, road



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S/No	Comment	BBO Response
		cross-sections capable of accommodating in-lane bus stops, and safeguarding of corridors for future public transport provision. However, the detailed design of any bus priority treatment will need to confirm that queues and spillback do not materially compromise bus travel time reliability at key locations.



Appendix D – Intersection Traffic Counts



Appendix E – Draft Construction Traffic Management Plan



Appendix D – WSP WWPS Capacity Assessment



Hamilton City Council

**SL1 Mexted Block to Peacocke
Wastewater Pumping Station - Capacity
Assessment**

05-05-2026

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Document distribution

Hamilton City Council

SL1 Mexted Block to Peacocke Wastewater Pumping Station - Capacity Assessment

05-05-2026

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Prepared for

Hamilton City Council

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Rev	Date	Details
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1. Preface

1.1 Jurisdictional Context

IAWAI is a newly established water services Council Controlled Organisation (CCO) jointly owned by Waikato District Council (WDC) and Hamilton City Council (HCC). IAWAI's statutory jurisdiction is limited to the existing HCC and WDC administrative boundaries. This jurisdiction does not include the SL1 area, nor any fast-track development areas located within or beyond that area.

At present, IAWAI does not have authorisation to provide water or wastewater services to developments outside the HCC and WDC territories, including individual fast-track developments.

Notwithstanding these limitations, the SL1 site's proximity to the Hamilton City boundary and the existing Hamilton water and wastewater networks has prompted developers to investigate whether servicing via HCC/IAWAI infrastructure may be technically feasible. Accordingly, technical assessments are underway to explore potential water and wastewater servicing options for the SL1 Mexted Block using existing and/or planned HCC/IAWAI infrastructure.

It is important to note that IAWAI does not currently have jurisdiction outside HCC and WDC areas, nor does it have the necessary commercial or statutory agreements with Waikato Waters Ltd or Waipā District Council to enable the provision of services beyond its existing boundaries.

1.2 Disclaimers and Limitations

The water and wastewater servicing assessments, including the scope and content of the attached report, have been prepared collaboratively by HCC and IAWAI in good faith and on a without prejudice basis.

This report is intended solely to assess the potential for servicing options and does not confer, imply, or guarantee any right or ability for the SL1 Mexted Block—or any other development—to connect to the HCC/IAWAI water or wastewater networks.

This assessment does not represent:

- Any commitment (actual or implied) by HCC or IAWAI to provide services
- Any confirmation of available network capacity
- Any approval for connection or use of existing or future infrastructure.

Any future servicing of developments outside the HCC and WDC territories using HCC/IAWAI infrastructure would be contingent on appropriate statutory approvals and commercial agreements being established, including agreements between IAWAI and Waikato Waters Ltd, and potentially Waipā District Council.

2. Scope of the Assessment

2.1 Scope

The SL1 development is anticipated to seek approval under the New Zealand Government Fast-track Approvals regime. New servicing solutions are required, as there are currently no existing water or wastewater services available that can meet the needs of the proposed development.

The SL1 Fast Track Area (FTA) includes both residential and industrial land uses. This assessment is limited in scope to the residential component of the FTA, referred to as the Mexted Block. An overview of the Mexted Block and its proposed staging is provided in Figure 2-1.



Figure 2-1: SL1 Mexted Block

2.2 Wastewater Servicing Considerations

An interim wastewater servicing option involving connection to the existing Peacocke wastewater network has been considered as part of this assessment. The Peacocke network has been recently constructed and is not yet fully utilised due to the staged nature of development in the area. On a preliminary and high-level basis, the Peacocke network is expected to have sufficient spare capacity to service the Mexted Block in the short term.

The long-term wastewater servicing strategy for the Mexted Block assumes ultimate connection to the future Southern Wastewater Treatment Plant (WWTP). A temporary connection to the Peacocke network may be considered acceptable by HCC/IAWAI subject to approvals and agreements, until such time as permanent connection to the Southern WWTP and its associated conveyance infrastructure becomes available.

2.3 Data Used and Assumptions

2.3.1 Data Used

WSP used the following resources for this assessment from previous work undertaken for the Peacocke development:

- Peacocke Strategic Wastewater – Preliminary Design Report – Version 3, WSP and Beca, August 2020
- Summary of Flow Sensitivity Analysis – Memo, WSP and Beca, July 2019
- VAR56 Sensitivity Analysis.xls – Version 5, WSP, August 2022

2.3.2 Assumptions

The following assumptions apply to this assessment:

- WSP has relied on the demand data provided by the developer for the SL1 Mexted Block.
- The wastewater network capacity for Peacocke has been adopted from previous assessments undertaken to inform the network design.
- No modelling was undertaken.

3. Proposed Interim Servicing

3.1 Existing Peacocke Network

The primary pump station servicing the catchment, known as the N4 Transfer Pump Station (N4 TPS), has a peak design flow capacity of **338 L/s**. This pump station capacity is fully allocated to service all stages of Peacocke development, and nearby sub-catchments in Fitzroy. The pump station capacity also accounts for the planned diversion of Te Anau and Splitt pump stations which is currently being implemented.

Figure 3-1 provides an overview of the sub-catchments planned to discharge to the N4 TPS.

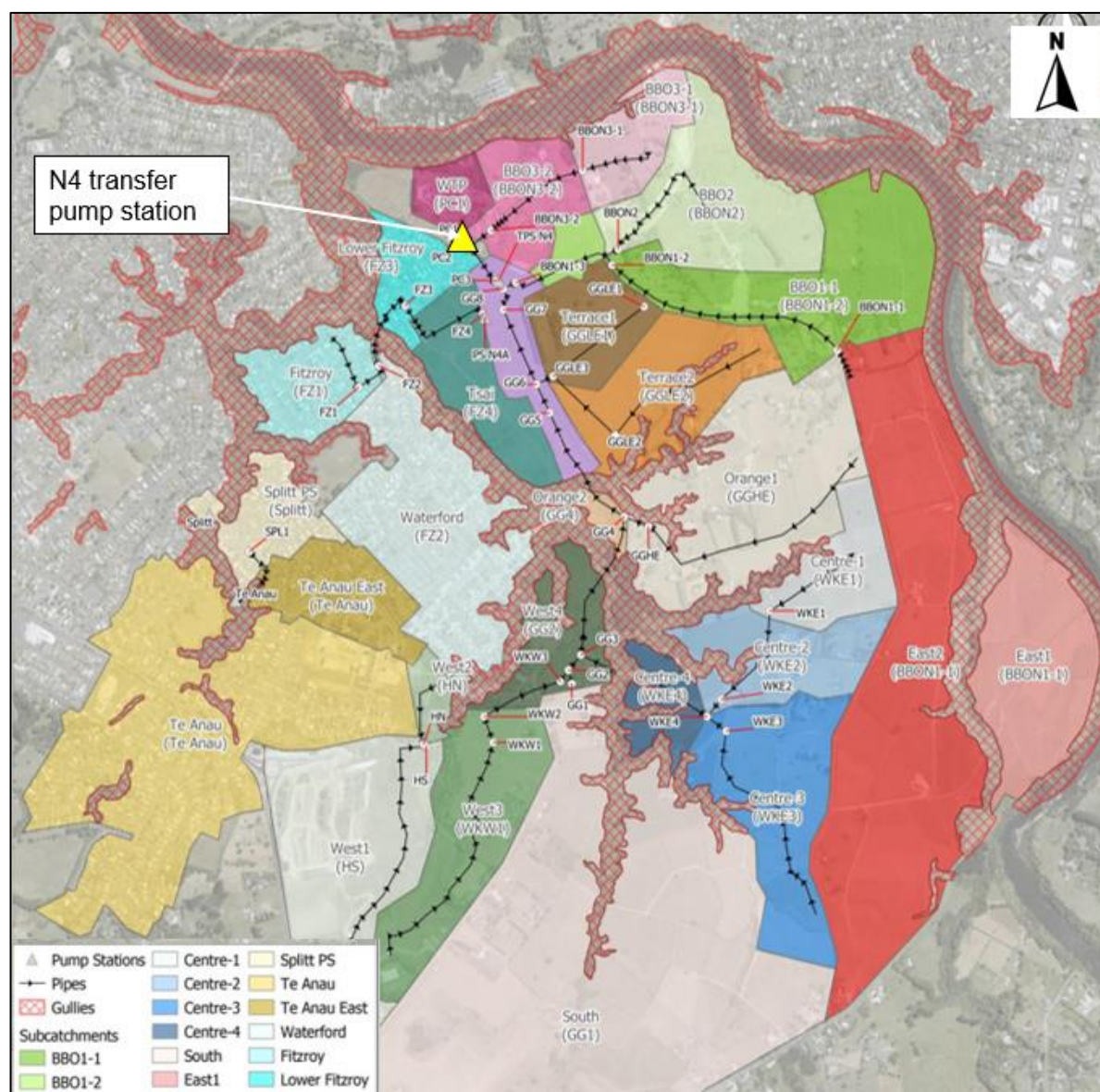


Figure 3-1: Catchments planned to discharge to N4 TPS

3.2 Proposed SL1 Mexted Block Connection

The estimated Peak Wet Weather Flow (PPWF) for the SL1 Mexted Block is **17.54 L/s** based on information provided by the developer. HCC has indicated that wastewater from the SL1 Mexted Block would be conveyed via a dedicated rising main to a discharge manhole (G20) within Peacocke, and through the associated network to the N4 TPS.

Figure 3-2 shows the location of the SL1 Mexted Block and the proposed discharge manhole relative to the Peacocke N4 TPS.

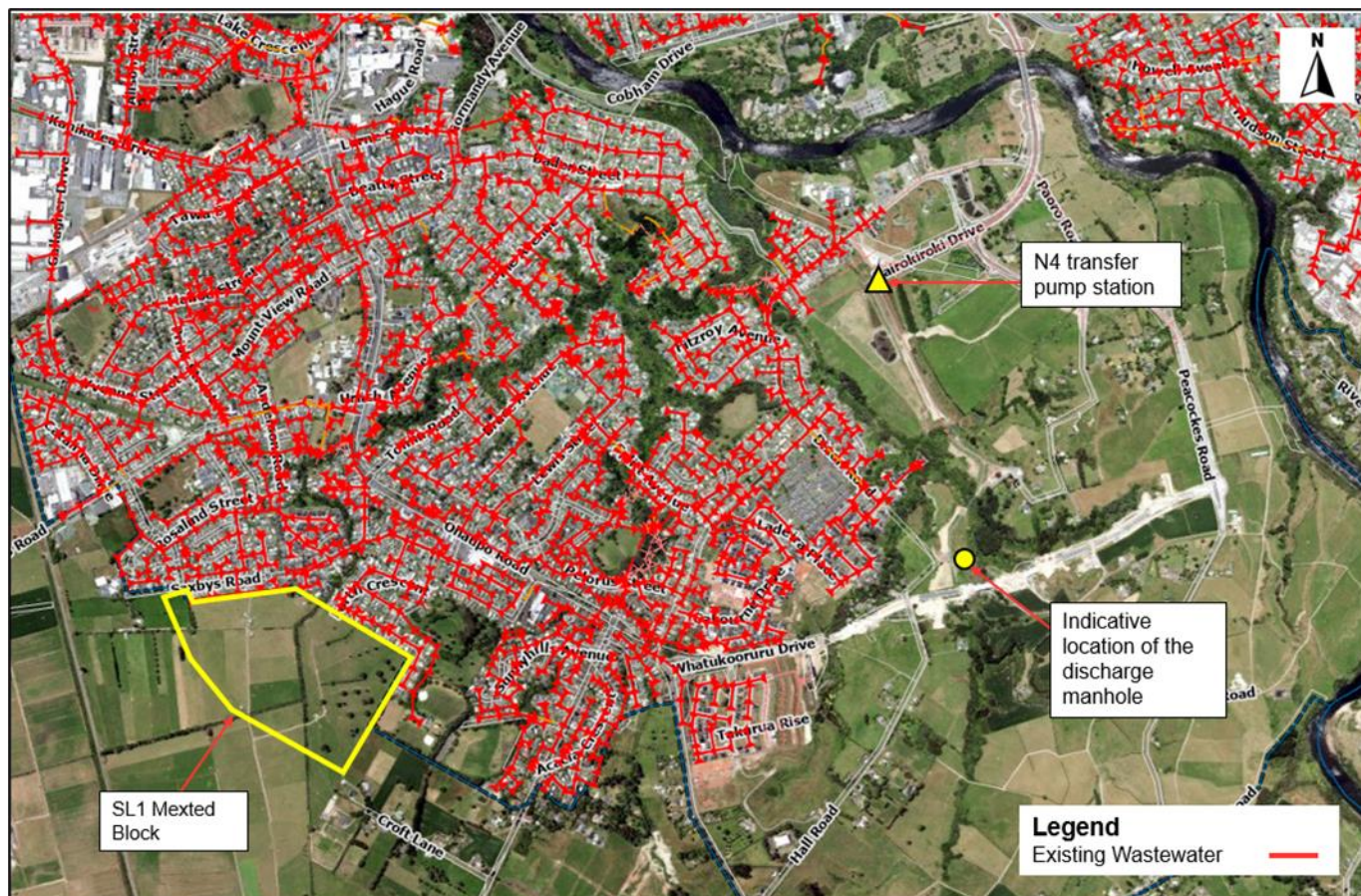


Figure 3-2: SL1 Mexted Block relative to the Peacocke wastewater network

4. Assessment

This section summarises the findings of the desktop assessment based on the existing information relevant to Peacocke development.

4.1 N4 Transfer Pump Station

Table 4-1 summarises projected Peak Wet Weather Flow (PWWF) from Peacocke development and other diversions, that will be discharged into the N4 TPS.

Table 4-1: Projected discharges to N4 TPS

Discharge scenario	Flow
Peacocke Development (all stages) PWWF	228 L/s
Fitzroy/ Splitt/ Te Anau/ WTP diversions PWWF	98 L/s
Total PWWF to N4	326 L/s
N4 Designed Capacity	338 L/s

Table 4-2 summarises the currently utilised capacity and the capacity allocated for the future Peacocke stages.

Table 4-2: Summary of utilised capacity

Capacity scenario	Flow
Currently utilised capacity (estimated – see note below)	160.5 L/s
Capacity allocated for the future Peacocke stages (currently unutilised)	177.5 L/s

Note: WSP estimated the current utilised capacity based on diverted catchments (Fitzroy/Splitt/Te Anau/Waiora WTP) and Peacocke Stage 1 which is substantially developed. The unutilised capacity is based on the Peacocke Stage 2 area which is currently starting to develop – the actual unutilised capacity may be less at the time of writing due to emerging development in Stage 2.

The SL1 Mexted Block (comprising 1,009 lots) represents approximately 10% of the unutilised capacity at the N4 TPS. The SL1 Mexted Block covers an area of approximately 34 ha, which is equivalent to around 5% of the Stage 2 Peacocke development area (approximately 700 ha) used as a proxy for unutilised capacity.

Note: The difference between the design inflow (326 L/s) and the design capacity of the N4 TPS (338 L/s) is negligible and is not considered spare capacity for use by areas outside of the Peacocke Structure Plan area or the planned WWPS diversions. Slight differences are expected and considered to allow for uncertainty in the ultimate network flow rates and the pump station performance over time.

4.2 Network Capacity

Figure 4-1 is an indicative map showing Stage 1 and Stage 2 of Peacocke development, along with the existing catchment diverted to N4 TPS.

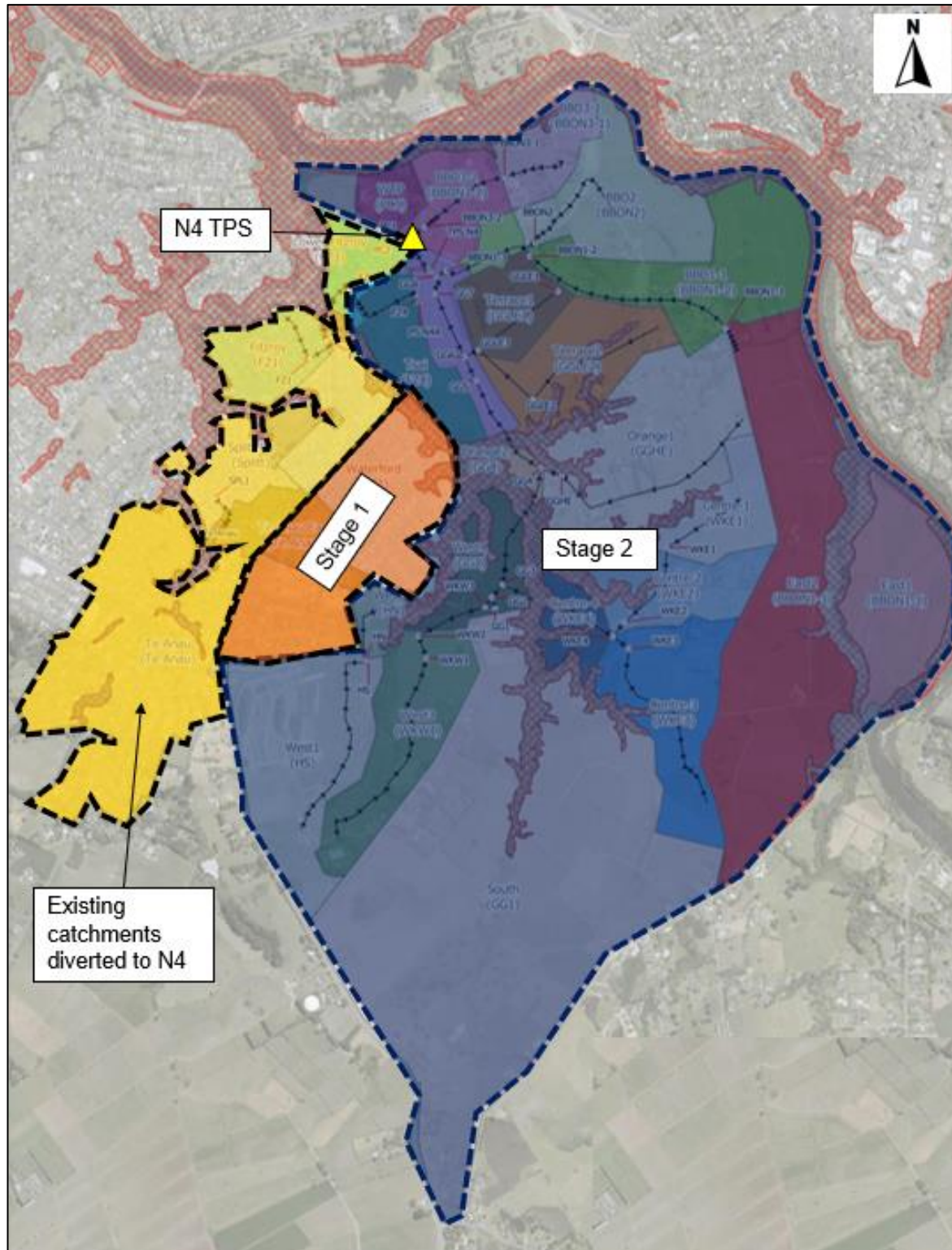


Figure 4-1: Indicative map showing Peacocke Stages 1 and 2

Figure 4-2 shows the indicative pipe sections between the proposed discharge manhole and the N4 TPS.

The pipe sections identified in Table 4-3 have sufficient interim capacity to accommodate a PWWF of 17.54 L/s from the SL1 Mexted Block to the N4 TPS. The SL1 Mexted discharge contributes approximately 16% of the total estimated flow and around 9% of the available capacity, of the GG3 pipe, which is the lowest-capacity pipe section.

Note: The pipe capacity calculations presented in Table 4-3 indicate available capacity within certain pipe sections with the inclusion of the SL1 Mexted Block PWWF. However, the overall Peacocke network capacity is defined by the N4 TPS, which has been designed to accommodate only the full Peacocke development.

5. Conclusions

WSP has reached the following conclusions:

- It is viable to permit an interim connection of the SL1 Mexted Block to the Peacocke wastewater network based on this capacity assessment:
 - The Peacocke network (N4 TPS) has sufficient capacity in the interim to accommodate the PWWF of 17.54 L/s from SL1 Mexted Block. The SL1 Mexted discharge represents 10% of the estimated unutilised pump station capacity at the time of writing.
 - The SL1 Mexted Block PWWF of 17.54 L/s represents about 16% of the estimated flow and approximately 9% of the capacity, of the lowest-capacity pipe section (GG3) between the discharge point and the N4 TPS.
- The full capacity of the N4 TPS has been allocated to servicing all stages of the Peacocke development and other confirmed diversions. Connection of the SL1 Mexted block to Peacocke cannot be relied upon as a permanent wastewater servicing solution.
- The duration of interim wastewater servicing for the SL1 Mexted Block is dependent on the implementation of the Southern WWTP and associated conveyance networks, and further development in SL1 which will require the ultimate servicing solution discharging to the Southern WWTP to be implemented.

6. WSP Limitations Statement

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Hamilton City Council ('Client'). WSP accepts no liability whatsoever for any use of or reliance on this Report, in whole or in part, by any third party.

The services undertaken by WSP in preparing this Report were strictly limited to those detailed in WSP's contract with the Client - Fast Track Development Water and Wastewater Assessment dated 07 March 2025 ('Contract') and the Report itself (together, the 'Services'), and WSP's liability is limited to those specific Services.

The Services and Report are subject to the assumptions, qualifications, exclusions and limitations set out in the Contract, the Report itself and/or otherwise communicated to the Client.

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Appendix E – Wastewater Pump Station Technical Specifications

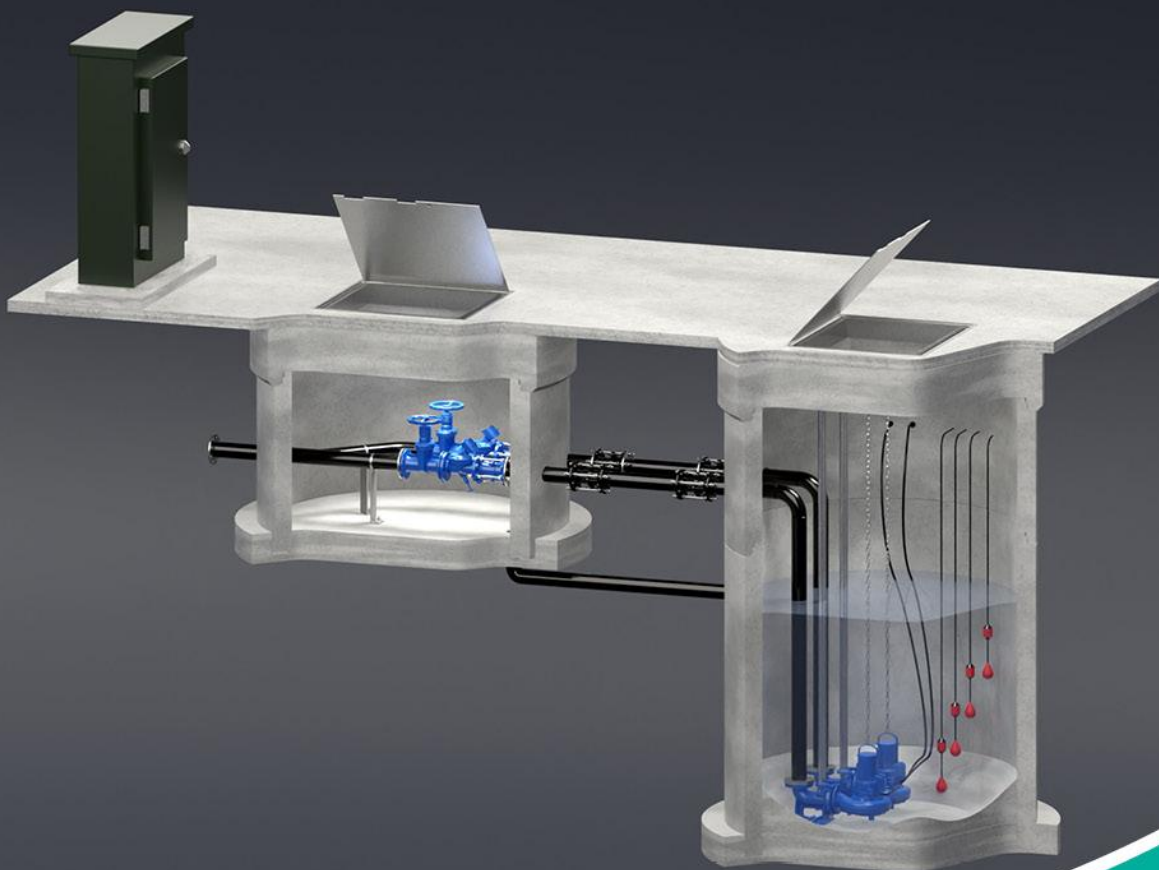
PUMP STATION

WWPS A, SOUTHERN LINKS 1, RESIDENTIAL 1, HAMILTON

TECHNICAL SPECIFICATIONS

MAVEN WAIKATO LIMITED

26 AUGUST 2026



Peter Carroll – Aquate Director
BE Civil, MBA, CPEng, FEngNZ
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Foreward

This installation manual is a guide only. All relevant Health and Safety laws and codes of construction must be adhered to and take precedence over any information in this manual. Installers must practice good professional practice and are required to understand all National and Local regulations in respect to the installation of drainage materials.

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APPENDICES

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1.1 Pumps/Pump Performance

See full specifications in the Appendices

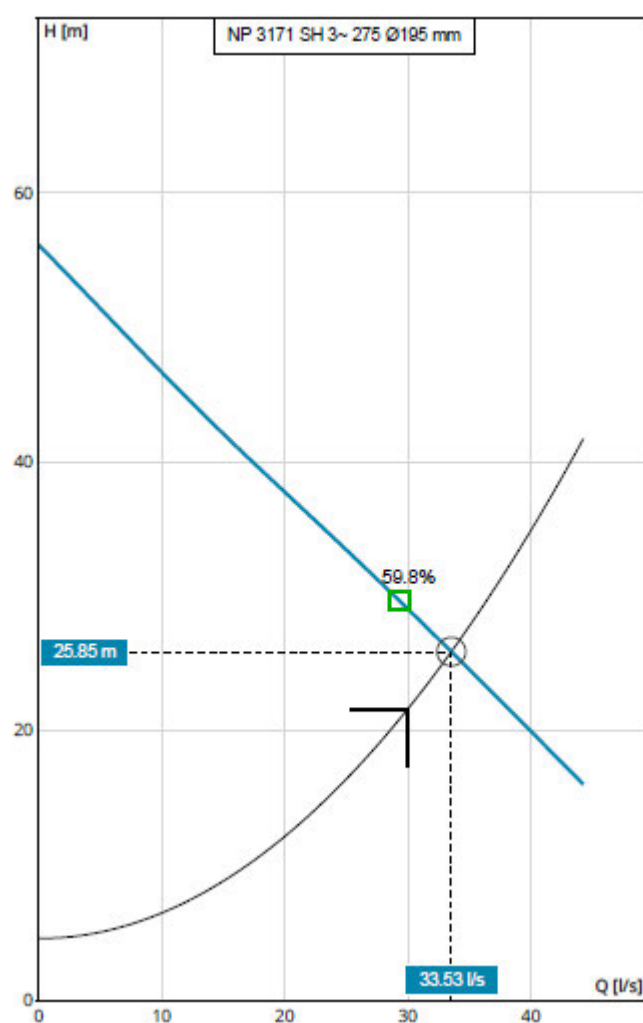
Manufacturer: Xylem Pumps

Type: Flygt NP3171 SH3 275

Connection: 415 V, 50 Hz

Power: 22 kW

Phases: Three



1.2 Design Information

1.2.1 Pump Design

The system above has been designed based on the information provided below.

Rising main length : 3060m

Static Lift : – 4.5 m

Rising main – PE100 (HDPE) PE 4710 / SDR 11 (PN 16) / DN 200 (250x22.7 mm)

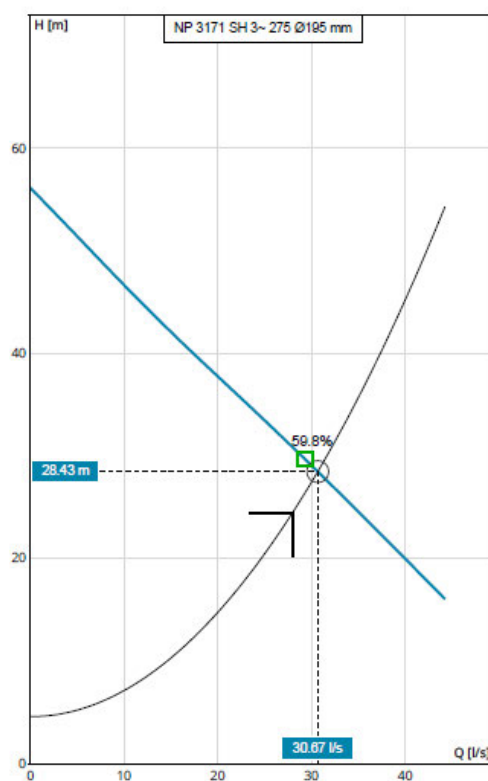
Rising main – OD – 250mm, ID – 204.6mm

Option 1 $K = 1.5$

Flygt NP3171 - Flow rate = 30.67 l/s with a total head loss of 28.43 m (single pump).

Pumps to operate in a duty / assist / standby function

Velocity in PE pipe = 0.93 m/s

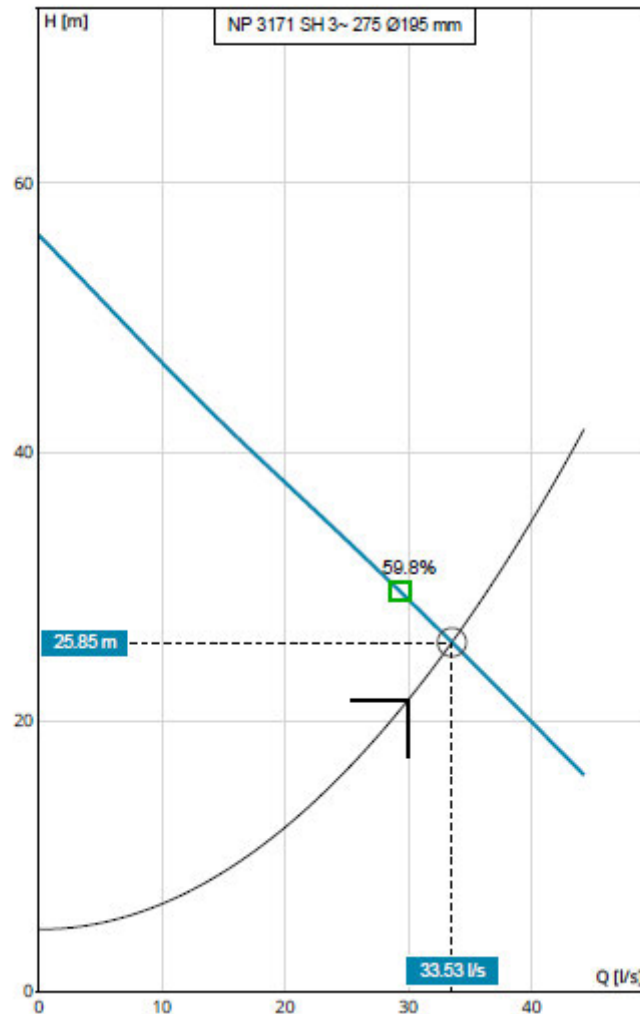


Option 2 $K = 0.5$

Flygt NP3171 - Flow rate = 33.53 l/s with a total head loss of 25.85 m (single pump).

Pumps to operate in a duty / assist / standby function

Velocity in PE pipe = 1.0 m/s



1.2.2 Storage Calculations

The total Average Dry Weather flow has been calculated from the expected flow rate with the following assumption:

Average dry weather flow = 941 dwellings = 564.6 m³/day

Less 220 dwellings to be stored at WWPS B (132 m³/day)

Total effective daily flow = 432.6 m³/day

Total emergency storage required is 9 hours = 162.26 m³

Total emergency storage in wet-well and emergency storage tank is 164.25 m³ so 9.1 hours storage has been provided.

1.2.3 Pump Operational Levels

The operational levels will be set as follows (dimensions taken from floor of wet-well) :

Set point		Description	Control function
Value	Unit		
300mm	4.9 %	Low Level Alarm	Stops both pumps/ alarms
350 mm	5.7%	Duty/ Standby Pump OFF	Stops Duty and Standby pump
800 mm	13.1%	Duty Pump ON	Starts duty pump
900 mm	14.8 %	Assist Pump ON	Assist Pump ON
1200 mm	19.6%	Hi Level Alarm	Hi Level alarm activated
250 mm		Stop Both Pumps - Float Switch	Stop Both Pumps
900 mm		Start Duty Pump – Float Switch	Start Duty Pump
1000 mm		Start Assist Pump – Float Switch	Start Assist Pump
1500 mm		Critical High Alarm – Float Switch	Critical High Alarm

1.2.4 Pump Stop/Start Calculations

Expected daily flow:	564600	litres
Infiltration (l/day)	0	litres
SWI (l/day)	0	litres
Peaking factor :	3	
ADDWF	6.53	l/s
PDDWF	16.34	l/s
PWWF	25.63	l/s

Pump Station diameter	2.55	m
Pump station depth (total)	6.25	m
Pump station depth (effective)	5.25	m
Volume (effective)	26.80	m ³

Pump Stop Level	0.4	m
Pump Start Level	1	m
Volume to pump:	3063	litres

Discharge rate:	30.67	l/s
-----------------	-------	-----

Time to empty: (PDDWF)	3.6	minutes
Time to empty: (PWWF)	10.1	minutes
Time to fill (PDDWF)	3.1	minutes
Time to fill (PWWF)	2.0	minutes
No starts/ hour (PDDWF)	9.0	
No starts/ hour (PWWF)	5.0	
No starts per pump (PDDWF)	4.5	
No starts per pump (PWWF)	2.5	
Max Start/Hour permissible	30	Okay

1.3 Pipework, Valves and Fittings

Discharge connection: 150 mm diameter flange coupler

Inlet and outlets: the inlet pipe to be installed on site and sealed by the drainage contractor. The outlet pipe is pre-installed in the factory.

Discharge pipework: Includes a non-return valve, dismantling joint and an isolation valve.

Lifting chains: a stainless steel chain is connected from the pump to the underside of the chamber for ease of pump removal if required.

Materials: All pipework will be 150mm 316 Stainless steel Schedule 40 and will be manufactured to the relevant AUS/ NZ Standards

Guide rails: Stainless steel

1.4 Access lids

Steel access lids (1600 x 1000mm) will be supplied as per the RITS design

1.5 Magflow metre

An ABB ProcessMaster DN150 is included installed in a 1500mm diameter manhole

1.6 Level Sensors

1 off – ABB Black Box Hydrostatic level sensor

4 off – Flygt ENM10 float switches for Low level, duty pump operation, standby pump operation, and High-level alarm

1.7 Electrical & Controls

This controller is designed on the latest 2023 HCC drawings which are quite different to their previous standards. Any comparison to a competing proposal should ensure that the same standards have been used in the pricing.

This allows for the design, including production of electrical drawings, build and factory acceptance testing (FAT) of the pump station controller.

The design will include::

- 1 x Allen Bradley Micro800 PLC and IO modules as per their standard design.
- 1 x programming of Allen Bradley PLC.
- 1 x Trio Radio unit for communicating to HCC's SCADA system.
- 1 x battery backup for communication and PLC 24VDC circuits.
- 1 x supply of aerial for radio communication to base station.
- 2 x DOL starting configuration with overload and short circuit protection as per HCC standards, for each pump.
- 2 x current transducers and amp meters.
- 2 x capacitors for power factor correction.
- 1 x phase failure relay with output to PLC.
- 1 x surge divertor with output to PLC.
- 1 x level indicator input.
- 1 x flow indicator input.
- 22mm dia push buttons and selector switches for pump circuitry and control.
- Cabinet door switches and internal lights.
- Anticondensation heaters for cabinet.
- 2 x isolation switches for the pumps.
- 1 x Cubic internal panel. Note this differs to the HCC drawing but is of an equal or better quality to the Bremca 250 series panel.
- 1 x generator connection with interlocked mains/generator breakers.
- RCD protected service plugs mounted within cabinet.
- 1 x painted aluminium pillar box approximately 1.95 x 1.525 x 0.5m (l x h x d) with multiple door access, and internal panels.
- 1 x full CAD drawings.

We have not allowed for any of the following:

- Supply of any boosting to the radio signal if the standard Trio radio unit and standard aerial is insufficient.
- Supply of any site metering although space left in cabinet for a smart meter.
- Any civil works including construction of plinth for controller to mount to.

- Any on site installation including running of cable to and from controller, or mounting revenue meter (if required), or installing any on site lighting, installing the aerial or aerial base. It is suggested the site electricians are engaged to do this where required.

1.8 Odour Control System

This has been excluded as per RITS standards. See section 5.3.7.16 RITS.

1.9 Protective lining

The wet-well including the underside of the lid will be lined with Blue-seal HDPE lining for sulphuric acid resistance (see Appendices)

1.10 Well-washer

A McBerns well washer has been specified by RITS – see appendices for details

A sprinkler system using BETE nozzles has been included in the storage tanks to RITS design

1.11 RPZ Cabinet

A steel cabinet to RITS design has been included along with an RPZ standpipe and two off solenoid valves for the well washer and sprinkler system

1.12 Inlet valve

A 225mm diameter knife-gate valve will be installed on the inlet pipe in to the wetwell. This includes a spindle to the underside of the lid

2 Construction

The pump station has been design using reinforced precast concrete components. The system will be fabricated off site and delivered to site ready for installation. The tank will have a 31,900 litre capacity and a total depth of 6.25 m.

The pump stations will be delivered to site in a kit-set format and will need to be installed in the ground by the drainage contractor.

The construction and commissioning of the Aquate pump station will then be completed by a trained Hynds Environmental Construction Technician.

3 Safety in Design

This pump station has been designed to minimise any risk to operators and service personnel.

Access into the pump station should not be required for ongoing maintenance as almost all servicing work can be completed from ground level. The main components can be accessed as follows:

- Pumps – these can be removed from the pump station by lifting them up out of the wet-well and inspecting above ground. Note : the pumps weight 147 kg each.
- Floats – can be lifted from the connection points in the access hole in the lid.
- Non-return valves/Isolation valves –can be access from ground level without the need to enter the chamber
- Venting will be required and will need to be installed on site. The access lids are air-tight.

Risk register

The risk register is a live document which requires continuous monitoring updating. This will need to be completed by the maintenance company for the pump station. The items below are a guide only. The safety and design and Hazops workshops have encompassed risks for normal operation of the vacuum wastewater pump station. Specific risks for the maintenance process are outlined below.

Risk matrix

			Consequence / potential severity				
			Minimal Non-injury or First Aid injury (FAI)	Minor Medical treatment injury	Moderate Medical treatment injury, with lost time (LTI)	Major Injury requiring hospital-/notifiable event	Catastrophic Fatality or multiple fatalities
Likelihood	Very high	Almost certain: Commonly occurs	3: Medium	4: High	4: High	5: Very high	5: Very high
	High	Likely: Could easily happen	2: Low	3: Medium	4: High	4: High	5: Very high
	Medium	Possible: Could happen or has been known to happen	2: Low	2: Low	3: Medium	4: High	4: High
	Low	Unlikely: Hasn't happened yet but could happen	1: Very Low	2: Low	3: Medium	3: Medium	4: High
	Very low	Rare: Very unlikely but could happen in exceptional circumstances	1: Very Low	2: Low	2: Low	3: Medium	4: High

	Hazards <i>(one per line)</i>		Hazard controls – what do we need to do to make it safe?	
What are we doing? <i>(step by step)</i>	What could cause harm?	Existing risk level <i>(use risk matrix)</i>	Eliminate/ Controls	Residual risk level
Wet-well inspection	The wet-well is classified as a confined space, an inspection is required prior to wet commissioning.	3	Elimination: The vessel will be isolated from the system at all exit points and inspected from the access hole in the lid . Isolate/Engineering Controls/PPE: Entry will only be required if debris is identified and cannot be removed by any other means. Entry to the vessel should follow confined space protocols, including ensuring all persons involved have the required training, admin and PPE controls.	1 1
Sewage Pump Testing	The wet well will be filled up for wet testing. This is a potential drowning hazard.	3	Elimination Barriers around the access hatch to be erected so no one can enter the wet-well. Engineering Controls/PPE: All essential persons to wear appropriate protection. Sewage pump shall only operate when required for wet testing..	1 1
Removing lids for access	Traffic moving through area Back strain	3 2	Isolate/Engineering Controls/PPE: Place cones around service area so vehicles cannot enter site Engineering Controls/PPE – use appropriate lifting equipment if lifting pumps / lids on site	
Removing pumps	This is a falling hazard	4	Elimination Barriers around the access hatch to be erected so no one can enter the wet-well.	
Electrical checks	Electrical shock	3	Engineering Controls/PPE: Only fully certified electricians to complete electrical work	

4 Warrantees

Aquate guarantees the performance and quality of its pump stations provided:

- The product is only used for the intended purposes as stated in the quote
- The control panel and pump station is correctly installed and commissioned by a suitable installer
- The fault is due to a defect in design, materials or workmanship
- The fault is reported to an Aquate agent or representative during the guarantee period
- No pump station components have been replaced by alternative products
- This guarantee does not cover faults resulting from misuse of the system, blockages or breakdowns caused by the introduction of inappropriate materials into the system, incorrect electrical installation of the control unit, deficient maintenance or normal wear and tear.

Aquate assumes no liability for bodily harm, property damage or economic losses as a result of its pump stations.

4.1 Pumps

The pumps come with a 12 month year warranty against faulty components and/or workmanship. If prohibited substances are introduced to the system causing the pump to block and burn out, the warranty is null and void.

Flygt undertakes to remedy faults in products sold by Flygt provided that:

- The fault is due to defects in design, materials or workmanship;
- The fault is reported to a Flygt representative during the guarantee period;
- The product is used only under conditions described in the care and maintenance instructions and in applications for which it is intended;
- The monitoring equipment incorporated in the product is correctly connected;
- All service and repair work is done by a workshop authorized by Flygt or the original manufacturer;
- Genuine manufacturer's parts are used
- Storage should be in accordance with the care and maintenance manual.
- The equipment is operated and maintained in accordance with the Operation and Care and Maintenance Manual.

Failure to comply with these requirements will render warranty void unless, due to the nature of the warranty claim, such voiding of warranty is prevented by law, regulation, act and/or ordinance.

Hence, the guarantee does not cover faults caused by deficient maintenance, abuse, incorrectly executed repair work or normal wear and tear.

5 Maintenance schedule

A certain amount of system maintenance is required on an ongoing basis to ensure that the system is working correctly. This is the responsibility of the owner

5.1 Six monthly

The following procedures should be completed every six months:

- The pumping station should be inspected to check the build-up of grease and fat particularly on the float switches and pumps. They may need to be withdrawn for cleaning.
- Visually inspect the pump station walls and hose down if necessary
- Ensure the pump station access lid is securely fastened and bolted down.
- Lift the pumps and inspect for any damage or blockages around the impellers
- Lift the floats and test the alarm system/pump operation
- Consult with the electrical control supplier for additional checks

5.2 Annually

The following procedures should be completed at least once every 12 months:

- The pumping station should be inspected to check the build-up of grease and fat particularly on the float switches and pumps. They may need to be withdrawn for cleaning.
- Visually inspect the pump station walls and hose down if necessary
- Lift the floats and test the alarm system/pump operation
- Press the mute button (audio alarms only) to check the audio alarm turns off.
- Visually check the pump station for any structural damage to the tank and pipework
- Ensure the pump station access lid is securely fastened and bolted down.
- Lift the pumps and inspect for any damage or blockages around the impellers
- Have the pump station sucked out to remove any debris/stones if necessary

5.3 Maintenance requirements

The pump maintenance and repair operations must be carried out by workers authorised by the manufacturer; Failure to comply with these instructions will result in forfeiture of the warranty and jeopardise the unit's safety.

Before any cleaning and/ or maintenance operations are carried out on the electric pump, the power supply must be switched off.

To disconnect the submersible electric pump from the electricity mains, first disconnect the phase conductors, then the yellow –green earth wires.

Use the special handle to remove the submersible electric pump from the tank.

ATTENTION: Before carrying out any operations, check the pump temperature. Only work on the pump when it is at room temperature.

Clean the electric pump thoroughly, using a jet of water or specific products to clean all its parts. When disposing of the waste material, follow the antipollution rules in force.

Replace any broken or worn parts with original spare parts only.

Given the likelihood that work on the electric pump will be carried out in confined spaces such as vats, wells, cesspools, tanks or cisterns, do not underestimate the risks caused by potentially poisonous exhalations.

APPENDICES

General Arrangement Drawing – Plan

General Arrangement Drawing – Section

General Arrangement Drawing – Plan with tank

General Arrangement Drawing – Section with tank

Flygt NP3171 SH3 275 Specifications k 1.5

Flygt NP3171 SH3 275 Specifications k 0.5

McBerns well washing brochure

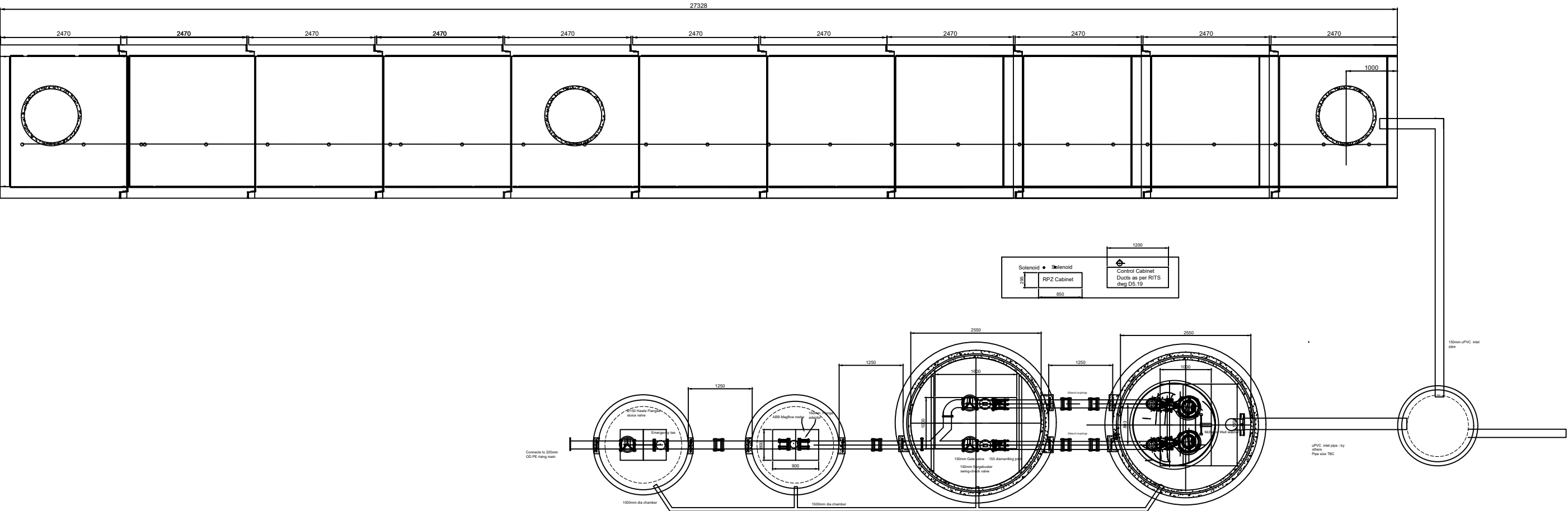
BlueSeal-AKS data sheet

Hyliner HDPE liner – data sheet

ABB Magflow Meter Specifications

ABB Blackbox level sensor specifications

Flygt ENM10 float switch specifications



NOTES:

1.

REVISIONS			
REV #:	REVISION DESCRIPTION:	DATE:	DRAWN:
A	Issued For Approval	21/5/26	PC
B	Changed pumps to NP3171	26/8/26	PC
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PO Box 58142, Botany, Auckland, 2316
Tel: 09-274 0316
Fax: 09-272 7485
email: hwwsupport@hynds.co.nz

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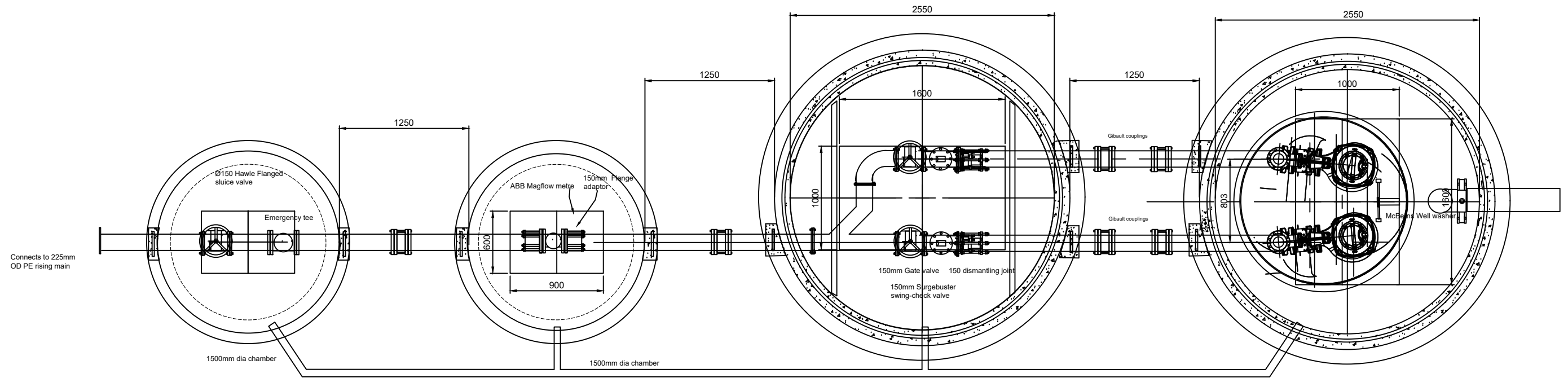
ISO 9001 CERTIFIED MANAGEMENT SYSTEM

PROJECT:
Southern Links Residential 1
Hamilton

WW Pump Station WWPS - A

DRAWING TITLE:
Plan View with tank

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PAPER SIZE: A3		26/8/26	
DRAWING NUMBER:	SHEET NUMBER:	REVISION NUMBER:	
AQ2283 - 23	of 4	B	



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REVISIONS			
REV #:	REVISION DESCRIPTION:	DATE:	DRAWN:
A	Issued For Approval	21/5/26	PC
B	Charned pumps to NP3171	26/8/26	PC
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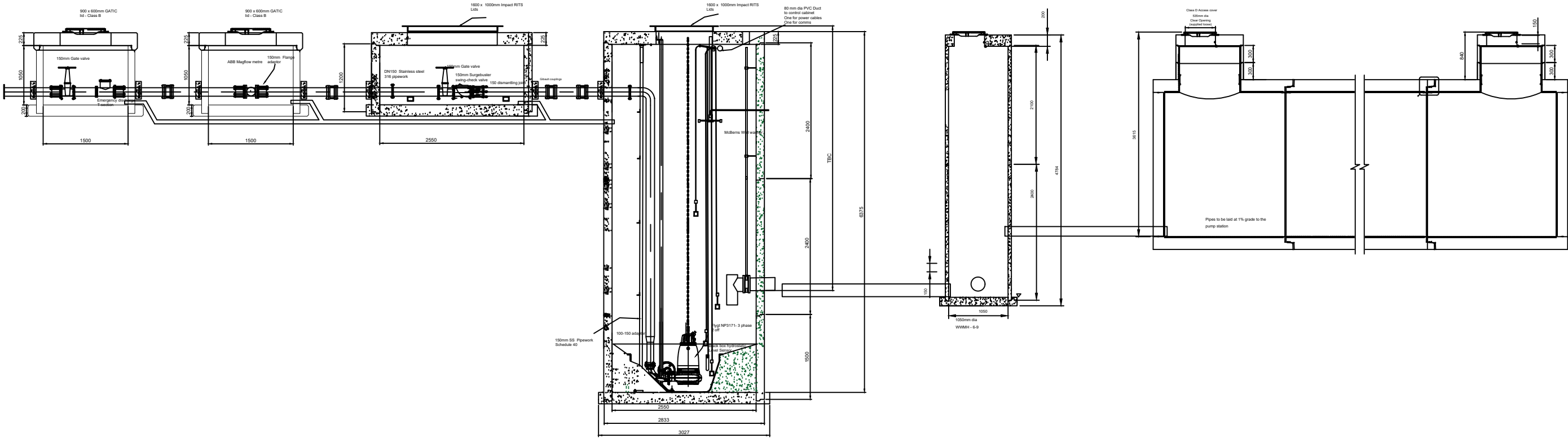
ISO 9001 CERTIFIED MANAGEMENT SYSTEM

PROJECT:
Southern Links Residential 1
Hamilton

WW Pump Station WWPS - A

DRAWING TITLE:
Plan View

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DRAWING NUMBER:	SHEET NUMBER:	REVISION NUMBER:	
AQ2283 - 21	of 4	B	



NOTES:

1.

REVISIONS			
REV #:	REVISION DESCRIPTION:	DATE:	DRAWN:
A	Issued For Approval	21/5/26	PC
B	Changed pump to NP3171	26/8/26	PC
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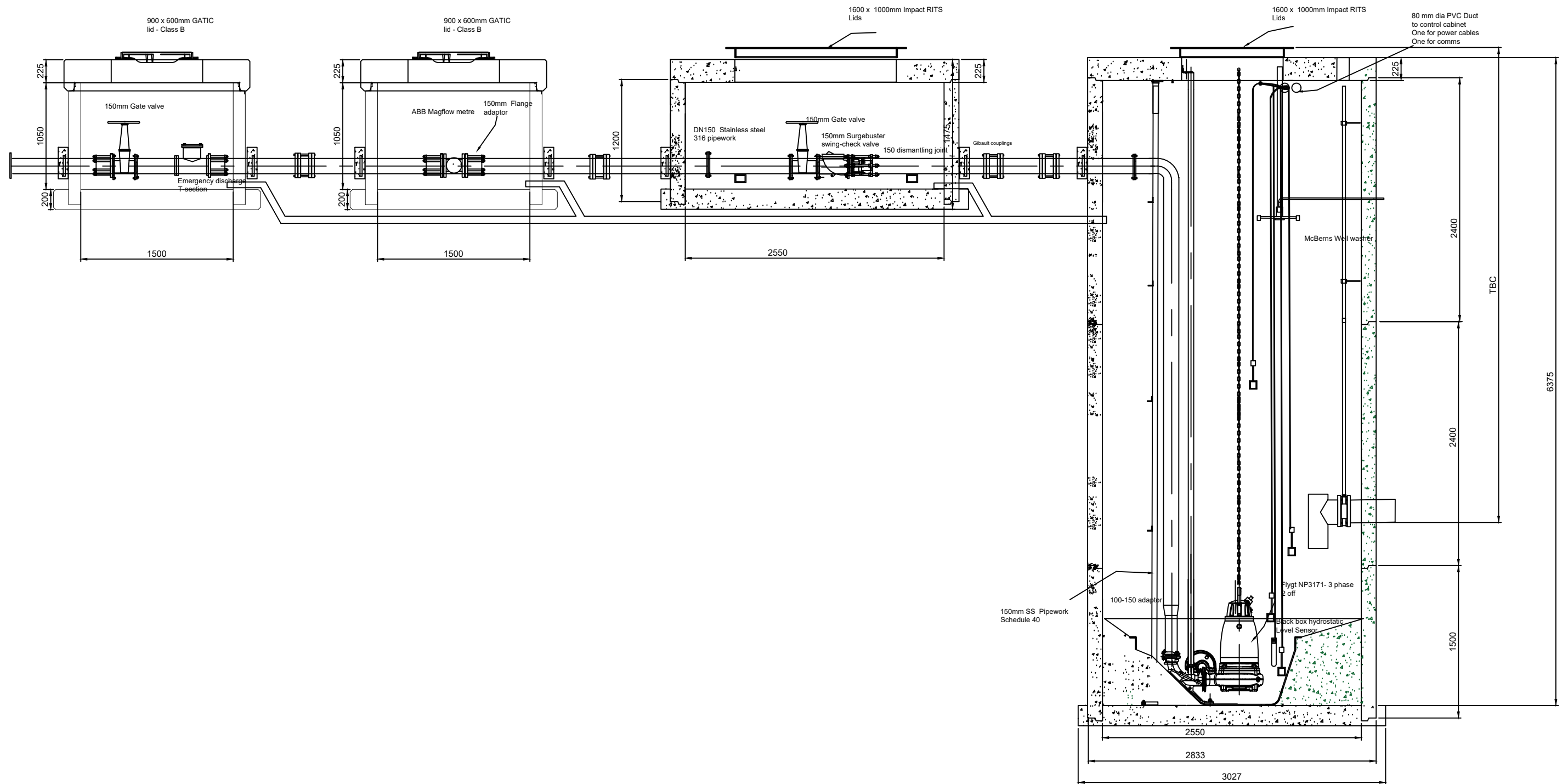
ISO 9001 CERTIFIED MANAGEMENT SYSTEM

PROJECT:
Southern Links Residential 1
Hamilton

WW Pump Station WWPS - A

DRAWING TITLE:
Section View with tank

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SIGNATURE:	SIGNATURE:	SIGNATURE:	
SCALE: As Shown	Note: Do not scale drawing if in doubt ASK!!!	DATE:	26/8/26
PAPER SIZE: A3			
DRAWING NUMBER:	SHEET NUMBER:	REVISION NUMBER:	
AQ2283 - 2	of 4	B	



NOTES:

1.

REVISIONS

REV #:	REVISION DESCRIPTION:	DATE:	DRAWN:
A	Issued For Approval	21/5/26	PC
B	Changed pump to NP3171	26/8/26	PC
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ISO 9001 CERTIFIED MANAGEMENT SYSTEM



PROJECT:
**Southern Links Residential 1
Hamilton**

WW Pump Station WWPS - A

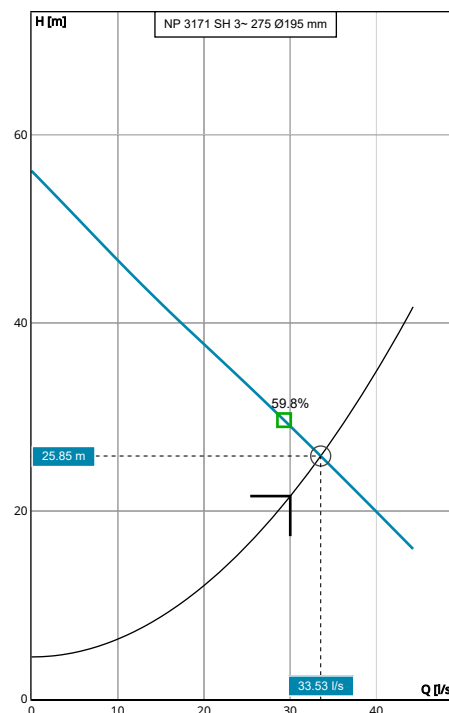
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Section View

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PAPER SIZE: A3		
DRAWING NUMBER: AQ2283 - 22	SHEET NUMBER: of 2	REVISION NUMBER: B

NP 3171 SH 3~ 275 | Configuration Summary



Flygt's self-cleaning non-clog N-pumps feature innovative designs and functions that deliver high sustained efficiency and the most reliable operation. This makes them the most reliable choice available for a broad range of wastewater applications for tough applications such as unscreened sewage, wastewater and sludge up to an 8 percent solids concentration. Impeller material available in Hardened cast Iron, Hard Iron and Stainless Steel to fit any wastewater application.



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

GENERAL

Explosion Proof	Impeller Diameter
No	195 mm
Max. Pumped Media Temp.	
40 °C	

MATERIAL AND COATING

Impeller Material
Hard-Iron
Volute Material
Grey Cast Iron

MOTOR

Rated Voltage	Motor Efficiency Class
400 V	Standard
Coupling	Rated Power
Y	22 kW

INSTALLATION

Installation Type
P - Semi-Permanent, Wet

NP 3171 SH 3~ 275 | Product Details

Description

N 3171

The Flygt N-series are equipped with the Flygt invented N-technology with its innovative self-cleaning impeller. Solid objects entering the pump will pass through the impeller between the impeller vanes. If an object gets caught on the leading edge of one of the vanes, it will slide along the backswept shape towards the perimeter of the inlet where it will be guided by a relief groove through the pump housing. This ensures a high sustained total efficiency over time. Due to the mechanical self-cleaning design, a sludge concentration of solids up to 8% can easily be pumped. The pump can easily be installed in either permanently or temporary submerged, or horizontally or vertically dry installations.

Flexible and Modular Design

The modular hydraulic design enables customization of the hydraulics to meet the requirements of many applications.

- Replaceable wear ring in two materials, gray iron or Hard Iron, for different operation conditions
- Hardened gray iron impeller for typical wastewater applications
- Hard-iron impeller for heavy duty wastewater applications containing abrasive and corrosive content
- Chopper ring intended for tough wastewater applications where cutting is required due to long fibres and solid concentrations up to 10-12%
- Stainless steel impeller for special applications that require duplex stainless steel

Robust and Reliable

- Short shaft overhang reduces shaft deflection and increases seal and bearing life
- Class H Motor designed for submersible use. Heat is concentrated to the stator core for improved cooling properties.
- The Plug-in seal with Active Seal system eliminates the risk associated with incorrect installation and careless handling. All in one unit. Available in Tungsten carbide (WCCR) or Silicone carbide (SiC) depending on pumped media.
- Motor cable SUBCAB® specially developed for submersible use
- Offers flexible cooling systems, e.g. closed-loop cooling system, media cooled or external cooling that allows full motor potential in dry installations.
- Premium brand bearings, greased for life, ensures a minimum of 50 000 hours of duty
- Leakage sensor and motor temperature sensor as standard

The N 3171 is available with the following options:

- ATEX, FM, CSA-approvals
- Premium efficiency motors
- Hard Iron hydraulic design
- Stainless Steel hydraulic design
- Vibration-sensor, extended motor temperature sensors, additional leakage-sensor, current-sensor and pump memory
- Compatible with SmartRun® Wastewater pump controller
- Compatible with MAS 801 monitoring system

Product Features

- State-of-the-art wastewater pump with N-technology
- Sustained high efficiency pumping with energy savings up to 25%
- Flexible and modular design
- Robust and reliable

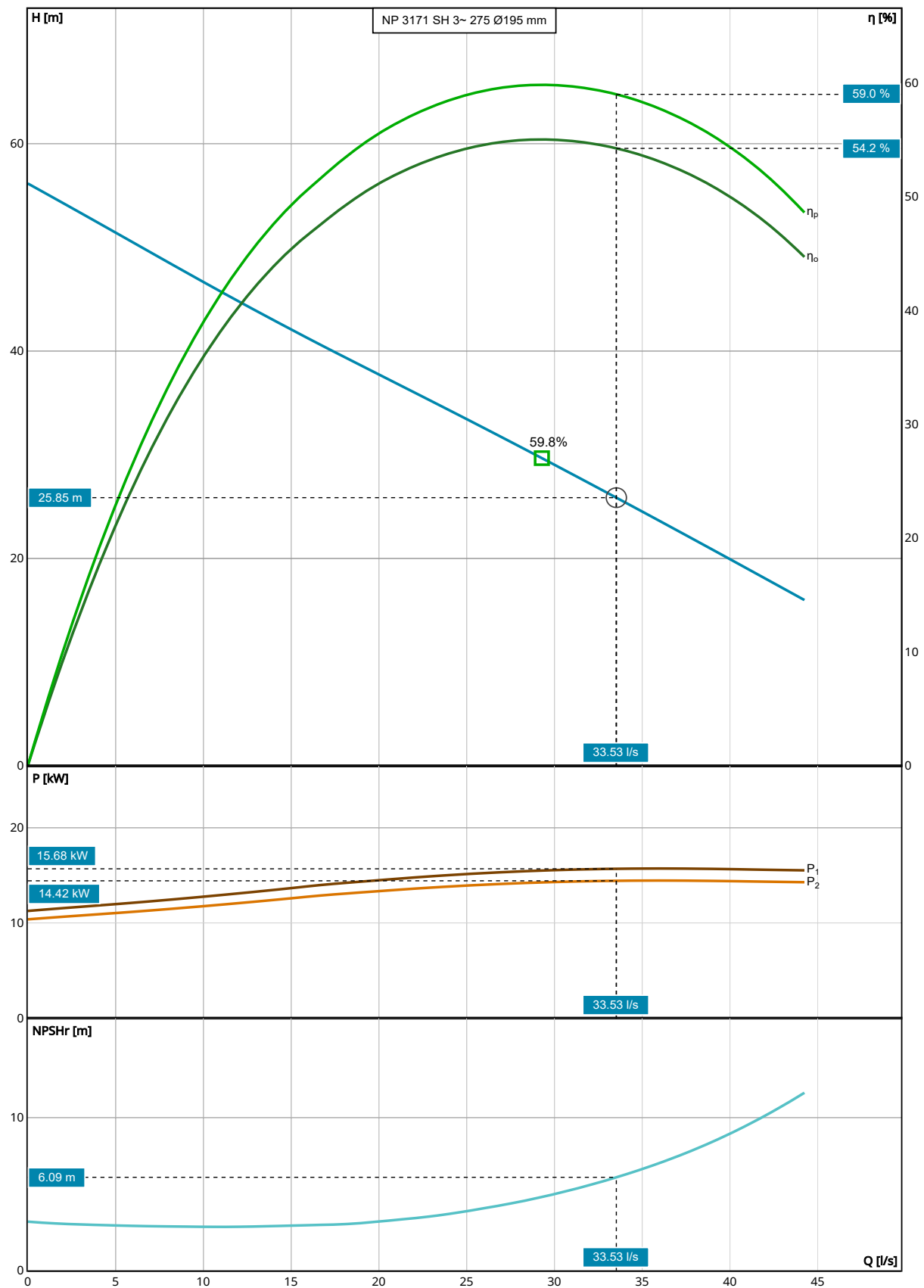
Construction Materials

Impeller Material	Volute Material	Stator Cover Material
Hard-Iron	Grey Cast Iron	-

Motor

Rated Power	Number Of Phases	Start Current Ratio	Motor Issue
22 kW	3	7.36	11
Motor Denomination	Rated Motor Speed	Insulation Class	Locked Rotor Code
25-18-2AA	2,925 RPM	H	H
Motor Efficiency Class	Rated Voltage	Approval	Max starts per hour
Standard	400 V	STD	30
Version Code	Rated Current	Total moment of inertia	Power Factor 100%
185	38 A	0.07 kgm ²	0.92
Frequency	Start Current	Type of duty	Power Factor 75%
50 Hz	280 A	S1	0.9
Max P2 (1x)	Starting Current, Direct Starting	Stator Variant	Power Factor 50%
14.44 kW	280 A	2	0.84
Number Of Poles	Starting Current, Star Delta	Motor Module	Efficiency 100%
2	93.33 A	111	90.3 %
			Efficiency 75%
			91.6 %
			Efficiency 50%
			92.2 %
			Cooling Jacket
			-

NP 3171 SH 3~ 275 | Hydraulic Data & Performance Curve



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

Selection

Series	Curve Code
N 3000	275
Name	Impeller Diameter
NP 3171 SH 3~ 275	195 mm
Frequency	Inlet Diameter
50 Hz	150 mm
Total Flow	Outlet Diameter
30 l/s	100 mm
Total Head	Number Of Vanes
21.59 m	2
Pump Flow	
30 l/s	
Pump Head	
21.59 m	
System Type	
Single Pump	
Operating Pumps	
1	
Standby Pumps	
No Standby Pump	

Design Point

Flow	Shaft power (P2)
33.53 l/s	14.42 kW
Head	NPSHR
25.85 m	6.09 m
Overall Efficiency (η_o)	Speed
54.23 %	2,953 RPM
Pump Efficiency (η_p)	Static Head
58.98 %	4.5 m
Input Power (P1)	Flow To BEP Ratio
15.68 kW	114.49 %

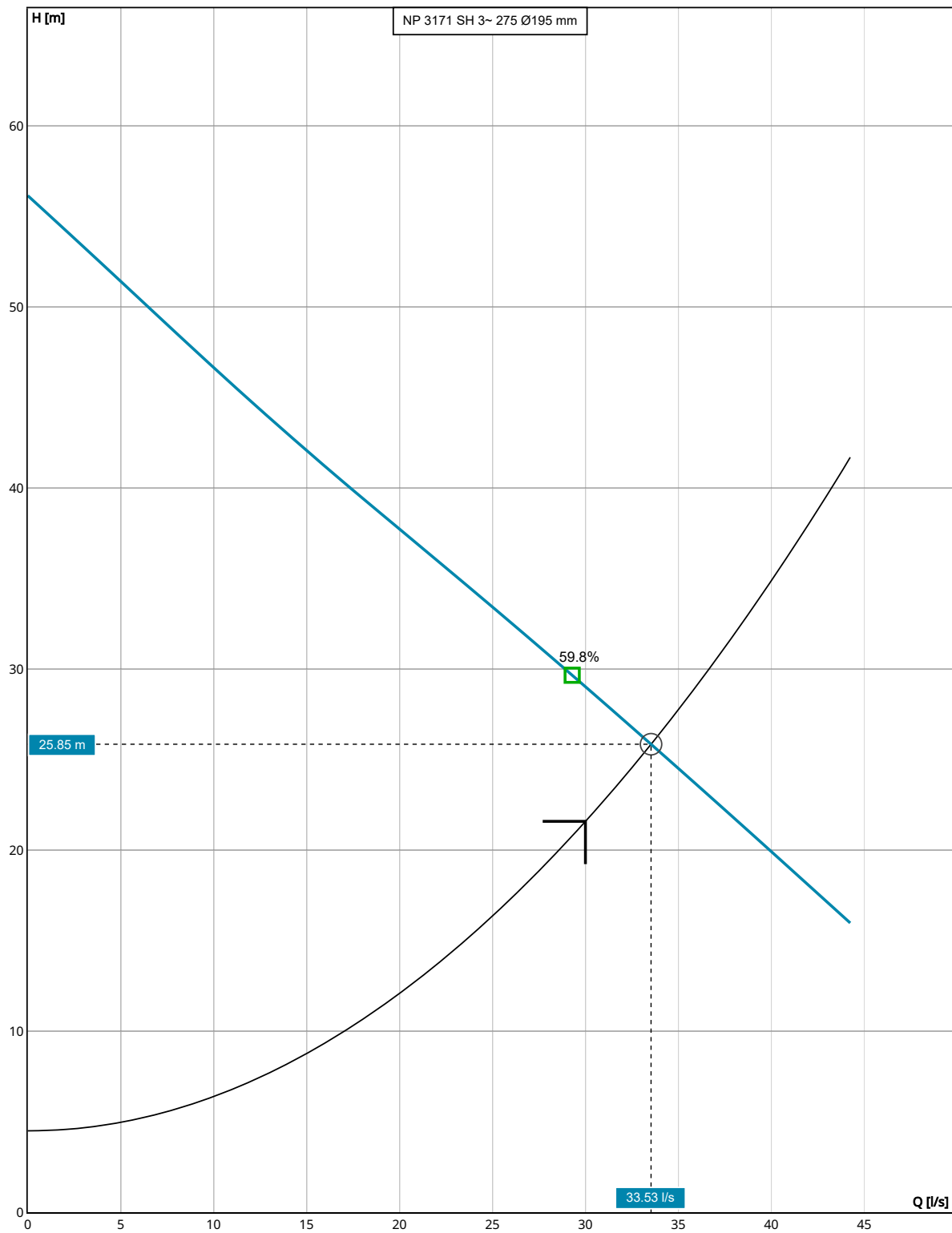
Fluid and Operating Conditions

Fluid Type	Density
Water	1,000 kg/m ³
Fluid Temperature	Dynamic Viscosity
4 °C	0.002 Pa·s
Specific Gravity	Fluid Vapor Pressure
1	8.14 mbar
	Atmospheric Pressure
	1,013.53 mbar
	Elevation
	0 m
	Ambient Temperature
	20 °C
	NPSH Available
	10.27 m
	Submergence
	0 m

Design Curve

Rated Speed	BEP Flow
50 Hz	29.29 l/s
Max Flow	BEP Head
44.24 l/s	29.66 m
H@QMin	Max P2
56.15 m	14.44 kW
H@QMax	Specific Energy
15.98 m	0.13 kWh/m ³
BEP	
59.81 %	

NP 3171 SH 3~ 275 | Duty Analysis

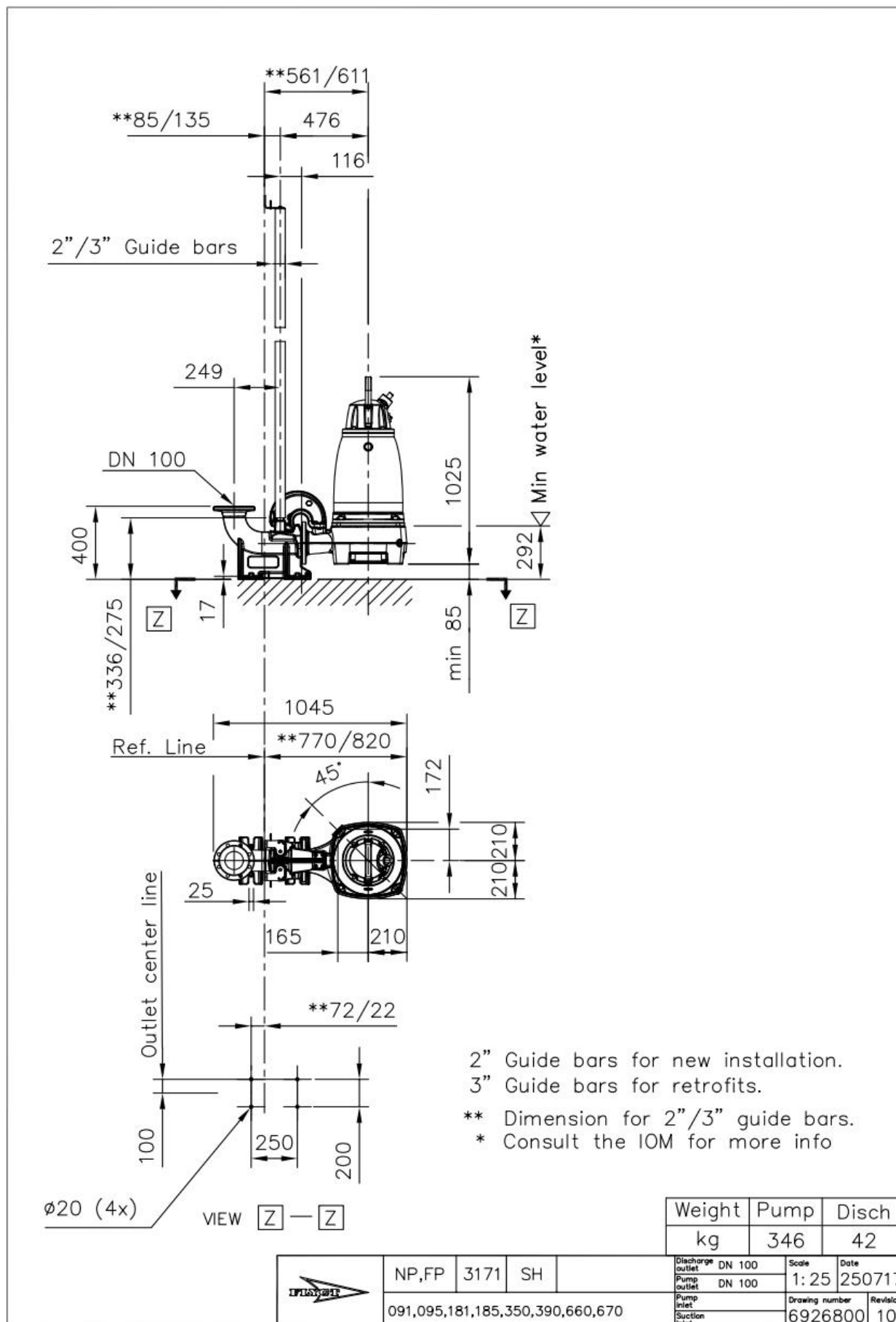


Curve: ISO 9906

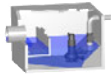
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

Name	Q (1x) [l/s]	H (1x) [m]	P2 (1x) [kW]	Q [l/s]	H [m]	P2 [kW]	η_p [%]	SE [kWh/m ³]	NPSHr [m]
DP @ 1x	33.53	25.85	14.42	33.53	25.85	14.42	58.98	0.13	6.09

NP 3171 SH 3~ 275 | Dimensional Data & Drawing



NP 3171 SH 3~ 275 | Headloss Calculation



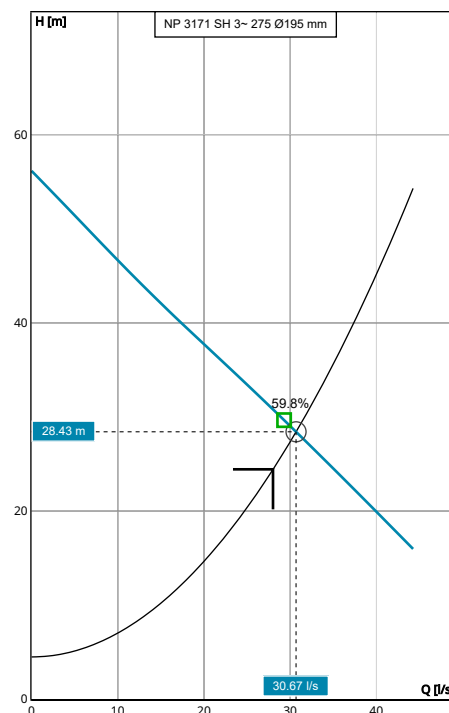
Fluid Type	Water	Total Flow	30 l/s	Kinematic Viscosity	0.000002 m ² /s
Static Head	4.5 m	Operating Pumps	1	System Type	Single Pump
Layout	Wet Installed Submersible Pumps	Calculation Model	Colebrook-White		

Type	Pipe Inner Diameter [mm]	Length / K Factor	Quantity	Velocity [m/s]	Pipe Roughness [mm]	Headloss [m]
Individual Discharge Piping / Pipe 1 / Stainless steel / PN 10 / DN 150 (159x4.0 mm) / New Pipes						
Pipe Length	151 mm	15 m	1	1.68 m/s	0.5 mm	0.39 m
90 Elbow	151 mm	0.3	1	1.68 m/s		0.04 m
Tee Line →  →	151 mm	0.1	1	1.68 m/s		0.01 m
Check Valve	151 mm	0.9	1	1.68 m/s		0.13 m
Gate Valve	151 mm	0.2	1	1.68 m/s		0.03 m
Total Head						0.61 m
Individual Discharge Piping / Pipe 2 / PE100 (HDPE) PE 4710 / SDR 11 (PN 16) / DN 200 (250x22.7 mm) / New Pipes						
Pipe Length	204.6 mm	3,060 m	1	0.91 m/s	0.5 mm	16.49 m
Total Head						16.49 m
Friction Loss Head						17.09 m
Static Head						4.5 m
Total Head						21.59 m

NP 3171 SH 3~ 275 | Configuration Summary



Flygt's self-cleaning non-clog N-pumps feature innovative designs and functions that deliver high sustained efficiency and the most reliable operation. This makes them the most reliable choice available for a broad range of wastewater applications for tough applications such as unscreened sewage, wastewater and sludge up to an 8 percent solids concentration. Impeller material available in Hardened cast Iron, Hard Iron and Stainless Steel to fit any wastewater application.



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

GENERAL

Explosion Proof	Impeller Diameter
No	195 mm
Max. Pumped Media Temp.	
40 °C	

MATERIAL AND COATING

Impeller Material
Hard-Iron
Volute Material
Grey Cast Iron

MOTOR

Rated Voltage	Motor Efficiency Class
400 V	Standard
Coupling	Rated Power
Y	22 kW

INSTALLATION

Installation Type
P - Semi-Permanent, Wet

NP 3171 SH 3~ 275 | Product Details

Description

N 3171

The Flygt N-series are equipped with the Flygt invented N-technology with its innovative self-cleaning impeller. Solid objects entering the pump will pass through the impeller between the impeller vanes. If an object gets caught on the leading edge of one of the vanes, it will slide along the backswept shape towards the perimeter of the inlet where it will be guided by a relief groove through the pump housing. This ensures a high sustained total efficiency over time. Due to the mechanical self-cleaning design, a sludge concentration of solids up to 8% can easily be pumped. The pump can easily be installed in either permanently or temporary submerged, or horizontally or vertically dry installations.

Flexible and Modular Design

The modular hydraulic design enables customization of the hydraulics to meet the requirements of many applications.

- Replaceable wear ring in two materials, gray iron or Hard Iron, for different operation conditions
- Hardened gray iron impeller for typical wastewater applications
- Hard-Iron impeller for heavy duty wastewater applications containing abrasive and corrosive content
- Chopper ring intended for tough wastewater applications where cutting is required due to long fibres and solid concentrations up to 10-12%
- Stainless steel impeller for special applications that require duplex stainless steel

Robust and Reliable

- Short shaft overhang reduces shaft deflection and increases seal and bearing life
- Class H Motor designed for submersible use. Heat is concentrated to the stator core for improved cooling properties.
- The Plug-in seal with Active Seal system eliminates the risk associated with incorrect installation and careless handling. All in one unit. Available in Tungsten carbide (WCCR) or Silicone carbide (SiC) depending on pumped media.
- Motor cable SUBCAB® specially developed for submersible use
- Offers flexible cooling systems, e.g. closed-loop cooling system, media cooled or external cooling that allows full motor potential in dry installations.
- Premium brand bearings, greased for life, ensures a minimum of 50 000 hours of duty
- Leakage sensor and motor temperature sensor as standard

The N 3171 is available with the following options:

- ATEX, FM, CSA-approvals
- Premium efficiency motors
- Hard Iron hydraulic design
- Stainless Steel hydraulic design
- Vibration-sensor, extended motor temperature sensors, additional leakage-sensor, current-sensor and pump memory
- Compatible with SmartRun® Wastewater pump controller
- Compatible with MAS 801 monitoring system

Product Features

- State-of-the-art wastewater pump with N-technology
- Sustained high efficiency pumping with energy savings up to 25%
- Flexible and modular design
- Robust and reliable

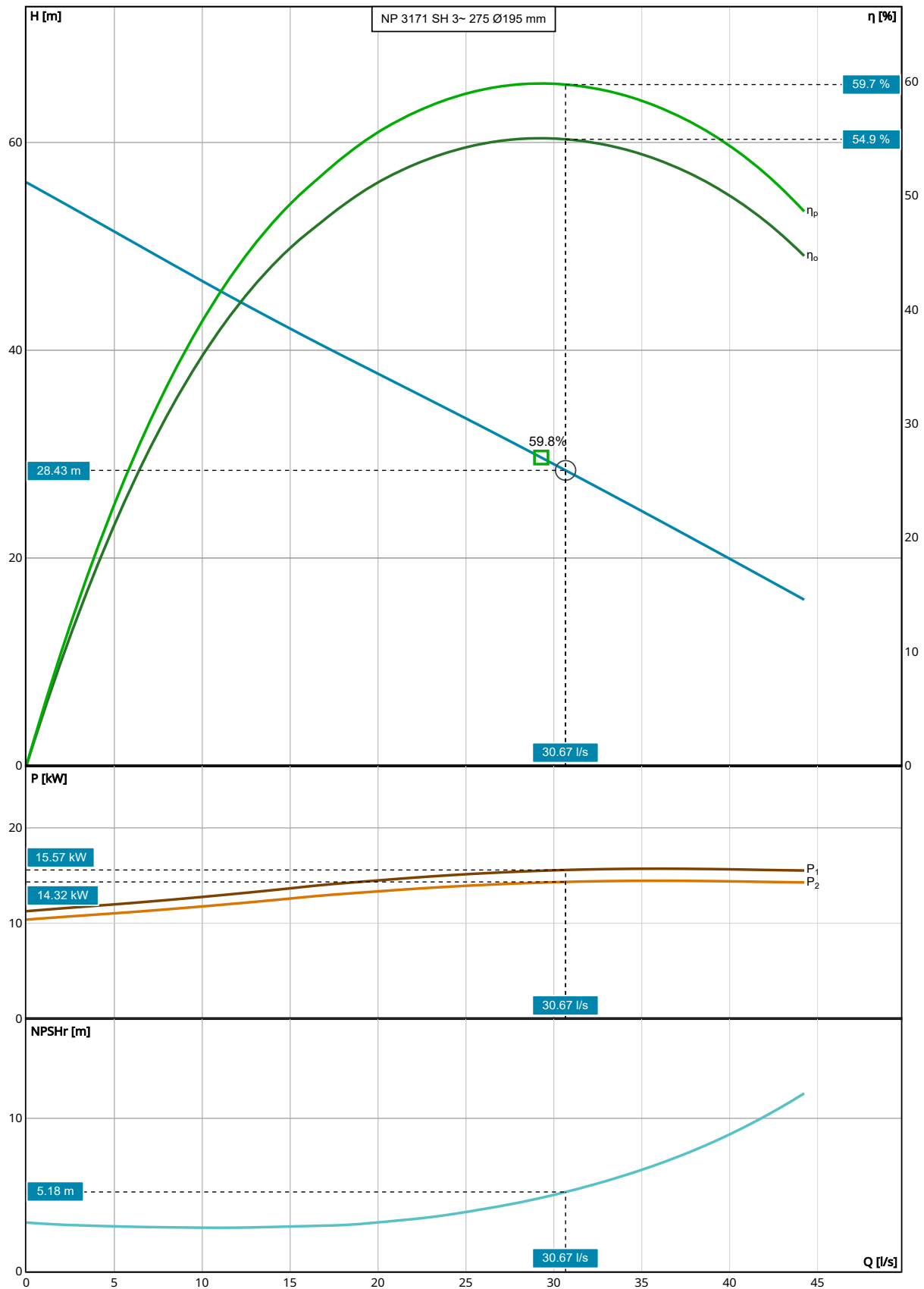
Construction Materials

Impeller Material	Volute Material	Stator Cover Material
Hard-Iron	Grey Cast Iron	-

Motor

Rated Power	Number Of Phases	Start Current Ratio	Motor Issue
22 kW	3	7.36	11
Motor Denomination	Rated Motor Speed	Insulation Class	Locked Rotor Code
25-18-2AA	2,925 RPM	H	H
Motor Efficiency Class	Rated Voltage	Approval	Max starts per hour
Standard	400 V	STD	30
Version Code	Rated Current	Total moment of inertia	Power Factor 100%
185	38 A	0.07 kgm ²	0.92
Frequency	Start Current	Type of duty	Power Factor 75%
50 Hz	280 A	S1	0.9
Max P2 (1x)	Starting Current, Direct Starting	Stator Variant	Power Factor 50%
14.44 kW	280 A	2	0.84
Number Of Poles	Starting Current, Star Delta	Motor Module	Efficiency 100%
2	93.33 A	111	90.3 %
			Efficiency 75%
			91.6 %
			Efficiency 50%
			92.2 %
			Cooling Jacket
			-

NP 3171 SH 3~ 275 | Hydraulic Data & Performance Curve



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

Selection

Series	Curve Code
N 3000	275
Name	Impeller Diameter
NP 3171 SH 3~ 275	195 mm
Frequency	Inlet Diameter
50 Hz	150 mm
Total Flow	Outlet Diameter
28 l/s	100 mm
Total Head	Number Of Vanes
24.44 m	2
Pump Flow	
28 l/s	
Pump Head	
24.44 m	
System Type	
Single Pump	
Operating Pumps	
1	
Standby Pumps	
No Standby Pump	

Design Point

Flow	Shaft power (P2)
30.67 l/s	14.32 kW
Head	NPSHR
28.43 m	5.18 m
Overall Efficiency (η_o)	Speed
54.92 %	2,953 RPM
Pump Efficiency (η_p)	Static Head
59.72 %	4.5 m
Input Power (P1)	Flow To BEP Ratio
15.57 kW	104.73 %

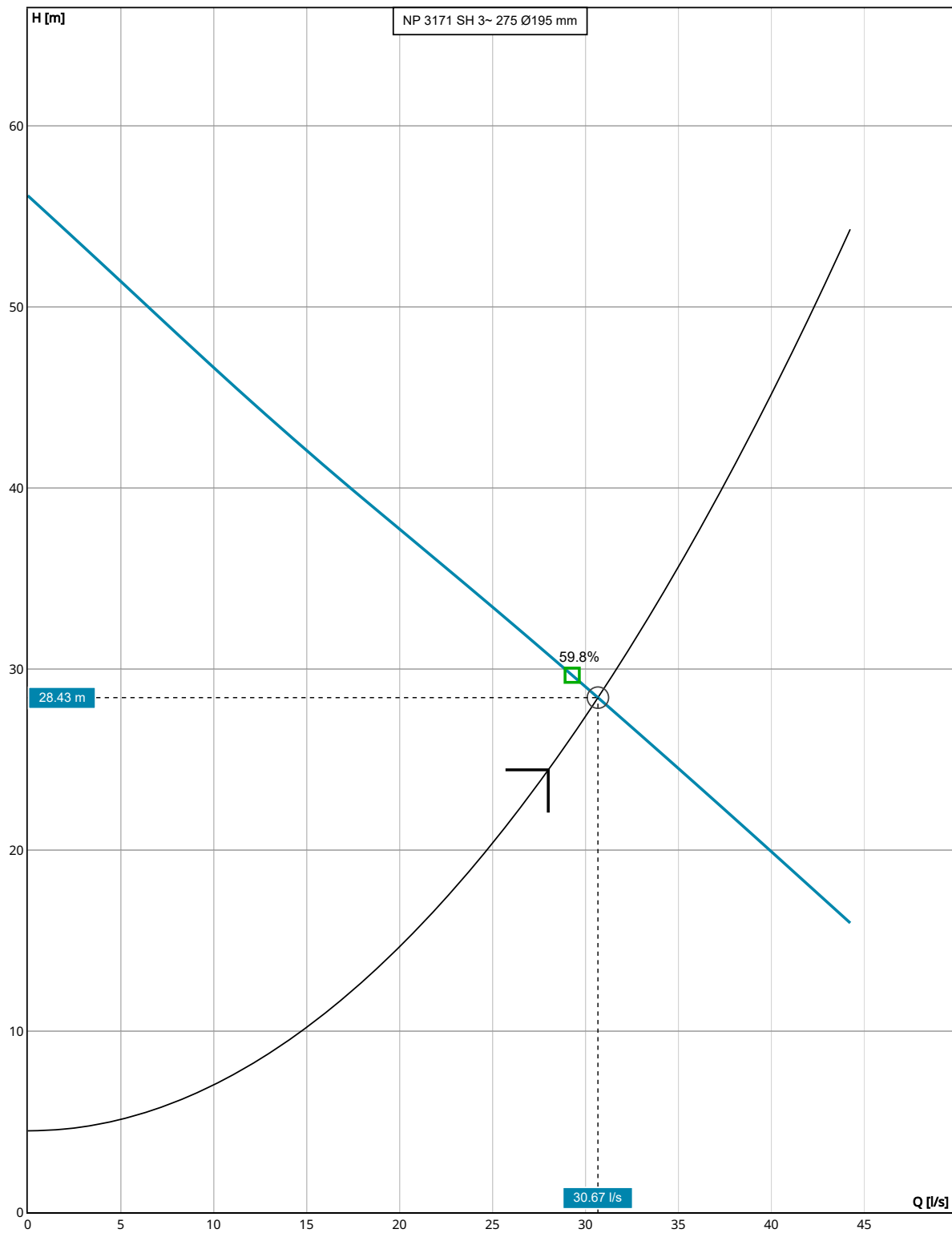
Fluid and Operating Conditions

Fluid Type	Density
Water	1,000 kg/m ³
Fluid Temperature	Dynamic Viscosity
4 °C	0.002 Pa·s
Specific Gravity	Fluid Vapor Pressure
1	8.14 mbar
	Atmospheric Pressure
	1,013.53 mbar
	Elevation
	0 m
	Ambient Temperature
	20 °C
	NPSH Available
	10.27 m
	Submergence
	0 m

Design Curve

Rated Speed	BEP Flow
50 Hz	29.29 l/s
Max Flow	BEP Head
44.24 l/s	29.66 m
H@QMin	Max P2
56.15 m	14.44 kW
H@QMax	Specific Energy
15.98 m	0.14 kWh/m ³
BEP	
59.81 %	

NP 3171 SH 3~ 275 | Duty Analysis

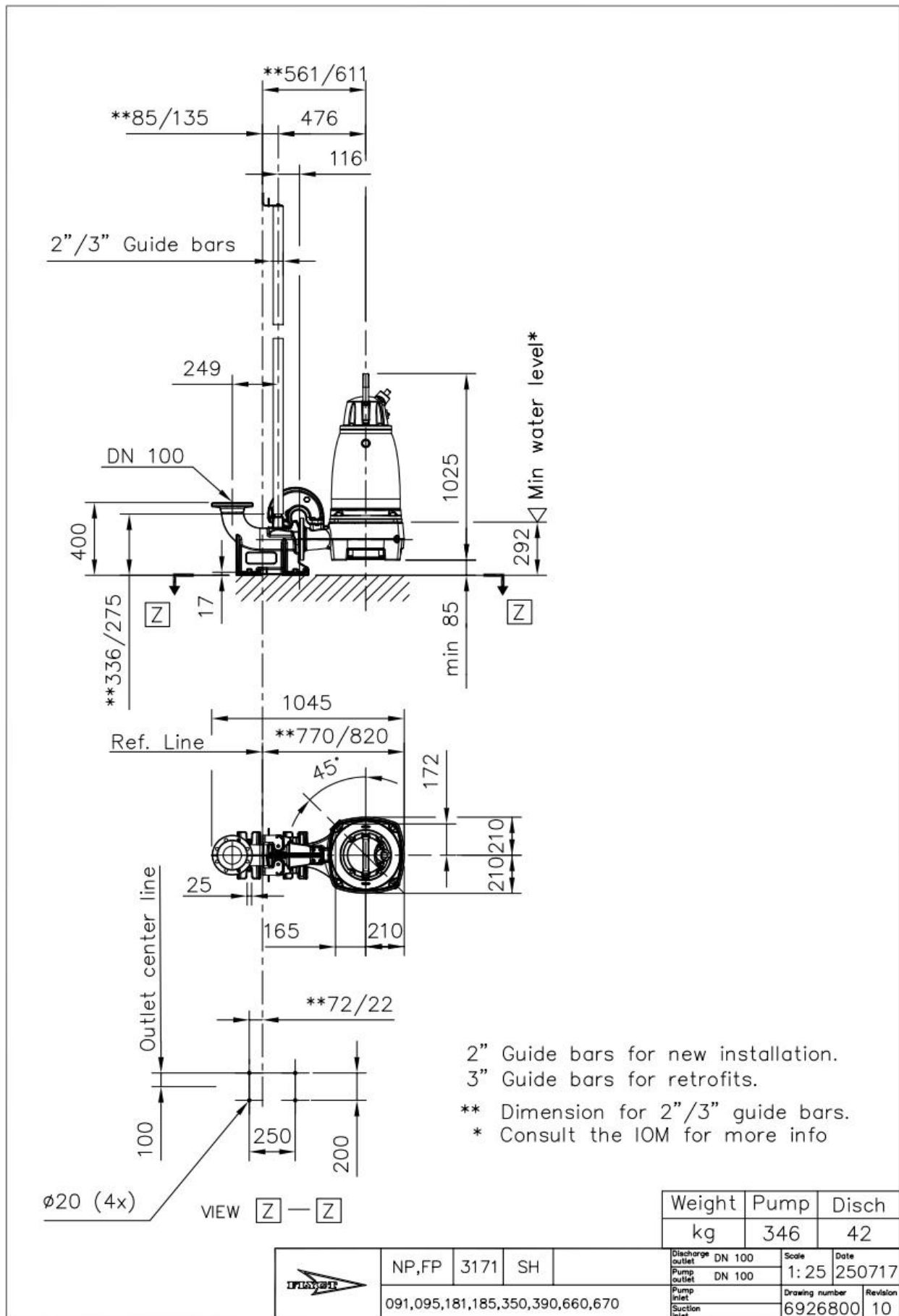


Curve: ISO 9906

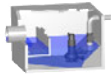
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

Name	Q (1x) [l/s]	H (1x) [m]	P2 (1x) [kW]	Q [l/s]	H [m]	P2 [kW]	η_p [%]	SE [kWh/m ³]	NPSHr [m]
DP @ 1x	30.67	28.43	14.32	30.67	28.43	14.32	59.72	0.14	5.18

NP 3171 SH 3~ 275 | Dimensional Data & Drawing



NP 3171 SH 3~ 275 | Headloss Calculation



Fluid Type	Total Flow	Kinematic Viscosity
Water	28 l/s	0.000002 m ² /s
Static Head	Operating Pumps	System Type
4.5 m	1	Single Pump
Layout	Calculation Model	
Wet Installed Submersible Pumps	Colebrook-White	

Type	Pipe Inner Diameter [mm]	Length / K Factor	Quantity	Velocity [m/s]	Pipe Roughness [mm]	Headloss [m]
Individual Discharge Piping / Pipe 1 / Stainless steel / PN 10 / DN 150 (159x4.0 mm) / New Pipes						
Pipe Length	151 mm	15 m	1	1.68 m/s	1.5 mm	0.47 m
90 Elbow	151 mm	0.3	1	1.68 m/s		0.04 m
Tee Line →  →	151 mm	0.1	1	1.68 m/s		0.01 m
Check Valve	151 mm	0.9	1	1.68 m/s		0.11 m
Gate Valve	151 mm	0.2	1	1.68 m/s		0.02 m
Total Head						0.66 m
Individual Discharge Piping / Pipe 2 / PE100 (HDPE) PE 4710 / SDR 11 (PN 16) / DN 200 (250x22.7 mm) / New Pipes						
Pipe Length	204.6 mm	3,060 m	1	0.91 m/s	1.5 mm	19.28 m
Total Head						19.28 m
Friction Loss Head						19.94 m
Static Head						4.5 m
Total Head						24.44 m

MCBERNS

INNOVATIVE SOLUTIONS

WELL WASHERS



Why choose a McBerns Well Washer?

- Eliminates fat & grease build up on infrastructure & Walls
- No power required
- Operates with mains pressure water
- Uses less than 100 lts water per/day
- Cleaner level sensor probes
- Reduces overflows caused by fogs
- Reduces odour
- Reduces confined space entries
- Reduces infrastructure corrosion
- Reduces maintenance
- Improved safety at pump stations
- Reduces customer complaints
- Healthier environment
- Optional pre-programmed with 5 cleaning cycle durations

McBerns Well Washers

The Well Washer has been in the Australasian marketplace for 25 years and is still the preferred method in keeping pump stations fat free. The AutoWellWasher™ will reduce maintenance in wet wells and tanks that accumulate fats, oils and greases (FOGs). Our design uses town water or recycled treated effluent at mains pressure to keep pump stations clean.

It can be installed using existing telemetry or with our pre-programmed timing device that activates towards the end of the pump out cycle.

Installing a wellwasher will eliminate large fatty build-up in pump stations, this then reduces blockages in pumps

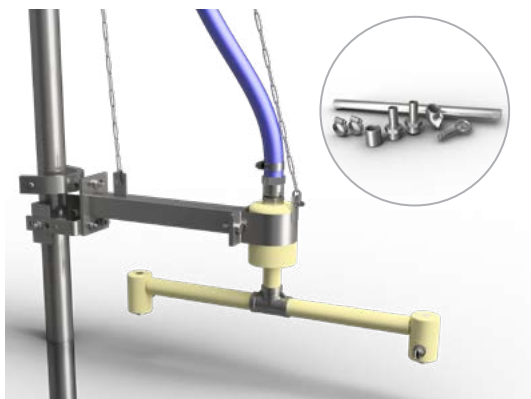
and downstream sewers. The level sensors remain clean so the pumps work more efficiently, reducing the risk of overflows due to FOG build-up. It has also been shown to significantly reduce sulphide corrosion on concrete walls, pumps and other internal infrastructure components. There are fewer confined space entries required, only when essential maintenance tasks are needed.

The Well Washer is wholly designed and manufactured in Australia and has Australian, United States & International Patents.

'The total water usage for a single washer is as little as 100 litres per day.'

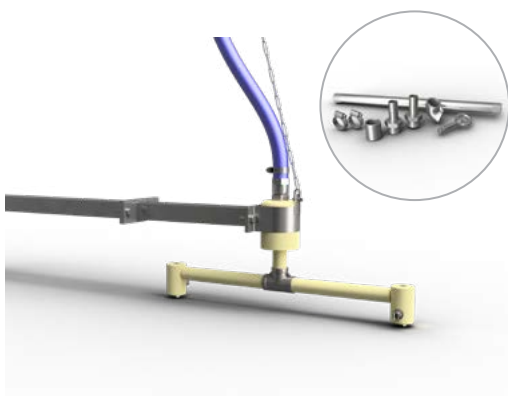
The principle behind the design is simple:
The Well Washer cleans the fat and grease away before it solidifies.





Well Washer Kit Guide Rail Mount

Part Number:	WWKITGRMOUNT
Description:	Kit includes washer, brackets and install hose & fittings
Application:	Eliminates fat & grease build up on infrastructure and walls
Material / Finish:	Austlon, 316 S/S
Dimensions:	Taking the infrastructure into account we can design to specific requirements
Weight:	6 kg
General Specifications:	40/60 PSI, 30 l/min, 5-6m (Diameter)



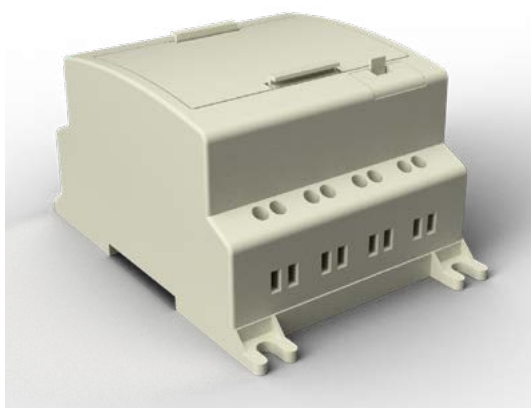
Well Washer Kit Wall Mount

Part Number:	WWKITWALLMOUNT
Description:	Kit includes washer, brackets and install hose & fittings
Application:	Eliminates fat & grease build up on infrastructure and walls
Material / Finish:	Austlon, 316 S/S
Dimensions:	600mm to 900mm Diameter
Weight:	6 kg
General Specifications:	40/60 PSI, 30 l/min, 5-6m (Diameter)



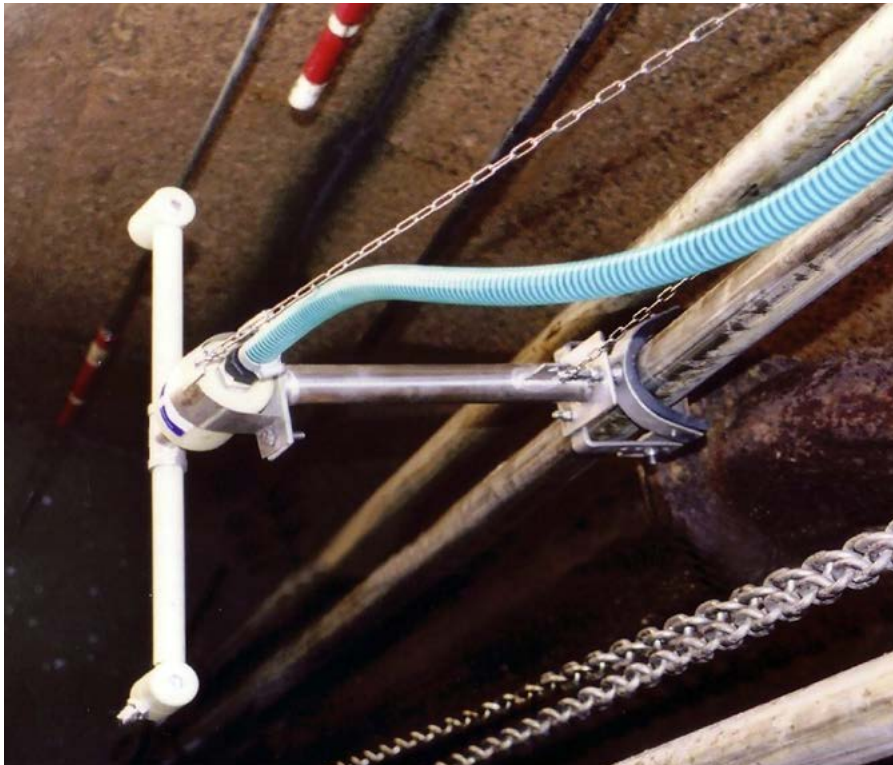
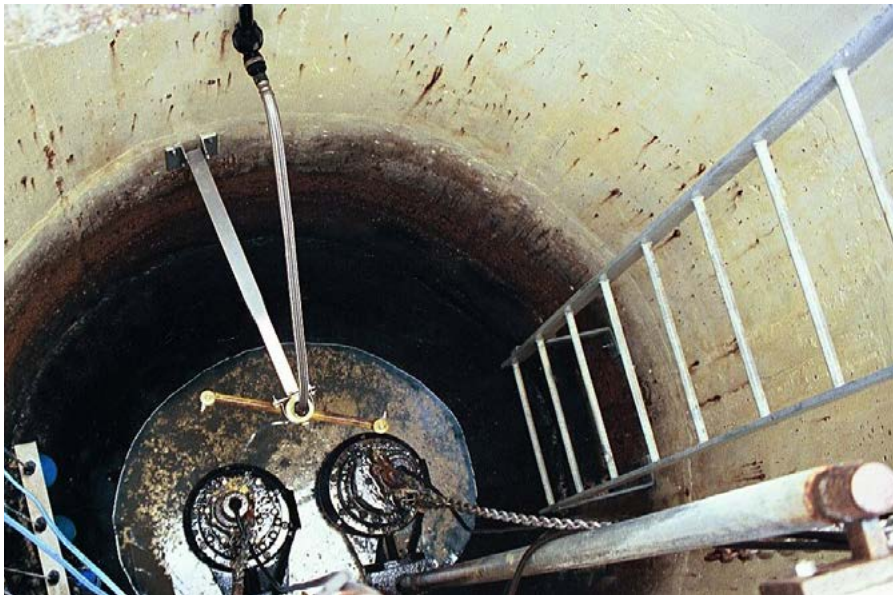
Optional Solenoid Valve

Part Number:	WWSOLENROID
Description:	Optional Solenoid Valves for water supply
Application:	Once energised allows water to flow to wellwasher
Material / Finish:	Glass reinforced nylon
Dimensions:	600mm to 900mm Diameter
Weight:	500 g
General Specifications:	Continuous operation 100% ED c/w LED connector plug IP65



Optional Pre-Programmed Allen-Bradley Micro810 Smart Relay

Part Number:	WWTIMER
Description:	Pre programmed with 5 cleaning cycle durations
Application:	Water Conservation, Minimise manual control
Material / Finish:	PVC
Dimensions:	600mm to 900mm Diameter
Weight:	500 g
General Specifications:	Less than 100 L daily



MCBERNS

INNOVATIVE SOLUTIONS

ODOUR MANAGEMENT
SAFETY ACCESS COVERS
DESIGN & FABRICATION
DATA ANALYTICS

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www.mcbarns.com



Aquate Commercial Pump Station

Technical Guide WW 10

Aquate Pump Stations are ideal for civil infrastructure applications where sewage or stormwater needs to be discharged into a reticulation network or wastewater treatment plant.



06.22 | WASTEWATER | WW10 AQUATE COMMERCIAL PUMP STATIONS

Applications

From residential subdivisions, schools, factories and commercial developments to stormwater networks, our complete range of pump stations is the solution for any sewer, stormwater or trade waste application.

Approvals/Standards

Concrete components designed and manufactured to AS/NZS 4058:2007
Precast Concrete Pipes

AS/NZS 1546:1 2008 – tank certification

AS/NZS3000 – electrical controller

AS/NZS 3500.2:2021 Sanitary plumbing and drainage

Built under ISO9001:2008 QA System

We are the supply partner of choice for New Zealand's civil construction industry, specialising in water and infrastructure based solutions.

Aquate Pump Stations are ideal for civil infrastructure applications where conventional gravity systems are impractical or not cost effective.

Introduction

Hynds offers a wide range of high performance and durable Aquate packaged pump stations. These systems include chambers, pumps, level controls, control equipment, piping and valves etc. Aquate Pump stations are manufactured in Hynds Precast Factories and available in either concrete or polyethylene.

Our dedicated design team at Aquate provide a complete design and specification for consulting engineers and contractors. No matter what challenges your project presents, Aquate's expert engineers will work with you step by step to custom design the perfect pump station solution. Safety in design, environmental risk mitigation and ease of maintenance for servicing is always front of mind.

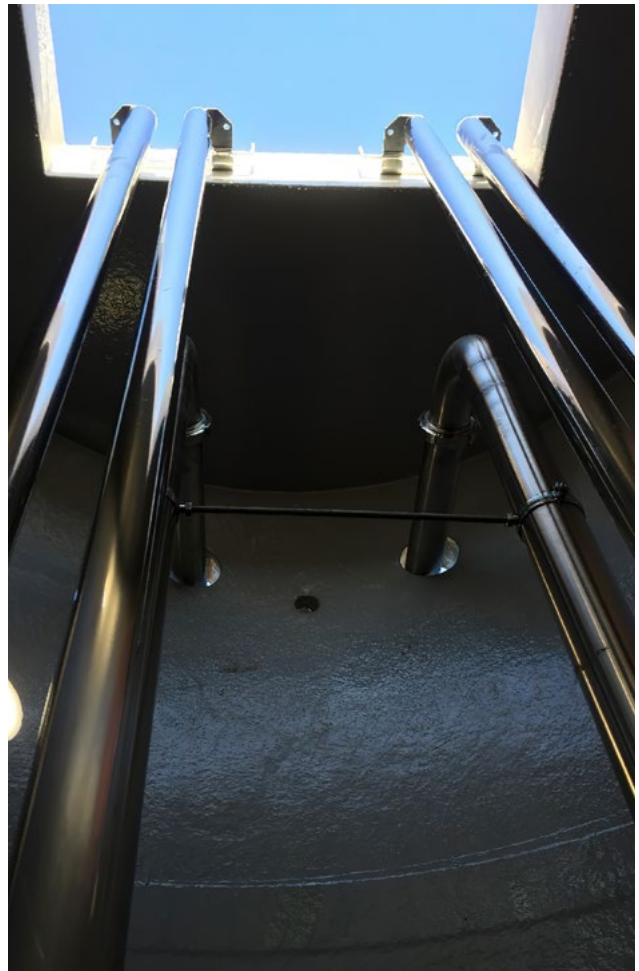
Hynds' dedicated Project Manager oversees the entire pump station project, including supply, on site installation, commissioning and quality assurance. Together with Aquate's world standard design service, the whole process from design through to installation is seamless.

Residential Aquate Pump Systems are also available for domestic applications.

See our website for more information: www.hynds.co.nz/product/aquate-residential-pump-station/

Features & Benefits

1. Flexible design: Aquate Pump Stations are designed to provide the required on-site storage and optimal pump performance.
2. Easy installation: The systems are prefabricated in the factory providing easy installation on site.
3. High quality pumps: Brands include Flygt, Grundfos, Domo and Zenit. Pumps are designed to meet the site specific requirements.



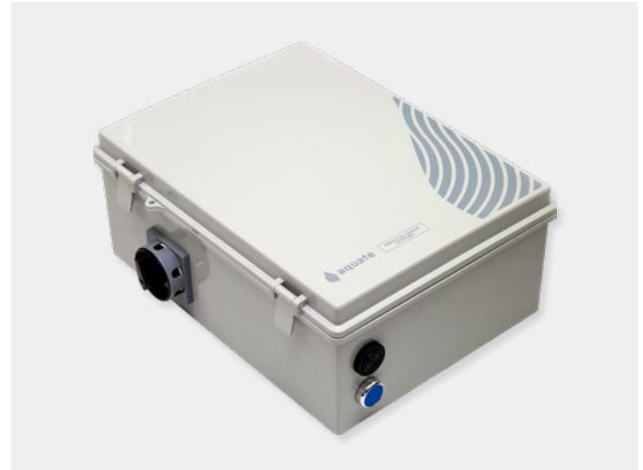
Technical data

Aquate Model No.	AQ1200	AQ1500	AQ1800	AQ2050	AQ2500	AQ3000
Internal diameter (mm)	1200	1500	1800	2020	2550	3000
Max chamber depth (m)	4.8	4.8	6.0	6.0	8.0	10.0
Min. riser sections (mm)	300	300	300	300	300	300
Valve chamber diameter (m)	1.2	1.2	1.5	1.5	1.8	1.8
Min volume wet-well (L)	2000	3500	5000	7000	10000	17000
Volume per additional metre depth (L)	1130	1760	2550	3100	5100	7050
Maximum pipework size (mm)	100	150	200	250	300	300

Control Panel

Hynds Aquate Pump Stations come complete with an electrical controller. This can be located on the pump chamber or installed at a nearby building. Features include:

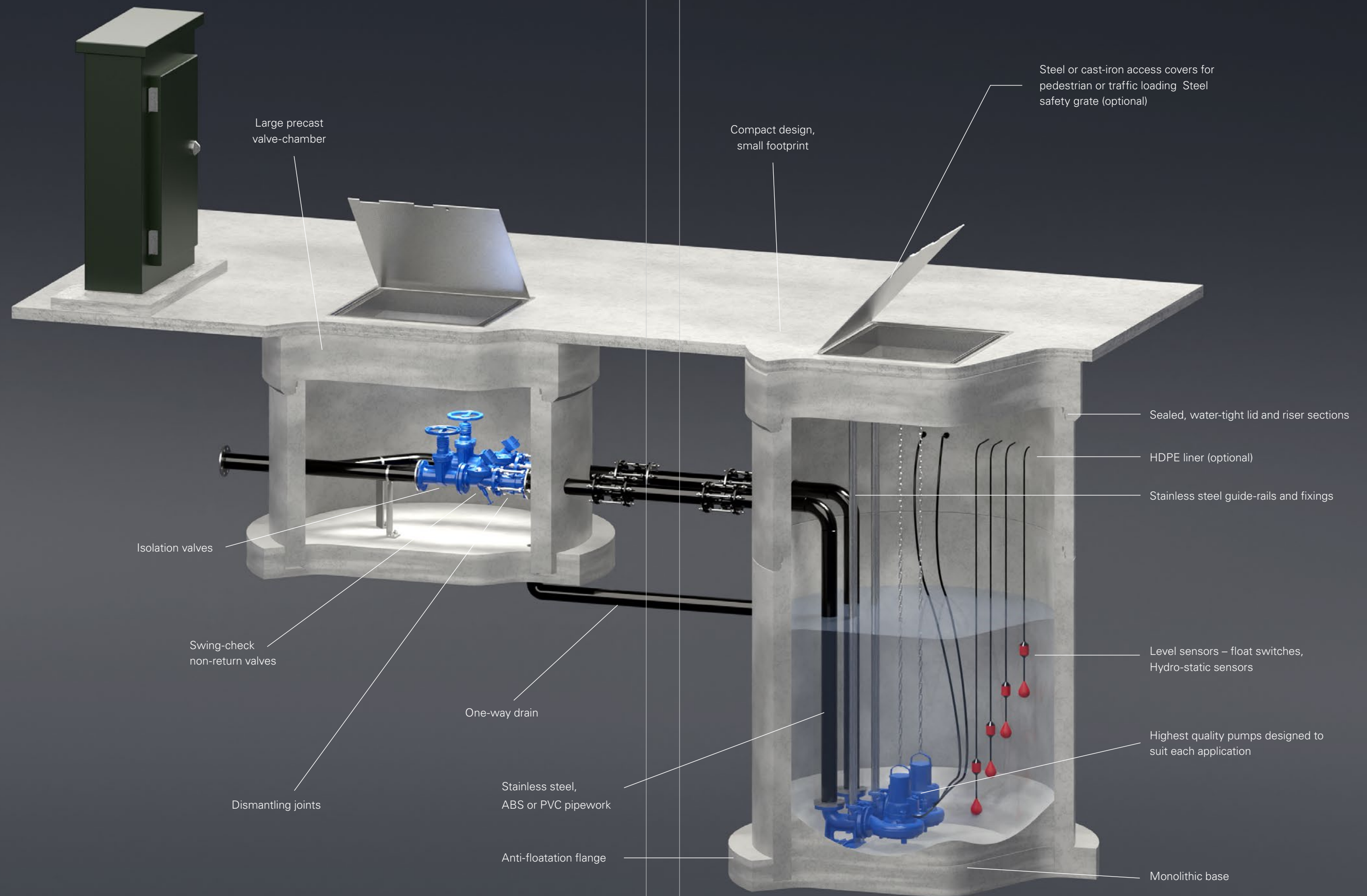
- Single or three phase option
- Simplex or duplex pump operation
- Lockable IP 65 rated enclosure
- Visual and audible pump failure alarm system
- High level alarm
- Over pressure protection
- Pump motor protection against variable electricity supply
- Performance data recorded



Options

- Web Based monitoring
- Float switches, hydrostatic transducers or ultrasonic level sensors
- Steel cabinets
- Hour run and start count
- Integration into a SCADA System
- Mag Flow Metres
- Alarm telemetry (SMS alarms), radio transmission, or outputs to BMS





Options cont...

- Flow Meters to monitor usage
- Auto well-washer for automatic station cleaning
- Odour filters
- Internal linings to prevent corrosion
- Lifting arm socket to simplify maintenance procedures
- Storage tank for emergency storage

Back up and support

Hynds has service agents throughout New Zealand. In the unlikely event of an alarm activation there is typically sufficient storage in the tank for 24 hours of normal operation. In the event of an alarm, either Hynds or the Local Council's Utility Services Team can provide onsite service.

Design Assistance

A dedicated Aquate Design Team will assist engineers design the ultimate pump station for their project.

The following information will need to be considered to complete the full design:

- Expected daily wastewater volumes
- Emergency storage requirements
- Private or Council owned
- Static lift of rising main
- Length of rising main
- Special requirements for the controller (see options available)
- Depth of inlet pipes
- Pedestrian or traffic loading

Based on the information provided, Aquate will supply a design and specification including :

- Size of wet-well required
- Emergency storage tank if required
- Pump model and design
- Rising main sizing
- GA drawings of the pump station and valve chamber

Contact

Contact our Project Manager to discuss your project

E: [REDACTED]

M: [REDACTED]



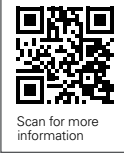


Branches Nationwide *Support Office & Technical Services* 0800 93 7473

Disclaimer: While every effort has been made to ensure that the information in this document is correct and accurate, users of Hynds product or information within this document must make their own assessment of suitability for their particular application. Product dimensions are nominal only, and should be verified if critical to a particular installation. No warranty is either expressed, implied, or statutory made by Hynds unless expressly stated in any sale and purchase agreement entered into between Hynds and the user.

hyndswastewater.co.nz
0800 425 433





Hynds Retention Tank with Mul-T-Level™ Outlet

Technical Guide D5.15

Hynds strong and reliable retention tanks are available in Ring Joint Pipe Internal Base or Flange Base manhole types.



03.15 | DRAINAGE | D5.15 HYND'S RETENTION TANK

Applications

Stormwater retention & detention

Sewer storage

Product Attributes

Versatile Mul-T-Level™ outlet

Highly durable

Simple installation

Various design layouts and large capacity options available

Water tight

Proven history

Approvals/Standards

AS/NZS 4058:2007 Precast concrete pipes (pressure and non-pressure)

Quality

ISO 9001:2008 Quality Management

*The go to organisation for civil
and rural water product solutions*

HYNDS

Hynds strong and reliable retention tanks are available in Ring Joint Pipe, Internal Base or Flange Base Manhole types.

Design Specifications and Applications

RJ Retention Tank

- Generally used when the location permits the installation of a long narrow tank.
- Comprised of Hyspec reinforced concrete rubber ring joint pipes.
- Usually includes a spigot-plugged pipe, standard intermediate pipes and a collar-plugged pipe.
- The spigot and collar plugs are factory cast to ensure water tightness and integrity.
- A manhole offtake is factory fitted to one or more pipes to provide easy access for maintenance.

IB or FB Retention Tank

- Generally used in compact site conditions where relatively small volumes is required.
- Comprised of Hynds internal base or flange base manhole risers and a precast concrete lid.

Mul-T-Level™ outlet

- Enables the tank to be used for both detention and retention.
- Both the RJ and IB/FB retention tanks have a standard 100 or 150mm diameter PVC slip coupler and Mul-T-Level™ outlet cast-in or fitted during manufacturing.
- The required retention/detention volume is set by an orifice hole (of specified diameter) being drilled on the Mul-T-Level™ outlet at a pre-determined height.

General Specifications

- Manufactured from Hyspec spun concrete pipes, using the centrifugal spinning process.
- When the tank is installed in an aggressive environment, such as tidal areas, sewerage or mild acid solutions, the use of a special grade concrete is recommended. Contact Hynds Technical Team for more information.
- Retention tanks are available in various class types to suit specific site conditions, loading and applications.
- The diameter and length of the retention tank is dependent on:
 - Storage volume required
 - Site configuration and access equipment available
- Inspection and maintenance access is provided by a fitted inspection chamber or manhole riser starter.
- PVC slip couplers are fitted to end plugs to provide inlet and outlet connections to the retention tank.
- Non-standard couplers or starter types can be cast-in on request.
- Orifice holes are drilled at levels to suit the design requirements.
- Standard lids are available for access risers in the RJ type tanks.
- A light or heavy duty cast iron cover and frame will fit directly onto the 600mm diameter access riser.
- The 1050 mm diameter access riser requires a 1050 mm diameter manhole lid, which can be fitted with the cast iron manhole frame and cover.
- The IB or FB tanks require a lid, which can be fitted with a cast iron frame and cover to suit the riser diameter.
 - Note: Lid thickness is dependent on loads and application
 - Refer to Table 1 for RJ tank capacities and Tables 2 and 3 for IB/FB tank capacities.

TABLE 1 RJ type retention tank

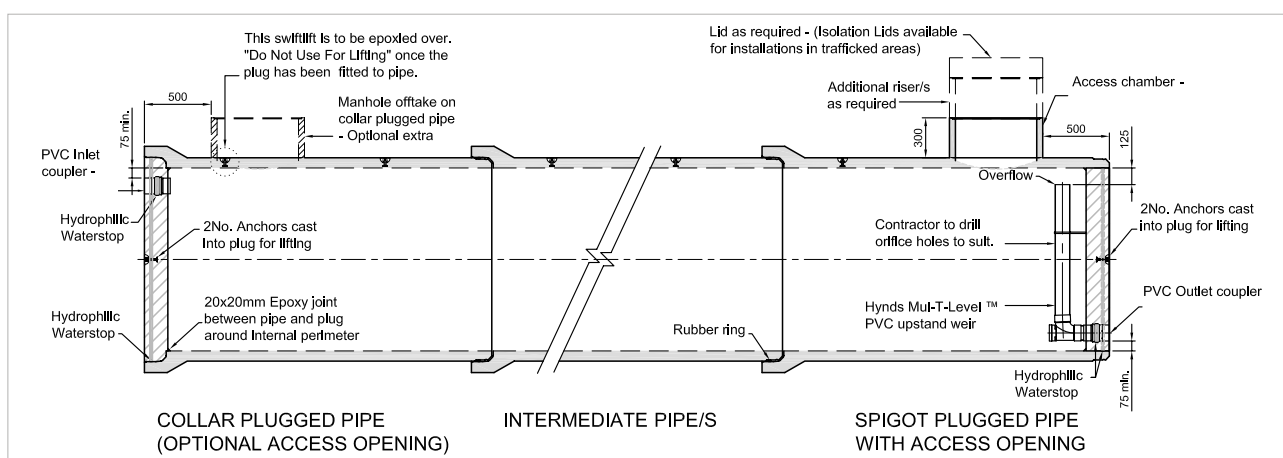
Nom Pipe Diameter and Joint Type	Pipe Effective Length (m)	Nom Vol per Pipe Length (m ³)	Nom Vol per Pipe Length (Litres)	Suggested Offtake Dia (mm)	Lifting plugged pipe anchor req.	Handling intermediate pipe anchor req.
675RJ	2.440	0.72	720	600	A1	A2
750RJ	2.440	0.92	920	600	A1	A2
825RJ	2.436	1.14	1140	600	A1	A2
900RJ	2.448	1.38	1380	600	A1	A2
975RJ	2.440	1.67	1670	600	B1	B2
1050RJ	2.440	1.94	1940	600	B1	B2
1200RJ	2.440	2.58	2580	600	B1	B2
1350RJ	2.454	3.31	3310	600/1050	B1	B2
1600RJ	2.440	4.51	4510	1050	C1	B2*
1800RJ	2.438	6.13	6130	1050	C1	C2
1950SRJ	2.440	7.05	7050	1050	C1	C2
2100SRJ	2.397	8.02	8020	1050	C1	C2
2300SRJ	2.735	11.01	11010	1050	C1	C2
2550SRJ	2.470	12.18	12180	1050	C1	C2

Key

- **A1** 1 Tonne
2 no. in plug
1 no. in pipe
- **A2** 1 Tonne
2 no. in pipe
- **B1** 2.5 Tonne
2 no. in plug
1 no. in pipe
- **B2** 2.5 Tonne
2 no. in pipe
- **C1** 5 Tonne
2 no. in plug
1 no. in pipe
- **C2** 5 Tonne
1 no. in pipe

Notes:

- All dimensions refer to Class 2 (X) pipes
- Outlet 75 mm minimum above bottom invert of pipe
- Overflow 125mm below top
- *1600 Ø retention tanks require both B2 & C1 type lifting clutches for offloading and installation
- See Fig 6 for 3 point lift on typical plugged end pipe

**FIG. 1** General layout of typical RJ type retention tank with Mul-T-Level™ outlet

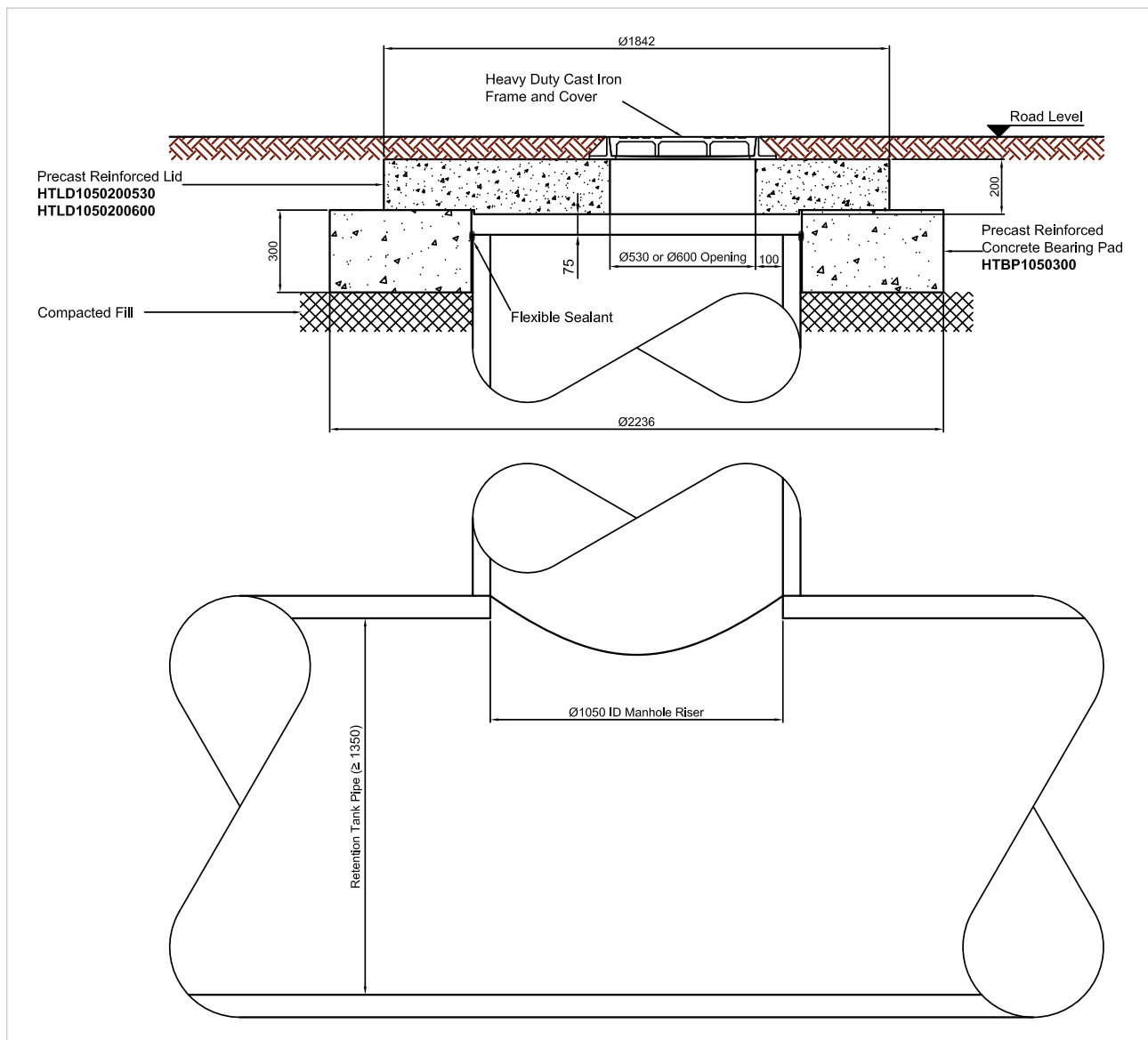
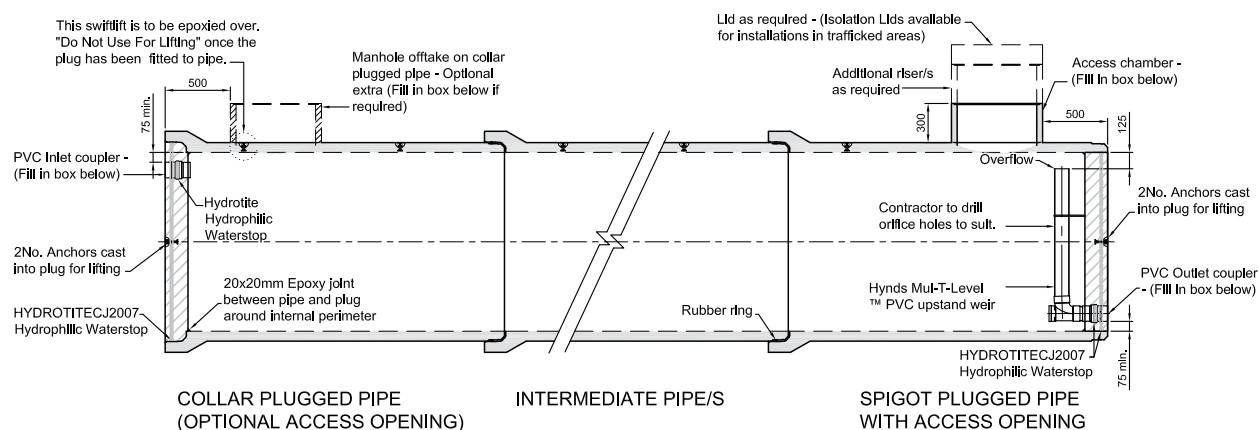


FIG. 2 Recommended detail for roadway installation



PIPE Ø

Mn Recommended Ø 675mm

JOB DETAILS

PIPE CLASS

TOTAL No. OF PIPES
(Incl. ends)

QUOTE No.

COVER TO INVERT

Inlet	Outlet

CO No.

PVC INLET FITTING Ø

Pipe Ø	Standard Fitting Ø	Ø Required
Ø675 to 1200mm	Ø100mm	
Ø1350 to 3000mm	Ø150mm	

PVC OUTLET FITTING Ø

Ø Pipe	Standard Fitting Ø	Ø Required
Ø675 to 1200mm	Ø100mm	
Ø1350 to 3000mm	Ø150mm	

ACCESS CHAMBER -
OUTLET SIDE Ø

Ø Pipe	Standard Offtake Ø	Ø Required
Ø675 to 1200mm	Ø600mm	
Ø1350 to 3000mm	Ø1050mm	
Ø1350 to 3000mm	Specify	

ACCESS CHAMBER
- OPTIONAL
INLET SIDE Ø

Ø Pipe	Standard Offtake Ø	Ø Required
Ø675 to 1200mm	Ø600mm	
Ø1350 to 3000mm	Ø1050mm	
Ø1350 to 3000mm	Specify	

I AUTHORISE HYNDS PIPE SYSTEMS LTD TO PROCEED WITH THE MANUFACTURING OF THIS PIPE SPECIAL AS DETAILED ABOVE. I ACKNOWLEDGE THAT ANY SPECIALS, ONCE MANUFACTURED, ARE DEEMED TO BE MY (CONTRACTOR'S) PROPERTY & ARE NON REFUNDABLE. STORAGE & HANDLING FEES WILL BE INCURRED FOR PRODUCTS THAT ARE NOT DELIVERED/COLLECTED WITHIN 1 MONTH OF THE DATE AGREED AT THE TIME OF ORDER. PRODUCT NOT DELIVERED/COLLECTED WITHIN 3 MONTHS OF THE DATE AGREED WILL BE DESTROYED AT MY EXPENSE.

NAME :- SIGNATURE :-

DATE :-

FIG. 3 RJ Retention Tank Order Form

Internal base type

TABLE 2 Internal base retention tank

Riser Height (mm)			450	600	900	1200	1500	1800	2100	2400
O/A Height Incl 150mm Thick Lid			580	730	1030	1330	1630	1930	2230	2530
O/A Height Incl 200mm Thick Lid			630	780	1080	1380	1680	1980	2280	2580
Effective Depth (mm)			225	375	675	975	1275	1575	1875	2175
Nominal Diameter	A = Riser OD (m)	B = Riser ID (m)	IB Capacity (m3)							
1050	1.194	1.066	0.20	0.33	0.60	0.87	1.14	1.41	1.67	1.94
1200	1.347	1.207	0.26	0.43	0.77	1.12	1.46	1.80	2.15	2.49
1400	1.524	1.372	0.33	0.55	1.00	1.44	1.88	2.33	2.77	3.22
1500	1.677	1.523	0.41	0.68	1.23	1.78	2.32	2.87	3.42	3.96
1650	1.842	1.676	0.50	0.83	1.49	2.15	2.81	3.47	4.14	4.80
1800	2.007	1.829	0.59	0.99	1.77	2.56	3.35	4.14	4.93	5.71
2050	2.236	2.036	0.73	1.22	2.20	3.17	4.15	5.13	6.10	7.08

Effective Depth (mm)			—	—	625	925	1225	—	—	2125
Nominal Diameter	A = Riser OD (m)	B = Riser ID (m)	IB Capacity (m³)							
2300	2.58	2.30	—	—	—	3.84	—	—	—	8.83
2550	2.85	2.55	—	—	3.19	—	6.26	—	—	10.85

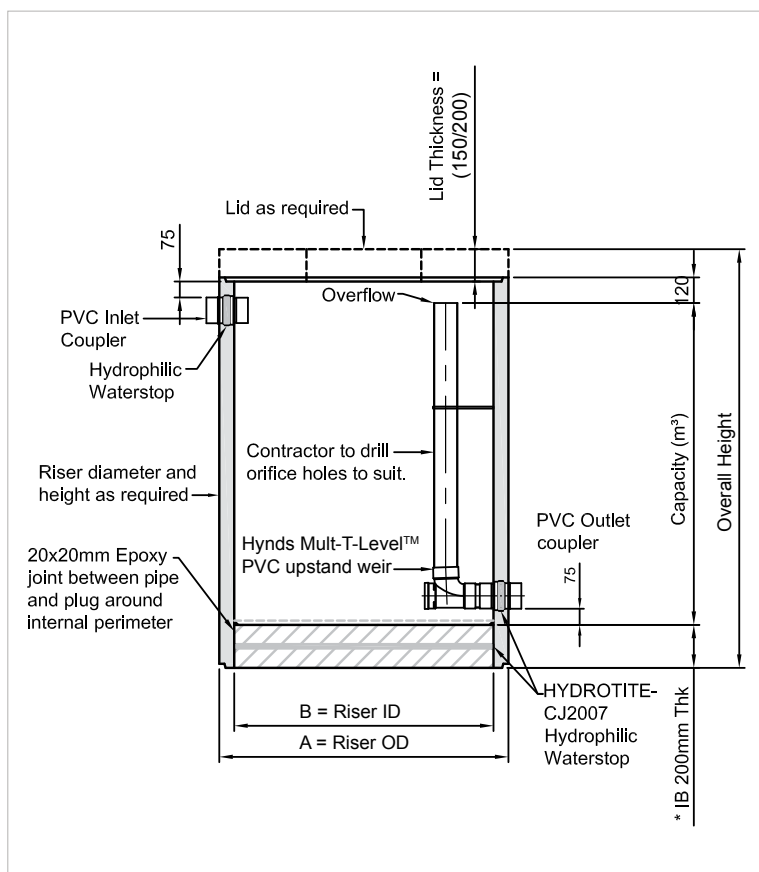


FIG. 4 Internal base

Flange base type

TABLE 3 Flange base retention tank

Riser Height (mm)			450	600	900	1200	1500	1800	2100	2400
O/A Height Incl 150mm Thick Lid			530	680	980	1280	1580	1880	2180	2480
O/A Height Incl 200mm Thick Lid			580	730	1030	1330	1630	1930	2230	2530
Effective Depth (mm)			225	375	675	975	1275	1575	1875	2175
Nominal Diameter	A = Riser OD (m)	B = Riser ID (m)	FB Capacity (m ³)							
1050	1.194	1.066	0.20	0.33	0.60	0.87	1.14	1.41	1.67	1.94
1200	1.347	1.207	0.26	0.43	0.77	1.12	1.46	1.80	2.15	2.49
1400	1.524	1.372	0.33	0.55	1.00	1.44	1.88	2.33	2.77	3.22
1500	1.677	1.523	0.41	0.68	1.23	1.78	2.32	2.87	3.42	3.96
1650	1.842	1.676	0.50	0.83	1.49	2.15	2.81	3.47	4.14	4.80
1800	2.007	1.829	0.59	0.99	1.77	2.56	3.35	4.14	4.93	5.71
2050	2.236	2.036	0.73	1.22	2.20	3.17	4.15	5.13	6.10	7.08

Effective Depth (mm)			-	-	625	925	1225	-	-	2125
Nominal Diameter	A = Riser OD (m)	B = Riser ID (m)	FB Capacity (m ³)							
2300	2.58	2.30	-	-	-	3.84	-	-	-	8.83
2550	2.85	2.55	-	-	3.19	-	6.26	-	-	10.85

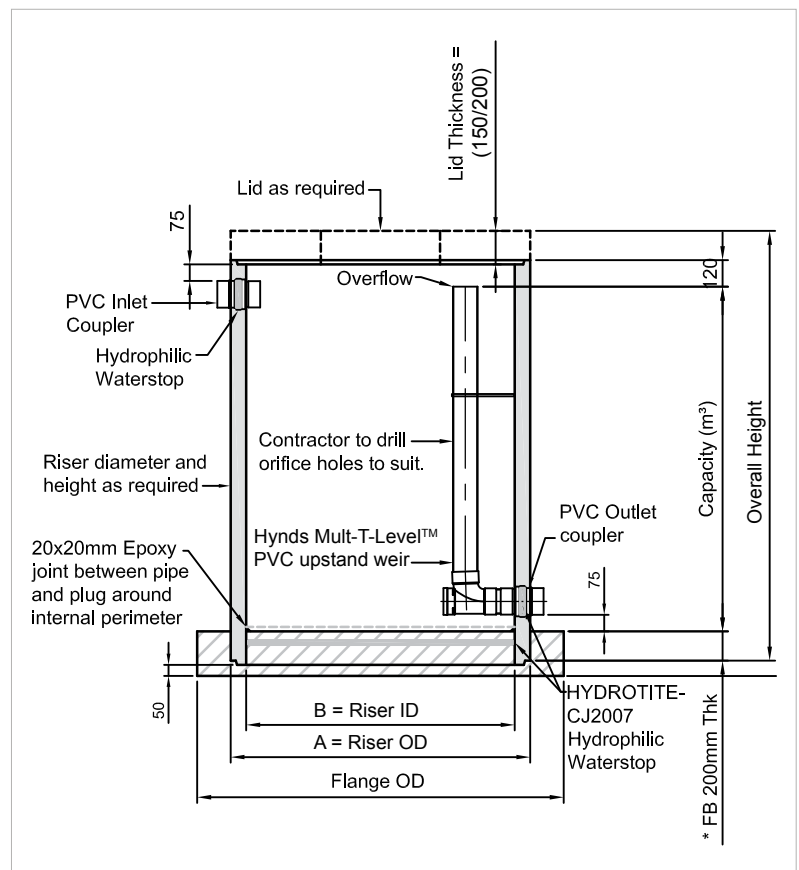


FIG. 5 Flange base

Installation

Mul-T-Level™ outlet

- Installation is simple and normally carried out by a drain layer using the same equipment and procedures as for the installation of concrete pipelines, or manholes.

RJ Retention Tank

- Similar installation to reinforced concrete rubber ring jointed pipes (including bedding requirements) and are dependent on site conditions and loading.
- Once the pipe sections have been installed and backfilled, the additional access risers are epoxied to the starter risers and brought up to the finished levels.
- The installation is then completed by fitting the required lids.
- The contractor must then drill the orifice holes at the required design levels.

Note: Refer to Figure 1 for a general layout of a typical RJ type tank.

RJ Retention Tank – Roadway Installation

- To minimise the effects of traffic, isolation of the manhole lid from the access riser is recommended.
- The depth of the modified flange base and riser must be kept to a minimum to enable maximum distribution of load above the tank.
- Refer to Figure 6 for 3 point lift of typical plugged end pipe.

IB or FB Retention Tank

- Similar installation to concrete manholes.
- Foundations should be prepared with compacted hardfill to prevent excessive settlement.
- Once the IB or FB tank is backfilled, the installation is completed by fitting the relevant concrete lid with the appropriate cast iron frame.



FIG. 6 Point lift of typical plugged end pipe

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Disclaimer: While every effort has been made to ensure that the information in this document is correct and accurate, users of Hynds product or information within this document must make their own assessment of suitability for their particular application. Product dimensions are nominal only, and should be verified if critical to a particular installation. No warranty is either expressed, implied, or statutory made by Hynds unless expressly stated in any sale and purchase agreement entered into between Hynds and the user.

Hyliner AKS HDPE Lining

Technical Guide D1.12

HyLiner AKS HDPE is used as corrosion protection lining in precast and cast in-situ concrete elements or structures to increase durability and reduce the risk of abrasion.



04.20 | DRAINAGE | D1.12 HYLINER AKS HDPE LINING

Applications

Corrosion protection lining for precast concrete pipes in sewer pipelines

Corrosion protection lining for in-situ concrete structures in wastewater treatment plants

Abrasion protection lining in high abrasion environments

Broad range of application in both precast and cast in-situ concrete

Product Attributes

Available in white (sewer applications) and black (where high UV resistance is required)

12 mm long anchors are integrally formed with the sheet

Factory QA tested and welding of joints is 100% quality tested onsite

Quality

ISO 9001:2008 Quality Management Standard

We are the supply partner of choice for New Zealand's civil construction industry, specialising in water and infrastructure based solutions.

HYNDS
PIPE SYSTEMS

HyLiner AKS HDPE is used as corrosion protection lining in precast and cast in-situ concrete elements or structures to increase durability and reduce the risk of abrasion.

Lining systems are able to bridge discontinuities in pipe or structure walls unlike other coating systems that rely on the integrity of the surface and quality of the surface preparation and the installer's expertise for functionality.

HyLiner AKS HDPE is a thermoplastic lining used to reduce the risk of sulphide attack or corrosion in sewage applications.

The high density polyethylene (*HDPE*) lining suits both precast and in-situ applications. Firmly anchored to the concrete surface of the pipe or structure, the lining requires only welding of joints to form a durable, chemically resistant concrete protection membrane with high abrasion resistance.

Installation

Installation procedures vary depending on the product:

Spun concrete pipe

The liner is inserted into the pipe prior to the completion of manufacture, with the pipe spinning process completed with the liner installed. This ensures that all the anchor knobs are well embedded in the spun concrete prior to the concrete curing and hardening.

Wet cast concrete pipe

The liner is securely attached to the inner mould before placement of reinforcement and casting of the pipe. The pipe once cast is cured in the normal manner using heat to accelerate the hardening process.

Precast concrete

This follows a similar process to the wet cast concrete pipe whereby the liner is attached to the mould prior to casting of the element.

In-situ concrete

This follows the same process as for precast concrete whereby the liner is attached to the formwork prior to casting of the concrete.

Installation Detail

In the case of concrete pipes, the liner need only be applied to the pipe's internal surface above low flow level during normal operating conditions as shown in fig 3.

Where 360° cover is required, the liner is fitted with an overlap at the invert (50 mm min) as shown in fig 4 & 5. This joint is not usually welded as it allows any accumulation of moisture from external hydrostatic pressure to dissipate from behind the liner.

Where the fluid contents are themselves aggressive, such as trade waste discharges, a longitudinal weld can be provided to seal the pipe invert.



FIG. 1 Where 360° cover is required, the liner is fitted with an overlap at the invert (50 mm min)

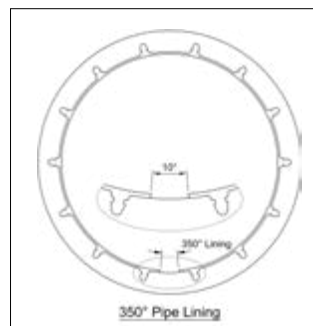


FIG. 3 Most concrete pipes only require the liner applied to the pipe's internal surface above low flow level during normal operating conditions.

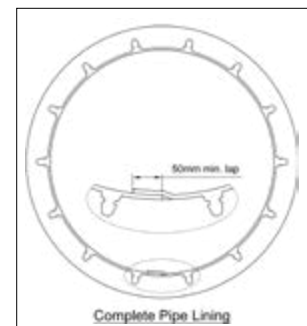


FIG. 2 Invert overlap in a 1050Ø pipe.

Jointing

A continuous lining system is created through the use of extrusion welding carried out by trained, qualified operators. Generally overlapped welds are recommended.

Various details for welded joints for precast concrete pipes and components are shown in Figures 4 to 6. Other details for site installation and fixing of brackets are shown in Figures 7 to 12.

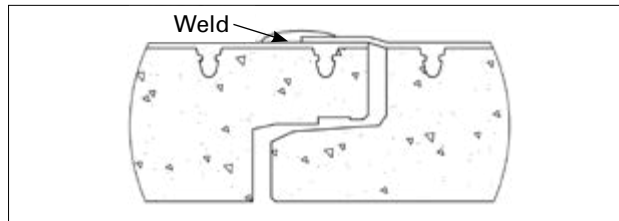


FIG. 4 HyLiner lined SRJ pipe (Lapped Joint)

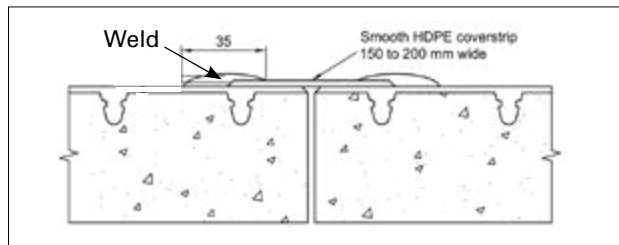


FIG. 5 Cover strip with 2 overlap welds

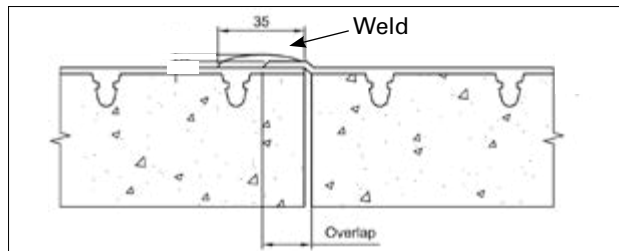


FIG. 6 Single overlap weld

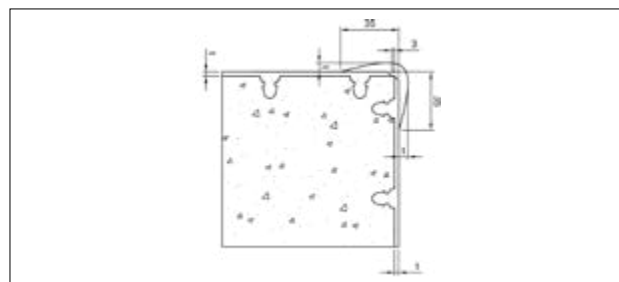


FIG. 7 Outside Corner Weld

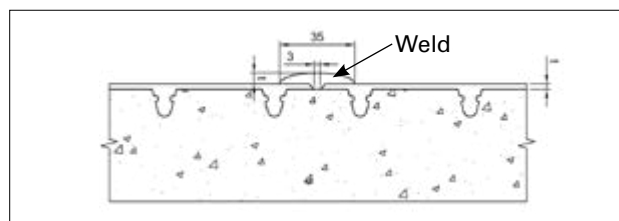


FIG. 8 Flat Extrusion Butt Weld

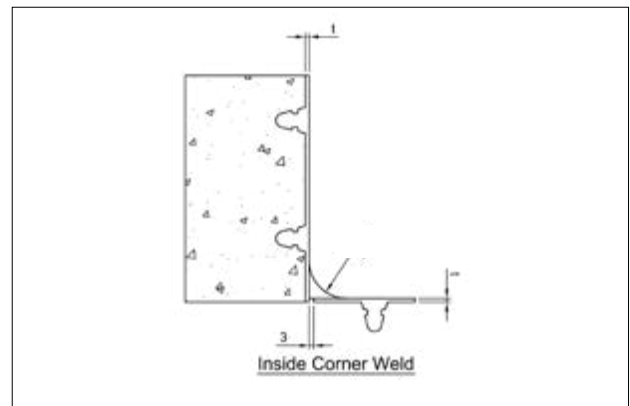


FIG. 9 Inside Corner Weld

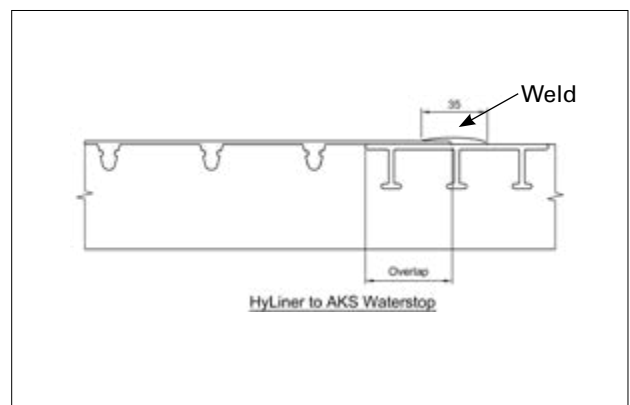


FIG. 10 HyLiner to AKS Waterstop

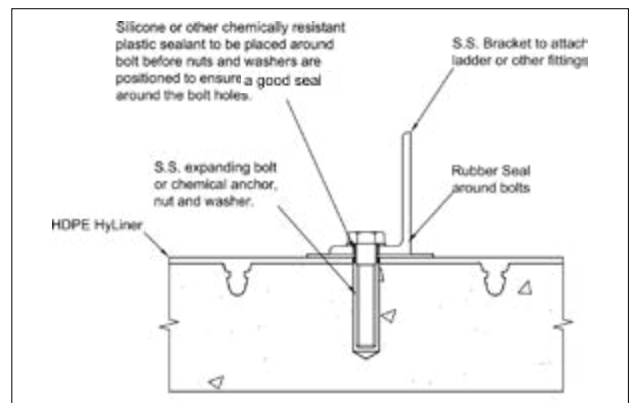


FIG. 11 Sealing of Brackets and Fittings to HyLiner Lined Structures

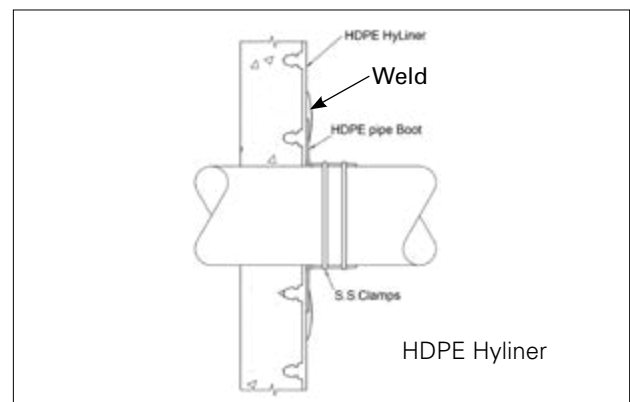


FIG. 12 Pipe Penetration Detail

Quality Control

In-plant quality control for the manufacture of the liner includes waviness, surface finish, knob shape and alignment, crimp height and depth of knobs, sheet thickness, density and tensile values.

Quality checks after casting into precast concrete pipes and components include effective anchor embedment, liner positioning on the product and spark testing for pin holes or damage.

All joints and the liner are spark tested after jointing is completed on site. This ensures the quality of the joints and identifies any damage in the liner as a result of handling and installation.

Abrasion resistance

HyLiner AKS HDPE has a good abrasion resistance when compared to other materials. A typical abrasion test value for HDPE liners is 0.3mm after 400 000 cycles (*Kirschmer, O., "Problems of Abrasion in Pipes", Steinzeugin Formationen, 1966, No 1, pp3-13*).

Wear rates are very slow even under continuous flow of abrasive slurry. Most drainage applications would have intermittent exposure to abrasion.

Suitable Structures for Lining

HyLiner AKS HDPE is suitable for installation in spun and wet cast concrete pipes from 1050–3000 mm diameter. HyLiner AKS HDPE is also suitable for lining a range of other concrete structures:

- Manhole risers and lids
- Rectangular or square precast concrete chambers and lids
- Precast concrete channels and lids
- Precast concrete pumpstations
- Insitu concrete structures such as tanks and chambers



FIG. 13 2300 Diameter Manhole Riser



FIG. 14 Liner being installed for a manhole lid

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Disclaimer: While every effort has been made to ensure that the information in this document is correct and accurate, users of Hynds product or information within this document must make their own assessment of suitability for their particular application. Product dimensions are nominal only, and should be verified if critical to a particular installation. No warranty is either expressed, implied, or statutory made by Hynds unless expressly stated in any sale and purchase agreement entered into between Hynds and the user.

BluSeal AKS

HDPE CONCRETE PROTECTION MEMBRANE



BluSeal Anchor Knob Sheet (AKS) is supplied and installed as a fully sealed and welded robust chemically resistant concrete protection lining.

BluSeal AKS is a synthetic membrane of HDPE sheet with integral anchors which are cast into concrete to form a flexible and durable corrosion protection lining. BluSeal AKS is used to protect concrete surfaces in chemically aggressive environments in sewerage tunnels, treatment works, pump stations, manholes and chemical retention bunds. It comes in a range of colours and thicknesses and can be applied to new and existing structures for protection or enhancement.

Application Advantages

- Fully welded homogenous lining
- Complete before 28-day concrete cure
- Factory assured thickness and absence of pinholes
- Retro-fitted lining is moisture compatible with assured bond

Lifecycle Advantages

- 100 year design life
- Membrane drainage eliminates negative pressure
- Chemical and impact resistant
- High anchor pull-out resistance
- Potable Water use to AS/NZS 4020:200
- Low coefficient of friction in lined conduits

About the Product

BluSeal AKS is supplied and installed as a fully sealed and welded, chemically resistant concrete protection system. The system includes propriety details for sealing around penetrations and against non-HDPE surfaces. Skilled applicators can fabricate the product into various shapes to suit irregular concrete formwork. All seams and joins are extrusion welded and then tested by spark or vacuum box testing. BluSeal AKS is designed and installed by approved applicators to international standards which are outlined in a manufacturer's installation manual. The elasticity of the membrane allows free drainage and relief of any hydrostatic pressure build-up in underground structures. The membrane can be cast into new structures or retrofitted by cement grouting onto the prepared surface of existing structures. AKS lined structures have an outstanding track record in aggressive environments, demonstrating a design life in excess of 100 years for the most demanding applications.

Application solutions

- Segmental sewer tunnels
- Inlet works and bioreactor tanks in WWTP
- Pump stations and manholes
- Tunnel waterproofing
- Chemical retention bunds
- Piles and foundation lining in aggressive ground conditions
- Sewer pipelines
- Slide pads on pipe plinths
- Concrete protection for industrial applications

Project Specification Clause

HDPE CORROSION PROTECTION LINING - The HDPE CPL membrane used for this project shall be supplied and installed as a fully sealed and welded ROBUST continuous membrane system. It shall be a factory produced product that has independent testing to validate the performance outlined in the technical data table on the following pages. BluSeal AKS supplied by Bluey Technologies or equivalent shall be acceptable.

Project Examples

Sewerage treatment plants, sewer pump stations, sewer manholes, trunk sewer mains, chemical processing plant bunds and trenches, gas pipelines (pipe plinths).





BluSeal AKS

HDPE CONCRETE PROTECTION MEMBRANE

Application Specification

PREPARATION

- I.1 BluSeal AKS must be installed onto formwork under the direction of an approved, specialised applicator who will plan layout configurations of sheets and weld seam locations. The applicator may also prefabricate some corner or seam sections and pipe penetration pieces offsite.
- I.2 At joins in sheets the edge knobs are removed from one edge and the sheet is overlapped by 50mm to prevent egress of concrete fines and to provide a sound foundation for welding the seams.
- I.3 Formwork shall be cleaned and free of defects. Form release oils are not necessary where BluSeal AKS is applied. Formwork should be designed to avoid leaking.
- I.4 The sheets must be tensioned over the form within the yield elongation limit, prior to securing to the forms.
- I.5 BluSeal Formtak can be used to assist in holding the sheet against timber formwork. Securing against the formwork is by nailing or stapling through the sheets at edges where extrusion welds will cover later or into edges that will be redundant and trimmed after the pour.
- I.6 On circular forms, the sheets are wrapped and tensioned around and secured at the overlap by wires around the knobs and/or temporary speed welding along the seam.
- I.7 In precast concrete applications the moulds may be designed to secure the membrane at the edges.
- I.8 When BluSeal AKS is applied to an existing structure all corroded concrete and contaminants must be removed, leaving a surface profile greater or equal to CSP4 in accordance with ACI guidelines.
- I.9 Treat or replace exposed reinforcement in accordance with ACI guidelines.
- I.10 Refer to Bluey Technical Notes for recommendations regarding proving grout bond strength and design criteria.

APPLICATION

- 2.1 Always pour concrete or grout at a cooler ambient temperature than the temperature when the sheets were applied to the formwork. This will ensure the membrane is taut on the forms.
- 2.2 Anticipated maximum concrete temperature or accelerated curing temperature should not exceed 60 degrees Centigrade. Contact Bluey to discuss exceptions.
- 2.3 When grouting the sheets onto an existing structure, only grouts approved by Bluey such as BluCem HS200 shall be used, and mixing and placement shall be strictly in accordance with Bluey instructions. Fast set grouts, such as BluCem HE80, are recommended to be used for retrofitting the membrane in short time frames where assets must be returned to service quickly.
- 2.4 When grouting the membrane to floors, plan pours at times of the day where temperature changes before initial set of the grout are minimal. Avoid these pours in direct sunlight.
- 2.5 Concrete mix design, mixing, placement and compaction of concrete should follow standard civil construction practice to minimise voids and ensure full encapsulation of the anchors on the membrane.
- 2.6 Extrusion welding and weld testing at seams will be undertaken by approved applicators and in accordance with installation guidelines provided by the manufacturer and generally in accordance with DVS 2227. This includes proper preparation of the sheet surfaces to be welded and daily destructive seam peel tests sampled from trial welds. Welding technicians shall have formal industry training in extrusion welding techniques.
- 2.7 Non-destructive testing of completed welds will be either by vacuum box or spark testing.
- 2.8 Repairs and patching will be completed by extrusion welding over small defects or applying a minimum 200mm diameter patch over larger defects, with a minimum 80mm edge distance to the defect.
- 2.9 Destructive pull testing of anchors should be avoided.
- 2.10 Encapsulation of anchors can be easily checked by tapping across the surface of the membrane to detect any hollow sounds that indicate voids under the membrane. If voids are detected, they can be filled by injection of BluCem HS200 high flow grout through the lining. Repair by extrusion welding over the injection hole.



BluSeal AKS

HDPE CONCRETE PROTECTION MEMBRANE

Product Data

Please refer to Important Notice on following page

Length of Knobs (nominal)	12mm
Knobs per m ²	1230
Pull-off Resistance	>700N per knob or 850kPa (short term loading)
Membrane Thickness	2.0mm to 10mm*
Roll Widths	Up to 3.2m
Colours	Black for UV exposed applications and light colours (such as white) for underground or covered structures.

TESTED CHARACTERISTIC	STANDARD	RESULT			
Density	ASTM D 505/D 792	≥940kg/m ³			
Carbon Black Content**	ASTM D 1603	2.0 - 3.0%			
Carbon Black Dispersion**	ASTM D 5596	Category 1 or Category 2			
ESCR (NCTL)	ASTM D 5397	>300 hours			
OIT	D 3895	>100 minutes			
Coefficient of Linear Expansion	ASTM E 831	1.1 - 1.4E-4cm/cm/deg C			
Tensile Properties (Sheet Material)	ASTM D 6693-04	Yield Stress 15MPa	Break Stress 27MPa	Yield Elongation 12%	Break Elongation 700%
Shore Hardness	DIN 53505	>50 Shore D			
Tear Resistance	ASTM D 1004	120N/mm			
Puncture Resistance	ASTM D 4833	300N/mm			
Dimensional Stability	ASTM D 1204	<2.0% change			
Water Absorption	ASTM D 570	<0.09%			
Flammability	UL94***	V0			

* Average minimum thickness to ASTM D 5199. Minimum thickness membrane made to order

** Black AKS only

*** Plastics flammability standard released by Underwriters Laboratories of the USA



BluSeal AKS

HDPE CONCRETE PROTECTION MEMBRANE

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IMPORTANT NOTICE

This Technical Data Sheet is provided for general information and instruction only. The properties and characteristics set out herein represent typical testing results under laboratory conditions. Results of actual product characteristics may vary slightly. Site-specific and project-specific conditions may affect product performance, including without limitation: surfaces, environmental conditions, contact conditions, storage conditions, storage timeframes, weather, and climatic or seasonal conditions. Not all product parameters are batch tested as part of the manufacturing quality control process, and performance may vary between batches.

If Bluey gives any express written product warranty in relation to the product, that warranty is subject to the foregoing qualifications, despite anything to the contrary in any other document. All other representations, advice, suggestions or promises regarding the product's performance or its implementation, whether verbal or in writing, and whenever given, including in the course of any field services, are expressly disclaimed. Without limiting the foregoing, Bluey will have no liability for loss or damage of any kind if any application specifications are not followed.

The foregoing is not intended to exclude any warranties or guarantees which by law cannot be excluded. Subject only to the foregoing provisions of this Notice, and to the extent permitted by law, Bluey disclaims all liability for loss or damage of any kind suffered as a result of or in connection with the product or its implementation. If such liability cannot be wholly excluded, Bluey's liability will, to the extent permitted by law, be limited to the replacement of the product itself or the direct cost of replacement of the product itself (not including any collateral or consequential loss or damage of any kind).

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ProcessMaster electromagnetic flowmeter

The perfect fit for the oil and gas industry



ABB has responded to the oil and gas industry's need for a rugged, reliable electromagnetic flowmeter

Measurement made easy

ProcessMaster flowmeters – perfect for the oil and gas industry

Expertise in measurement technology

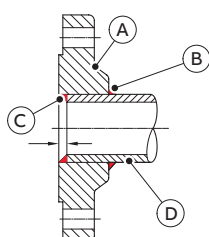
ABB's high pressure electromagnetic flowmeters are reliable, accurate and easily maintained. Customers worldwide have benefited from our application-oriented know-how and comprehensive service.

To learn more about our extensive portfolio, visit www.abb.com/measurement.

Designed specifically for oil and gas

We have added a two-tier, high-pressure version to our comprehensive range of electro-magnetic ProcessMaster flowmeters. It is available with either weld neck or slip-on flanges with RTJ and raised face connections.

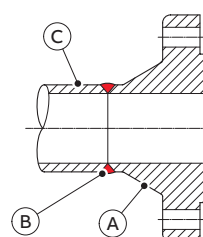
There are differences between X-Ray and dye penetrant test. For weld neck design we offer both dye penetrant and X-Ray tests; for slip-on design we offer only dye penetrant test.



(A) Slip-on flange (B) Fillet weld (outside) (C) Fillet weld (inside) (D) Pipe

Applications

- Slurries such as drilling mud
- Mixtures of fluids such as oil/water plus sand or produced water plus sand
- Injection fluids including sand and chemical additives for lubrication and corrosion prevention
- Sludge or sludge-like wastewater from produced water treatment
- Operating conditions such as high pressure or entrained gas in the fluid
- Harsh environmental conditions such as heat, moisture or vibration and explosive or corrosive atmospheres



(A) Weld neck flange (B) Butt weld (C) Pipe

Robust design for long life

The ProcessMaster flow sensor is designed for reliability in the demanding operating conditions found in oil and gas industry applications.

- Long lasting sensor lining materials withstand abrasion and corrosion, resulting in longer sensor service life and minimal maintenance requirements
- No additional pressure drop caused by protrusions into the pipe
- Optional self-cleaning measuring electrodes prevent issues caused by build-up of deposits
- Double sealed measuring electrodes minimize the risk of leakage and enhance reliability
- Optional all-316 stainless steel construction for corrosive offshore atmosphere
- Optional fully-welded sensor made from 316 material
- Protection of internal sensor components against moisture and vibration with potted Ex sensor

Range of certificates and test reports

- 3.1 material certificates and/or PMI certificates
- Certificates for non-destructive testing, X-Ray and/or dye penetration test
- Welder qualifications and procedures
- Hydrostatic pressure testing

Specification

Accuracy	Standard: 0.4 % of rate Enhanced: 0.2 % of rate
Nominal size range	DN 25 to 400 (1 to 18 in)
Nominal pressure	ASME CL 600 to 2500
Lining	Hard rubber, ETFE
Electrodes	Stainless steel, Hastelloy C
Process connection	Steel, stainless steel
IP rating	IP67, IP68
Fluid temperature	–25 to 130 °C (–13 to 266 °F)
Power supply	100 to 230 V AC, 24 V AC/DC
I/Os	Current, pulse status output
Communication *	HART protocol, PROFIBUS PA, FOUNDATION Fieldbus
Sensor housing material	Stainless steel 316
Transmitter housing material	Stainless steel
Wetted parts material	Option for NACE
Ex approvals	ATEX/IEC Zone 1.2, FM/cFM Cl1 Div.1, Cl1 Div.2
Marine approval	DNV
Verification	ScanMaster

* Acknowledgements

HART is a registered trademark of FieldComm Group, Austin, Texas, USA.

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FEP630 high pressure magnetic flowmeter



FEP610 high pressure magnetic flowmeter

BLACKBOX

Technical Specifications:

Blackbox 130 is a compact low-cost intelligent controller that allows users to locally program the unit and give a readout of level. Economical and simple to program and operate, users benefit from extremely accurate and reliable digital echo processing with access to the dB and dBR range of transducers, measuring from 125 mm (4.9 in) right through to 40 m (131.2 ft).



PHYSICAL: MOUNTING OPTION SPECIFIC

Mounting Option:	Standard Wall Mount:	Large Wall Mount:
Controller Body Dimensions:	130 mm x 150 mm x 63.5 mm (5.1 in x 5.9 in x 2.5 in)	130 mm x 180 mm x 85 mm (5.1 in x 7.09 in x 3.3 in)
Weight:	Nominal 0.7 kg (1.4 lb)	Nominal 0.8 kg (1.7 lb)
Enclosure Material/Description:		ABS Base with polycarbonate lid, flammability rating UL 94 HB
Cable Entry Detail:	Underside fitted with 3 x M20, nylon cable glands suitable for 6 mm to 12 mm (0.2 in to 0.5 in) cable	Underside fitted with 3 x M20, nylon cable glands suitable for 6 mm to 12 mm (0.2 in to 0.5 in) cable
Transducer Cable Extensions:	2-core screened (2 conductor 20 AWG screened)	
Nominal Separation:	1,000 m (3,280 ft), for greater separation distances please contact us	

ENVIRONMENTAL

IP Rating:	IP66/67
Max. & Min. Temperature (Electronics):	-20 °C to +55 °C (-4 °F to +131 °F)
Flammable Atmosphere Approval:	All Blackbox units must be mounted in a safe area. Compatible with approved dB Transducers
CE Approval:	See EU Declaration of Conformity in the manual
UL Approval:	UL Listed. UL Listed to Canadian Safety Standards. Certificate Number E257330.

PERFORMANCE

Accuracy/Repeatability:	0.25% of the measured range or 6 mm (0.2 in), <i>whichever is greater</i>
Resolution:	dBMAH3 0.3 mm (0.01 in), dB3 0.5 mm (0.02 in), dB6 and dB10 1 mm (0.04 in), dB15 1.5 mm (0.06 in), dB25 2.5 mm (0.1 in), and dB40 5 mm (0.2 in).
Min. & Max. Range:	Dependent on Transducer. Nominally 125 mm to 40 m (4.9 in to 130 ft)
Echo Processing:	DATM (Digital Adaptive Tracking of Echo Movement)
Rate Response:	Fully Adjustable

OUTPUTS

Analog Output:	Isolated output of 4-20mA or 0-20mA into 1 kΩ (user programmable and adjustable) 0.1% resolution
Digital Output:	RS232 for programming and data extraction
Volt Free Contacts, Number, & Rating:	2 form "C" (SPDT) rated at 2 A at 240 V AC
Display:	2 x 12 alpha numeric

PROGRAMMING

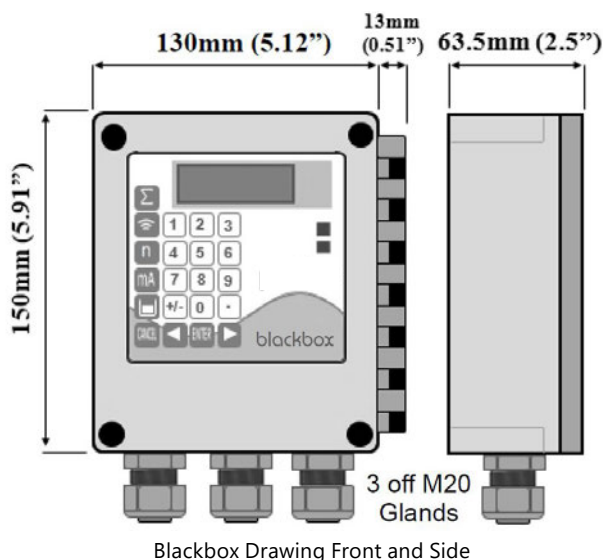
On-board Programming:	Via RS232 using supplied software
PC Programming:	Via RS232 using supplied software
Programming Security:	Via Passcode (user selectable and adjustable)
Programmed Data Integrity:	Via non-volatile RAM
Remote Programming:	Via RS232 using optional handheld calibrator

SUPPLY

Power Supply:	115 V AC +5% / -10% 50/60 Hz, 230 V AC +5% / -10% 50/60 Hz, 10-28 V DC, 10 W maximum power (typically 5 W)
Fuses:	50mA at 230 V AC, 100mA at 115 V AC

REMOTE COMMUNICATIONS

Power Supply:	Power supplied via Blackbox RS232 interface
----------------------	---



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Rev 4.0

dB ULTRASONIC TRANSDUCERS

Technical Specifications:

The dB Transducer Series is a range of non-contacting ultrasonic transducers for level, volume, and flow measurement. Available in a variety of models and compatible with all Pulsar controllers so that you have a specific solution to suit your application requirements.



PHYSICAL: TRANSDUCER SPECIFIC

Model:	Dimensions:	Dia Face:	Weight:	Measurement Range:	Frequency:	Beam Angle:
dB3	78 (D) mm x 115 (H) mm (3.1 in x 4.5 in)	19 mm (0.7 in)	1.1 kg (2.4 lb)	125 mm to 3 m (4.9 in to 9.8 ft)	125kHz	<10°
dB6	86 (D) mm x 106 (H) mm (3.4 in x 4.2 in)	30 mm (1.2 in)	1.1 kg (2.4 lb)	300 mm to 6 m (11.8 in to 19.7 ft)	75kHz	<10°
dB56	86 (D) mm x 106 (H) mm (3.4 in x 4.2 in)	45 mm (1.8 in)	1.1 kg (2.4 lb)	200 mm to 6 m (7.9 in to 19.7 ft)	50kHz	<10°
dB10	86 (D) mm x 106 (H) mm (3.4 in x 4.2 in)	45 mm (1.8 in)	1.1 kg (2.4 lb)	300 mm to 10 m (11.8 in to 32.8 ft)	50kHz	<10°
dB15	86 (D) mm x 122 (H) mm (3.4 in x 4.8 in)	60 mm (2.4 in)	1.2 kg (2.6 lb)	500 mm to 15 m (19.7 in to 49.2 ft)	41kHz	<8°
dB25	105 (D) mm x 142 (H) mm (4.1 in x 5.6 in)	78 mm (3.1 in)	1.4 kg (3.1 lb)	600 mm to 25 m (23.6 in to 82 ft)	30kHz	<6°
dB40	205 (D) mm x 223 (H) mm (8.1 in x 8.8 in)	160 mm (6.3 in)	6 kg (13.2 lb)	1.2 m to 40 m (3.9 ft to 131.2 ft)	20kHz	<5°

PHYSICAL: ALL TRANSDUCERS

Sensor Body Material:	Valox 357 U and syntactic foam face
Cable Lengths:	Standard = 5 m, 10 m, 20 m, or 30 m (16.4 ft, 32.8 ft, 65.6 ft, or 98.4 ft). Optional: up to 150 m (492 ft) maximum (increments of 10 m (32.8 ft) only)
Maximum Separation:	500 m (1,640 ft)
Mounting Connection:	BSP or 1" NPT

ENVIRONMENTAL

Enclosure Protection:	IP68 / NEMA 6P
Max. And Min. Temperature (Electronics):	Standard: -40° C to +90° C (-40° F to +194° F) Hazardous area versions: -40° C to +75° C (-40° F to +167° F)

APPROVALS

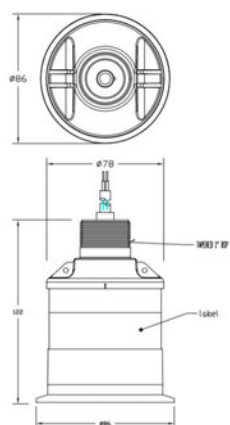
CE Approval:	2014/30/EU to EMC & 2014/34/EU ATEX Directives. Standards applied: EN 60079-0:2012+A11:2013/ EN 60079-11:2012 / EN 60079-18:2009 / EN 60079-26:2007 / EN 61326-1:2013
ATEX Approval:	Standard ATEX EEx m II T6 or optional EEx ia IIC T6. FM/FMC approval.

TRANSDUCER OPTIONS

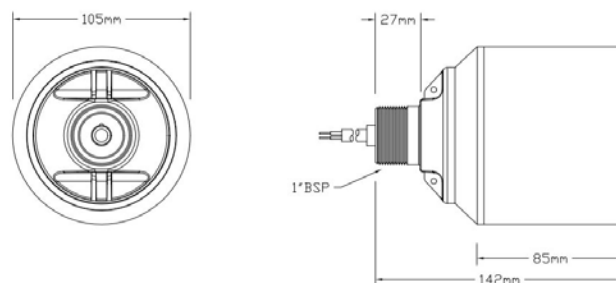
Model:	dB3	dBs6	dB6	dB10	dB15	dB25	dB40
PVDF		✓	✓	✓			
Front Threaded / PVDF	✓	✓	✓	✓			
Submergence Shield	✓	✓	✓	✓	✓	✓	
Flanged DIN/ANSI		✓	✓	✓	✓		
Foam Face		✓		✓	✓	✓	✓
Sanitary Flange		✓	✓	✓			
Intrinsically Safe of All the Above	✓	✓	✓	✓	✓	✓	✓

PERFORMANCE

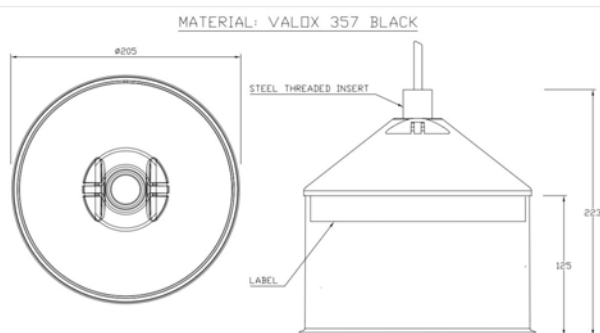
Accuracy:	0.25% or 6 mm (0.2 in) whichever is greater
Resolution:	0.01% or 2 mm (0.08 in) whichever is greater
Temp. Compensation:	Automatic, internal temperature sensor, ± 0.5 °C/°F



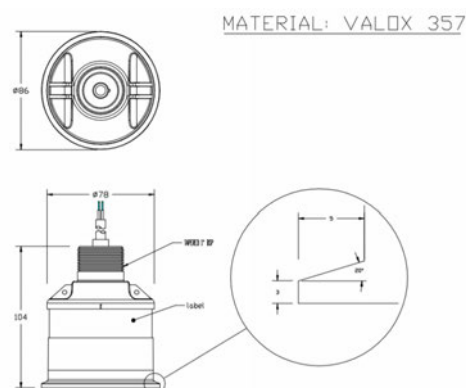
dB15 Transducer Drawing



dB25 Transducer Drawing



dB40 Transducer Drawing



dB6 & dB10 Transducer Drawing



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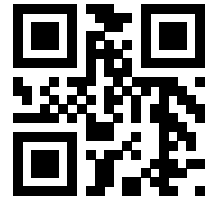
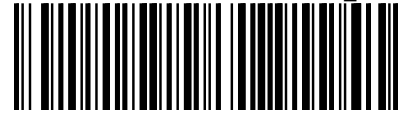
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Rev 7.0

Technical Specification

891480_17.0



ENM 10

Level switch

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1 Product Description

1.1 Product design

Usage

ENM-10 is a level regulator for level control applications. The level regulator starts and stops a pump or activates an alarm device when the liquid level reaches the regulator.

Materials

Denomination	Standard version	Ex version
Regulator casing	Polypropylene	Polypropylene with black conductive casing
Bend relief	EPDM rubber	NBR-PVC rubber
Cable sheath	PVC	NBR-PVC rubber

The plastic components are welded and screwed together.

1.2 Technical data

Application limits

Feature	Value
Liquid temperature	Minimum 0°C (32°F) Maximum 60°C (140°F)
Liquid density	Minimum 0.65 g/cm ³ Maximum 1.5 g/cm ³

Electrical specifications

Feature	Value
Degree of protection	IP68, 20 m (65 ft), 2 bars
Interrupting capacity of micro switch	AC, resistive load, 250 V 10 A AC, inductive load, 250 V 3 A $\cos \phi = 0.5$ DC, 30 V 5 A
Interrupting capacity of gold-plated micro switch	AC, resistive load, 250 V 10 A AC, inductive load, 250 V 3 A $\cos \phi = 0.5$ DC, 24 V 10 mA

Voltage limits are subject to local regulations.

Density ranges

Density g/cm ³	Regulator length mm (in.)	Diameter mm (in.)
0.65 – 0.80	194 (7 10/16)	100 (4)
0.80 – 0.95	177 (7)	100 (4)
0.95 – 1.10	162 (6 3/8)	100 (4)
1.05 – 1.20	142 (5 9/16)	100 (4)
1.20 – 1.30	133 (5 1/4)	100 (4)
1.30 – 1.40	130 (5 2/16)	100 (4)

Density g/cm ³	Regulator length mm (in.)	Diameter mm (in.)
1.40 - 1.50	126 (5)	100 (4)

Weight

A regulator with standard density and 20 m cable weighs approximately 2 kg (4.5 lb).

1.3 Cables

Lengths

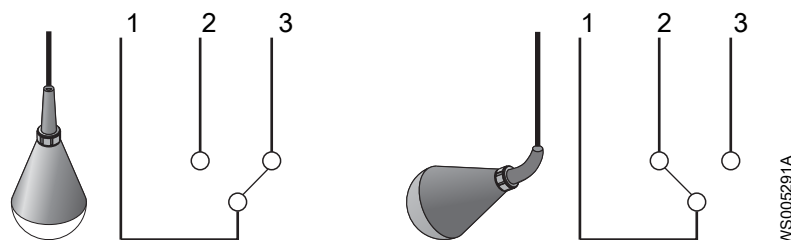
For liquids with specific density between 0.95 and 1.10 g/cm³, the following cables are available:

Version	Lengths m (ft)
Standard	• 6 m (20 ft) • 13 m (42 ft) • 20 m (65 ft) • 30 m (100 ft) • 50 m (167 ft)
Ex	• 6 m (20 ft) • 13 m (42 ft) • 20 m (65 ft) • 30 m (98 ft) • 50 m (164 ft)

Diameter

The cable diameter for all product variants is 6.7 mm (0.26 in), +/- 0.2 mm (0.00787 in).

Color codes



Cable	1	2	3
Color	Grey	Black	Brown

1.4 Approvals and standards

Standard approvals

LVD approval according to EN61058
 CSA approval: Certificate Number 1330172
 Cl. I Zone 0, Gr. IIC
 CL.I Div.1 Gr A, B, C and D
 Cl.II Gr. E, F, and G

Ex approvals

IECEX ia IIC T4 Ga: -20°C ≤ Ta ≤ 60°C
 IECEX NEMKO 09.0008
 ATEX II 1G Ex ia IIC T4 Ga

NEMKO 10 ATEX 1082

Applied standards for ATEX and IEC

- EN 60079-0:2012 / IEC 60079-0:2011
- EN 60079-11:2012 / IEC 60079-11:2011

Intrinsically safe circuits are required for the automatic control system. Use a Zener barrier, for example, part number 84 01 07.

The electrical connections must comply with the Ex regulations of the national submitter.



2 References

2.1 Chemical resistance tables

The tables show the degree of resistance the level regulator has to different chemicals at two different temperatures. The density of the liquid determines the buoyancy of the regulator.

Acids

Acid	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Acetic acid 50%	1	2	0	0
Acetic acid 75%	2	2	0	0
Benzoic acid	2	2	0	0
Boric acid 5%	0	–	0	0
Butyric acid	2	2	2	2
Chromic acid 10%	0	2	2	2
Citric acid	0	1	0	0
Hydrobromic acid 5%	1	2	0	0
Hydrochloric acid 10%	0	1	0	1
Hydrochloric acid 37%	1	2	0	2
Hydrocyanic acid 10%	0	0	1	2
Hydrofluoric acid 5%	0	2	0	1
Hypochloric acid	1	2	2	2
Maleic acid	2	2	2	2
Nitric acid 5%	1	1	1	1
Nitric acid 65%	2	2	2	2
Oleic acid	1	2	2	2
Oxalic acid 50%	1	1	1	2
Phosphoric acid 25%	0	0	1	2
Phosphoric acid 85%	0	0	1	2
Sulphuric acid 10%	1	2	1	2
Sulphuric acid 78%	2	2	2	2
Tannic acid	0	0	0	0
Tartaric acid	1	1	1	1

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Alkalis

Alkali	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Ammonium hydroxide	0	–	0	0
Calcium hydroxide	0	0	0	0

Alkali	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Potassium hydroxide	1	2	0	0
Sodium hydroxide	1	2	0	0

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Salts

Salt	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Aluminum chloride	0	0	0	0
Calcium sulphate	0	0	0	0
Calcium chloride	0	0	0	0
Calcium nitrate	0	0	0	0
Copper chloride	0	0	0	0
Copper sulphate	0	0	0	0
Ferric chloride	0	0	0	0
Ferrous sulphate	0	0	0	0
Magnesium chloride	0	0	0	0
Potassium sulphate	0	0	0	0
Potassium nitrate	0	0	0	0
Potassium carbonate	1	1	1	1
Potassium bicarbonate	0	0	0	0
Sodium sulphate	0	0	0	0
Sodium chloride	0	0	0	0
Sodium nitrate	0	0	0	0
Sodium bicarbonate	0	0	0	0
Sodium carbonate	0	0	0	0
Tin chloride	1	1	1	1
Zinc sulphate	0	0	0	0
Zinc chloride	0	0	0	0

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Oils

Oil	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Castor oil	1	1	1	1
Coconut oil	0	–	0	2
Corn oil	2	2	2	2
Diesel oil	2	2	2	2
Linseed oil	2	2	2	2
Mineral oils	2	2	2	2
Olive oil	1	1	1	1
Silicone oils	0	0	0	0

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Solvents and miscellaneous

Chemical	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Acetone	2	2	2	2
Aniline	2	2	1	2
Benzene	2	2	2	2
Butyl alcohol	2	2	0	1
Carbon tetrachloride	2	2	2	2
Chlorobenzene	2	2	2	2
Chloroform	2	2	2	2
Ethyl alcohol	2	2	0	1
Ethyl ether	2	2	2	2
Ethyl acetate	2	2	2	2
Ethylene dichloride	2	2	2	2
Ethylene chloride	2	2	2	2
Formaldehyde 37%	1	2	0	0
Gasoline	2	2	2	2
Kerosene	2	2	2	2
Methyl alcohol	2	2	0	0
Methyl ethyl ketone	2	2	2	2
Methylene chloride	2	2	2	2
Nitrobenzene	2	2	2	2
Phenol	2	2	2	2
Toluene	2	2	2	2
Trichlorethylene	2	2	2	2
Turpentine	2	2	2	2
Xylene	2	2	2	2

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Gases

Gas	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Carbon dioxide	0	0	0	0
Carbon monoxide	0	0	0	0
Chlorine - wet	2	2	2	2
Hydrogen sulfide	0	0	1	1
Sulphur dioxide - wet	1	1	2	2

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

2.2 Product range

Version	For density (g/cm ³)	Color of level switch	Length of cable (m)	Type of cable ¹	Approvals	For market
582 88 00	0.65–0.80	Blue	20	1	CE	International
582 88 01	0.80–0.95	Blue	20	1	CE	International
582 88 02	0.95–1.10	Blue	6	1	CE	International
582 88 03	0.95–1.10	Blue	13	1	CE	International
582 88 04	0.95–1.10	Blue	20	1	CE	International
582 88 05	1.05–1.20	Blue	20	1	CE	International
582 88 06	1.20–1.30	Blue	20	1	CE	International
582 88 07	1.30–1.40	Blue	20	1	CE	International
582 88 08	1.40–1.50	Blue	20	1	CE	International
582 88 09	0.65–0.80	Gray	20	3	CSA/CE	Canada
582 88 10	0.80–0.95	Gray	20	3	CSA/CE	Canada
582 88 11	0.95–1.10	Gray	6	3	CSA/CE	Canada
582 88 12	0.95–1.10	Gray	13	3	CSA/CE	Canada
582 88 13	0.95–1.10	Gray	20	3	CSA/CE	Canada
582 88 14	1.05–1.20	Gray	20	3	CSA/CE	Canada
582 88 15	1.20–1.30	Gray	20	3	CSA/CE	Canada
582 88 16	1.30–1.40	Gray	20	3	CSA/CE	Canada
582 88 17	1.40–1.50	Gray	20	3	CSA/CE	Canada
582 88 18	0.65–0.80	Gray	20	1	CSA/CE	Canada
582 88 19	0.80–0.95	Gray	20	1	CSA/CE	Canada
582 88 20	0.95–1.10	Gray	6	1	CSA/CE	Canada
582 88 21	0.95–1.10	Gray	13	1	CSA/CE	Canada
582 88 22	0.95–1.10	Gray	20	1	CSA/CE	Canada
582 88 23	1.05–1.20	Gray	20	1	CSA/CE	Canada
582 88 24	1.20–1.30	Gray	20	1	CSA/CE	Canada
582 88 25	1.30–1.40	Gray	20	1	CSA/CE	Canada
582 88 26	1.40–1.50	Gray	20	1	CSA/CE	Canada
582 88 36	0.95–1.10	Gray	30	3	CSA/CE	Canada
582 88 37	0.95–1.10	Gray	50	3	CSA/CE	Canada
582 88 38	0.95–1.10	Gray	100	3	CSA/CE	Canada
582 88 39	0.95–1.10	Gray	150	3	CSA/CE	Canada
582 88 51	0.95–1.10	Red	65	2	CE	International
582 88 52	0.95–1.10	Red	6	2	CE	International
582 88 53	0.95–1.10	Red	13	2	CE	International
582 88 54	0.95–1.10	Red	20	2	CE	International
582 88 57	0.95–1.10	Red	20	2	CE	Canada
582 88 70	0.65–0.80	Blue	20	3	CE	International
582 88 71	0.80–0.95	Blue	20	3	CE	International
582 88 72	0.95–1.10	Blue	6	3	CE	International
582 88 73	0.95–1.10	Blue	13	3	CE	International

¹ See *Type of cables* on page 9.

Version	For density (g/cm ³)	Color of level switch	Length of cable (m)	Type of cable ¹	Approvals	For market
582 88 74	0.95–1.10	Blue	20	3	CE	International
582 88 75	1.05–1.20	Blue	20	3	CE	International
582 88 76	1.20–1.30	Blue	20	3	CE	International
582 88 77	1.30–1.40	Blue	20	3	CE	International
582 88 78	1.40–1.50	Blue	20	3	CE	International
582 88 79	0.95–1.10	Blue	65	1	CE	International
582 88 80	0.95–1.10	Blue	30	1	CE	International
582 88 81	0.95–1.10	Blue	50	1	CE	International
582 88 82	0.95–1.10	Gray	30	1	CSA/CE	Canada
582 88 83	0.95–1.10	Gray	50	1	CSA/CE	Canada
582 88 86	0.95–1.10	Red	30	2	CE	International
582 88 87	0.95–1.10	Red	50	2	CE	International
582 88 90	0.95–1.10	Blue	30	3	CE	International
582 88 91	0.95–1.10	Blue	50	3	CE	International
582 88 92	0.95–1.10	Red	6	2	CE	Japan
582 88 93	0.95–1.10	Red	13	2	CE	Japan
582 88 94	0.95–1.10	Red	20	2	CE	Japan
582 88 95	0.95–1.10	Blue	6	1	CE	Japan
582 88 96	0.95–1.10	Blue	13	1	CE	Japan
582 88 98	0.95–1.10	Blue	50	1	CE	Japan
594 79 10	0.95–1.10	Blue	70	3	CE	International
594 79 13	0.95–1.10	Blue	100	3	CE	International
594 79 18	0.95–1.10	Blue	150	3	CE	International
594 79 19 ²	0.95–1.10	Blue	20	3	CE	International
594 79 20 ²	0.95–1.10	Gray	20	3	CSA/CE	International
594 79 21 ²	0.95–1.10	Transparent	6	3	CE	For demonstration only.
594 79 40 ²	0.95–1.10	Black	6	3	ATEX/IECEX ³	International
594 79 41 ²	0.95–1.10	Black	13	3	ATEX/IECEX ³	International
594 79 42 ²	0.95–1.10	Black	20	3	ATEX/IECEX ³	International
594 79 49 ²	0.95–1.10	Black	30	3	ATEX/IECEX ³	International
594 79 50 ²	0.95–1.10	Black	50	3	ATEX/IECEX ³	International

Type of cables

Type of cable	Jacket	Color coding of wires
1	Blue polyvinyl chloride (PVC)	Grey/Brown/Black
2	Red PVC	Grey/Brown/Black
3	Black nitrile rubber (NBR)/PVC	Grey/Brown/Black

¹ See *Type of cables* on page 9.

² Designed for low current, slow movements and oil. Includes micro switch with gold plated contacts.

³ Zener barrier 84 01 07 required.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com



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contacts/](http://www.xylemwatersolutions.com/contacts/)

Visit our Web site for the latest version of this document
and more information

The original instruction is in English. All non-English
instructions are translations of the original instruction.

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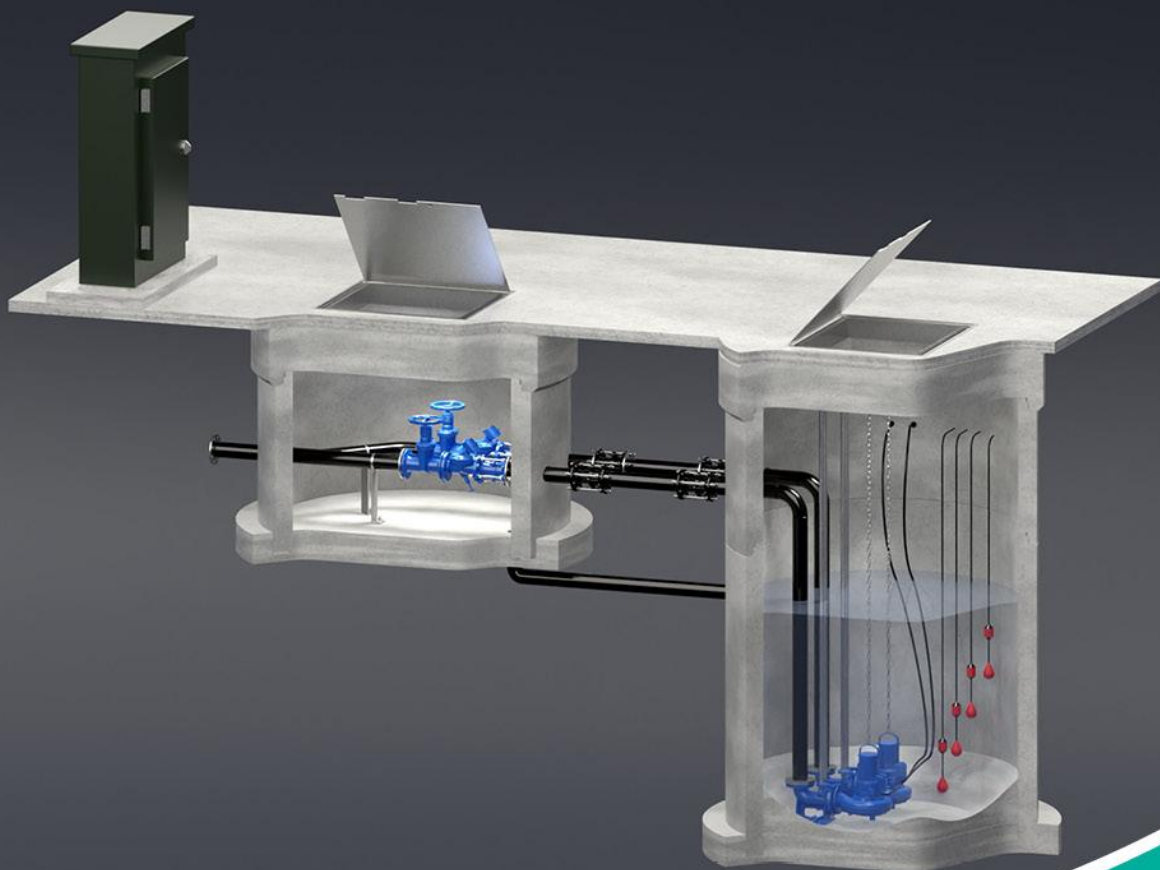
PUMP STATION

WWPS B, SOUTHERN LINKS 1, RESIDENTIAL 1, HAMILTON

TECHNICAL SPECIFICATIONS

MAVEN WAIKATO LIMITED

21 May 2026



Peter Carroll – Aquate Director
BE Civil, MBA, CPEng, FEngNZ
www.aquate.co.nz

HYNDS
PUMP SOLUTIONS

Foreward

This installation manual is a guide only. All relevant Health and Safety laws and codes of construction must be adhered to and take precedence over any information in this manual. Installers must practice good professional practice and are required to understand all National and Local regulations in respect to the installation of drainage materials.

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APPENDICES

12

1.1 Pumps/Pump Performance

See full specifications in the Appendices

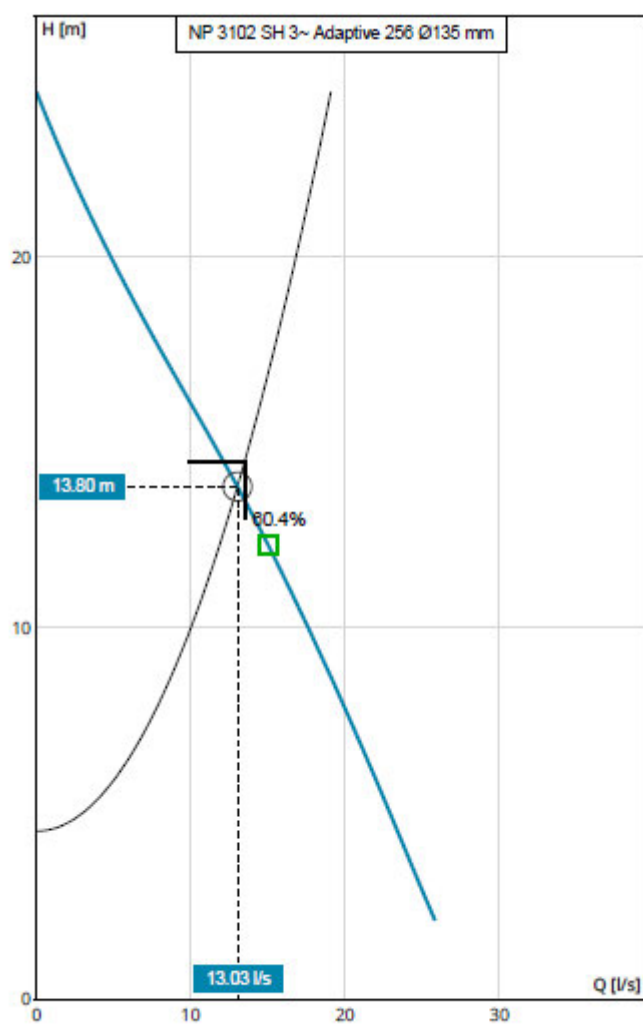
Manufacturer: Xylem Pumps

Type: Flygt NP3102 SH3 256

Connection: 415 V, 50 Hz

Power: 4.5 kW

Phases: Three



1.2 Design Information

1.2.1 Storage Calculations

The total Average Dry Weather flow has been calculated from the expected flow rate with the following assumption:

Average dry weather flow = 220 dwellings = 132 m³/day

Total emergency storage required is 9 hours = 49.5 m³

Total emergency storage in wet-well and emergency storage tank is 49.5 m³ so 9.0 hours storage has been provided.

1.2.2 Pump Design

The system above has been designed based on the information provided below.

Rising main length : 525m

Static Lift : – 4.5 m

Rising main – PE100 (HDPE) PE 4710 / SDR 11 (PN 16) / DN 150 (160x14.6 mm)

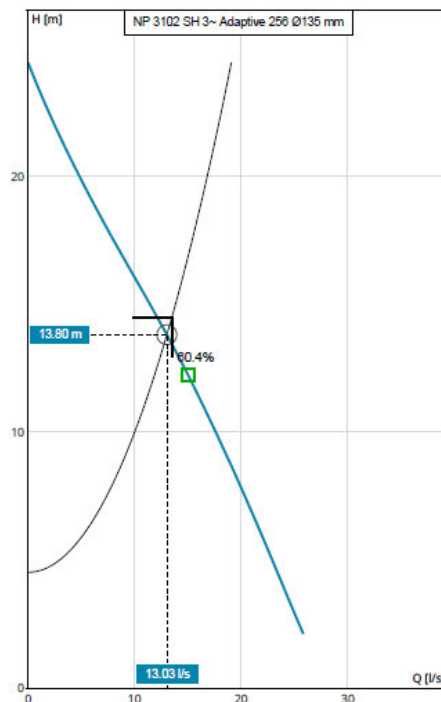
Rising main – OD – 160mm, ID – 130.8 mm

Option 1 K = 1.5

Flygt NP3102 - Flow rate = 13.03 l/s with a total head loss of 13.8 m (single pump).

Pumps to operate in a duty / assist / standby function

Velocity in PE pipe = 0.97 m/s

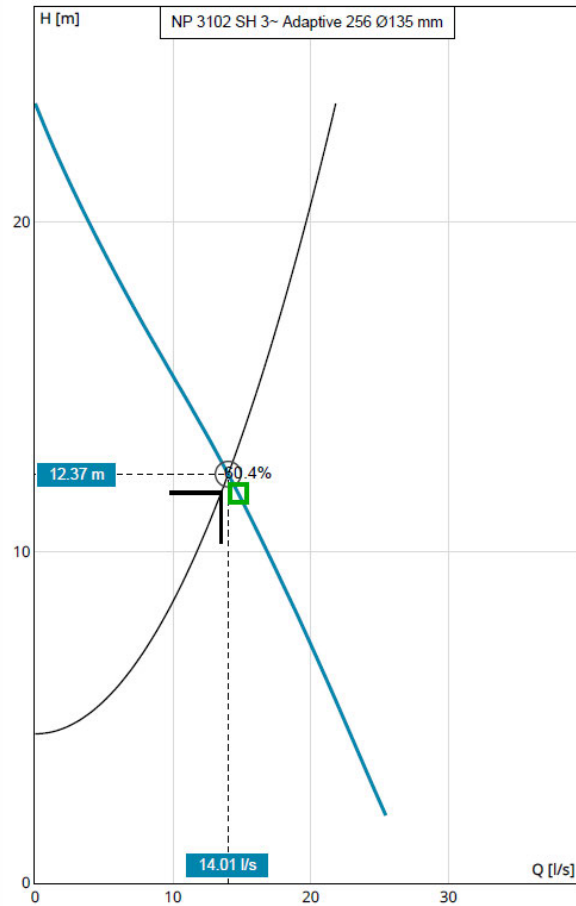


Option 2 $K = 0.5$

Flygt NP3102 - Flow rate = 14 l/s with a total head loss of 12.37 m (single pump).

Pumps to operate in a duty / assist / standby function

Velocity in PE pipe = 1.05 m/s



1.2.3 Pump Operational Levels

The operational levels will be set as follows (dimensions taken from floor of wet-well) :

Set point		Description	Control function
Value	Unit		
300mm	5.2 %	Low Level Alarm	Stops both pumps/ alarms
350 mm	6.1%	Duty/ Standby Pump OFF	Stops Duty and Standby pump
800 mm	13.9%	Duty Pump ON	Starts duty pump
900 mm	15.6 %	Assist Pump ON	Assist Pump ON
1200 mm	20.8%	Hi Level Alarm	Hi Level alarm activated

250 mm		Stop Both Pumps - Float Switch	Stop Both Pumps
900 mm		Start Duty Pump – Float Switch	Start Duty Pump
1000 mm		Start Assist Pump – Float Switch	Start Assist Pump
1500 mm		Critical High Alarm – Float Switch	Critical High Alarm

1.2.4 Pump Stop/Start Calculations

Expected daily flow:	132000	litres
Infiltration (l/day)	0	litres
SWI (l/day)	0	litres
Peaking factor :	3	
ADDWF	1.53	l/s
PDDWF	3.82	l/s
PWWF	6.72	l/s
Pump Station diameter	1.8	m
Pump station depth (total)	5.55	m
Pump station depth (effective)	4.55	m
Volume (effective)	11.57	m ³
Pump Stop Level	0.4	m
Pump Start Level	1	m
Volume to pump:	1526	litres
Discharge rate:	14	l/s
Time to empty: (PDDWF)	2.5	minutes
Time to empty: (PWWF)	3.5	minutes
Time to fill (PDDWF)	6.7	minutes
Time to fill (PWWF)	3.8	minutes
No starts/ hour (PDDWF)	6.6	
No starts/ hour (PWWF)	8.2	
No starts per pump (PDDWF)	3.3	
No starts per pump (PWWF)	4.1	
Max Start/Hour permissible	15	Okay

1.3 Pipework, Valves and Fittings

Discharge connection:	100 mm diameter flange coupler
Inlet and outlets:	the inlet pipe to be installed on site and sealed by the drainage contractor. The outlet pipe is pre-installed in the factory.
Discharge pipework:	Includes a non-return valve, dismantling joint and an isolation valve.
Lifting chains:	a stainless steel chain is connected from the pump to the underside of the chamber for ease of pump removal if required.
Materials:	All pipework will be 100mm 316 Stainless steel Schedule 40 and will be manufactured to the relevant AUS/ NZ Standards
Guide rails:	Stainless steel

1.4 Access lids

Steel access lids (1200 x 900mm) will be supplied as per the RITS design

1.5 Magflow metre

An ABB ProcessMaster DN100 is included installed in a 1500mm diameter manhole

1.6 Level Sensors

1 off – ABB Black Box Hydrostatic level sensor

4 off – Flygt ENM10 float switches for Low level, duty pump operation, standby pump operation, and High-level alarm

1.7 Electrical & Controls

This controller is designed on the latest 2023 HCC drawings which are quite different to their previous standards. Any comparison to a competing proposal should ensure that the same standards have been used in the pricing.

This allows for the design, including production of electrical drawings, build and factory acceptance testing (FAT) of the pump station controller.

The design will include::

- 1 x Allen Bradley Micro800 PLC and IO modules as per their standard design.
- 1 x programming of Allen Bradley PLC.
- 1 x Trio Radio unit for communicating to HCC's SCADA system.
- 1 x battery backup for communication and PLC 24VDC circuits.
- 1 x supply of aerial for radio communication to base station.
- 2 x DOL starting configuration with overload and short circuit protection as per HCC standards, for each pump.
- 2 x current transducers and amp meters.
- 2 x capacitors for power factor correction.
- 1 x phase failure relay with output to PLC.
- 1 x surge divertor with output to PLC.
- 1 x level indicator input.
- 1 x flow indicator input.
- 22mm dia push buttons and selector switches for pump circuitry and control.
- Cabinet door switches and internal lights.
- Anticondensation heaters for cabinet.
- 2 x isolation switches for the pumps.
- 1 x Cubic internal panel. Note this differs to the HCC drawing but is of an equal or better quality to the Bremca 250 series panel.
- 1 x generator connection with interlocked mains/generator breakers.
- RCD protected service plugs mounted within cabinet.
- 1 x painted aluminium pillar box approximately 1.95 x 1.525 x 0.5m (l x h x d) with multiple door access, and internal panels.
- 1 x full CAD drawings.

We have not allowed for any of the following:

- Supply of any boosting to the radio signal if the standard Trio radio unit and standard aerial is insufficient.
- Supply of any site metering although space left in cabinet for a smart meter.
- Any civil works including construction of plinth for controller to mount to.

- Any on site installation including running of cable to and from controller, or mounting revenue meter (if required), or installing any on site lighting, installing the aerial or aerial base. It is suggested the site electricians are engaged to do this where required.

1.8 Odour Control System

This has been excluded as per RITS standards. See section 5.3.7.16 RITS.

1.9 Protective lining

The wet-well including the underside of the lid will be lined with Blue-seal HDPE lining for sulphuric acid resistance (see Appendices)

1.10 Well-washer

A McBerns well washer has been specified by RITS – see appendices for details

A sprinkler system using BETE nozzles has been included in the storage tanks to RITS design

1.11 RPZ Cabinet

A steel cabinet to RITS design has been included along with an RPZ standpipe and two off solenoid valves for the well washer and sprinkler system

1.12 Inlet valve

A 225mm diameter knife-gate valve will be installed on the inlet pipe in to the wetwell. This includes a spindle to the underside of the lid

2 Construction

The pump station has been design using reinforced precast concrete components. The system will be fabricated off site and delivered to site ready for installation. The tank will have a 14,200 litre capacity and a total depth of 5.75 m.

The pump stations will be delivered to site in a kit-set format and will need to be installed in the ground by the drainage contractor.

The construction and commissioning of the Aquate pump station will then be completed by a trained Hynds Environmental Construction Technician.

3 Safety in Design

This pump station has been designed to minimise any risk to operators and service personnel.

Access into the pump station should not be required for ongoing maintenance as almost all servicing work can be completed from ground level. The main components can be accessed as follows:

- Pumps – these can be removed from the pump station by lifting them up out of the wet-well and inspecting above ground. Note : the pumps weight 105 kg each.
- Floats – can be lifted from the connection points in the access hole in the lid.
- Non-return valves/Isolation valves –can be access from ground level without the need to enter the chamber
- Venting will be required and will need to be installed on site. The access lids are air-tight.

Risk register

The risk register is a live document which requires continuous monitoring updating. This will need to be completed by the maintenance company for the pump station. The items below are a guide only. The safety and design and Hazops workshops have encompassed risks for normal operation of the vacuum wastewater pump station. Specific risks for the maintenance process are outlined below.

Risk matrix

			Consequence / potential severity				
			Minimal Non-injury or First Aid injury (FAI)	Minor Medical treatment injury	Moderate Medical treatment injury, with lost time (LTI)	Major Injury requiring hospital-/notifiable event	Catastrophic Fatality or multiple fatalities
Likelihood	Very high	Almost certain: Commonly occurs	3: Medium	4: High	4: High	5: Very high	5: Very high
	High	Likely: Could easily happen	2: Low	3: Medium	4: High	4: High	5: Very high
	Medium	Possible: Could happen or has been known to happen	2: Low	2: Low	3: Medium	4: High	4: High
	Low	Unlikely: Hasn't happened yet but could happen	1: Very Low	2: Low	3: Medium	3: Medium	4: High
	Very low	Rare: Very unlikely but could happen in exceptional circumstances	1: Very Low	2: Low	2: Low	3: Medium	4: High

	Hazards <i>(one per line)</i>		Hazard controls – what do we need to do to make it safe?	
What are we doing? <i>(step by step)</i>	What could cause harm?	Existing risk level <i>(use risk matrix)</i>	Eliminate/ Controls	Residual risk level
Wet-well inspection	The wet-well is classified as a confined space, an inspection is required prior to wet commissioning.	3	Elimination: The vessel will be isolated from the system at all exit points and inspected from the access hole in the lid . Isolate/Engineering Controls/PPE: Entry will only be required if debris is identified and cannot be removed by any other means. Entry to the vessel should follow confined space protocols, including ensuring all persons involved have the required training, admin and PPE controls.	1 1
Sewage Pump Testing	The wet well will be filled up for wet testing. This is a potential drowning hazard.	3	Elimination Barriers around the access hatch to be erected so no one can enter the wet-well. Engineering Controls/PPE: All essential persons to wear appropriate protection. Sewage pump shall only operate when required for wet testing..	1 1
Removing lids for access	Traffic moving through area Back strain	3 2	Isolate/Engineering Controls/PPE: Place cones around service area so vehicles cannot enter site Engineering Controls/PPE – use appropriate lifting equipment if lifting pumps / lids on site	
Removing pumps	This is a falling hazard	4	Elimination Barriers around the access hatch to be erected so no one can enter the wet-well.	
Electrical checks	Electrical shock	3	Engineering Controls/PPE: Only fully certified electricians to complete electrical work	

4 Warrantees

Aquate guarantees the performance and quality of its pump stations provided:

- The product is only used for the intended purposes as stated in the quote
- The control panel and pump station is correctly installed and commissioned by a suitable installer
- The fault is due to a defect in design, materials or workmanship
- The fault is reported to an Aquate agent or representative during the guarantee period
- No pump station components have been replaced by alternative products
- This guarantee does not cover faults resulting from misuse of the system, blockages or breakdowns caused by the introduction of inappropriate materials into the system, incorrect electrical installation of the control unit, deficient maintenance or normal wear and tear.

Aquate assumes no liability for bodily harm, property damage or economic losses as a result of its pump stations.

4.1 Pumps

The pumps come with a 12 month year warranty against faulty components and/or workmanship. If prohibited substances are introduced to the system causing the pump to block and burn out, the warranty is null and void.

Flygt undertakes to remedy faults in products sold by Flygt provided that:

- The fault is due to defects in design, materials or workmanship;
- The fault is reported to a Flygt representative during the guarantee period;
- The product is used only under conditions described in the care and maintenance instructions and in applications for which it is intended;
- The monitoring equipment incorporated in the product is correctly connected;
- All service and repair work is done by a workshop authorized by Flygt or the original manufacturer;
- Genuine manufacturer's parts are used
- Storage should be in accordance with the care and maintenance manual.
- The equipment is operated and maintained in accordance with the Operation and Care and Maintenance Manual.

Failure to comply with these requirements will render warranty void unless, due to the nature of the warranty claim, such voiding of warranty is prevented by law, regulation, act and/or ordinance.

Hence, the guarantee does not cover faults caused by deficient maintenance, abuse, incorrectly executed repair work or normal wear and tear.

5 Maintenance schedule

A certain amount of system maintenance is required on an ongoing basis to ensure that the system is working correctly. This is the responsibility of the owner

5.1 Six monthly

The following procedures should be completed every six months:

- The pumping station should be inspected to check the build-up of grease and fat particularly on the float switches and pumps. They may need to be withdrawn for cleaning.
- Visually inspect the pump station walls and hose down if necessary
- Ensure the pump station access lid is securely fastened and bolted down.
- Lift the pumps and inspect for any damage or blockages around the impellers
- Lift the floats and test the alarm system/pump operation
- Consult with the electrical control supplier for additional checks

5.2 Annually

The following procedures should be completed at least once every 12 months:

- The pumping station should be inspected to check the build-up of grease and fat particularly on the float switches and pumps. They may need to be withdrawn for cleaning.
- Visually inspect the pump station walls and hose down if necessary
- Lift the floats and test the alarm system/pump operation
- Press the mute button (audio alarms only) to check the audio alarm turns off.
- Visually check the pump station for any structural damage to the tank and pipework
- Ensure the pump station access lid is securely fastened and bolted down.
- Lift the pumps and inspect for any damage or blockages around the impellers
- Have the pump station sucked out to remove any debris/stones if necessary

5.3 Maintenance requirements

The pump maintenance and repair operations must be carried out by workers authorised by the manufacturer; Failure to comply with these instructions will result in forfeiture of the warranty and jeopardise the unit's safety.

Before any cleaning and/ or maintenance operations are carried out on the electric pump, the power supply must be switched off.

To disconnect the submersible electric pump from the electricity mains, first disconnect the phase conductors, then the yellow –green earth wires.

Use the special handle to remove the submersible electric pump from the tank.

ATTENTION: Before carrying out any operations, check the pump temperature. Only work on the pump when it is at room temperature.

Clean the electric pump thoroughly, using a jet of water or specific products to clean all its parts. When disposing of the waste material, follow the antipollution rules in force.

Replace any broken or worn parts with original spare parts only.

Given the likelihood that work on the electric pump will be carried out in confined spaces such as vats, wells, cesspools, tanks or cisterns, do not underestimate the risks caused by potentially poisonous exhalations.

APPENDICES

General Arrangement Drawing – Plan

General Arrangement Drawing – Section

General Arrangement Drawing – Plan with tank

General Arrangement Drawing – Section with tank

Flygt NP3102 SH3 256 Specifications k 1.5

Flygt NP3102 SH3 256 Specifications k 0.5

McBerns well washing brochure

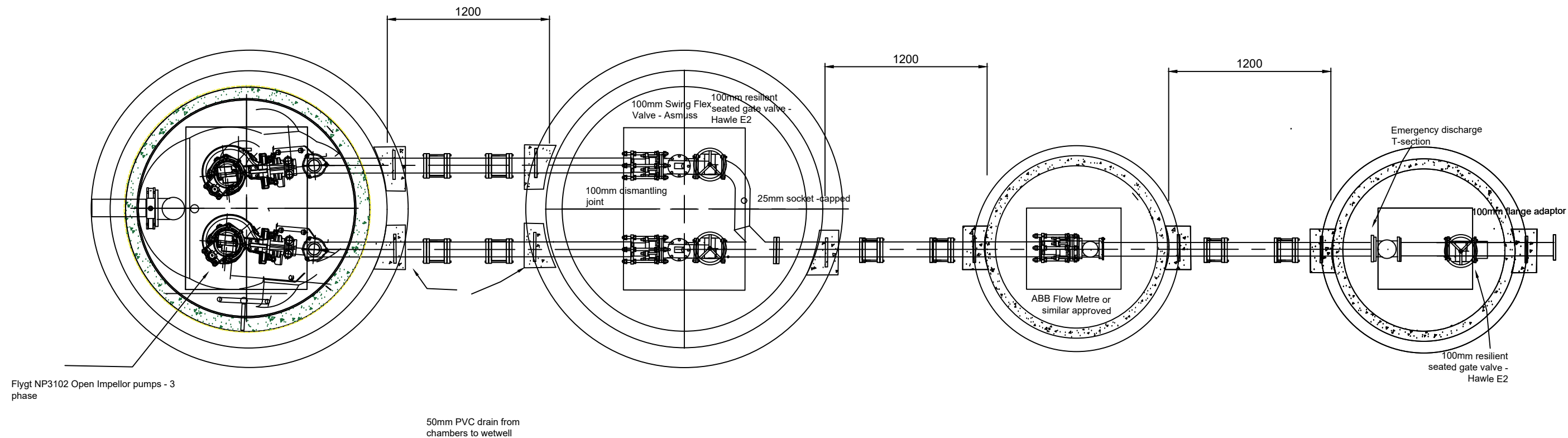
BlueSeal-AKS data sheet

Hyliner HDPE liner – data sheet

ABB Magflow Meter Specifications

ABB Blackbox level sensor specifications

Flygt ENM10 float switch specifications



NOTES:

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REVISIONS

REV #	REVISION DESCRIPTION	DATE	DRAWN
A	Preliminary design	21/5/26	PC

PO Box 58142, Botany, Auckland, 2316
Tel: 09-274 0316
Fax: 09-272 7485
email: hwvsupport@hynds.co.nz

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ISO 9001 CERTIFIED MANAGEMENT SYSTEM



PROJECT:

Southern Links Residential
Hamilton
Wastewater Pump Station WWPS-B

DRAWING TITLE:

Plan View

REFERENCE/QUOTE NUMBER:

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PAPER SIZE: A3

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AQ2283A 1

AQ2283A

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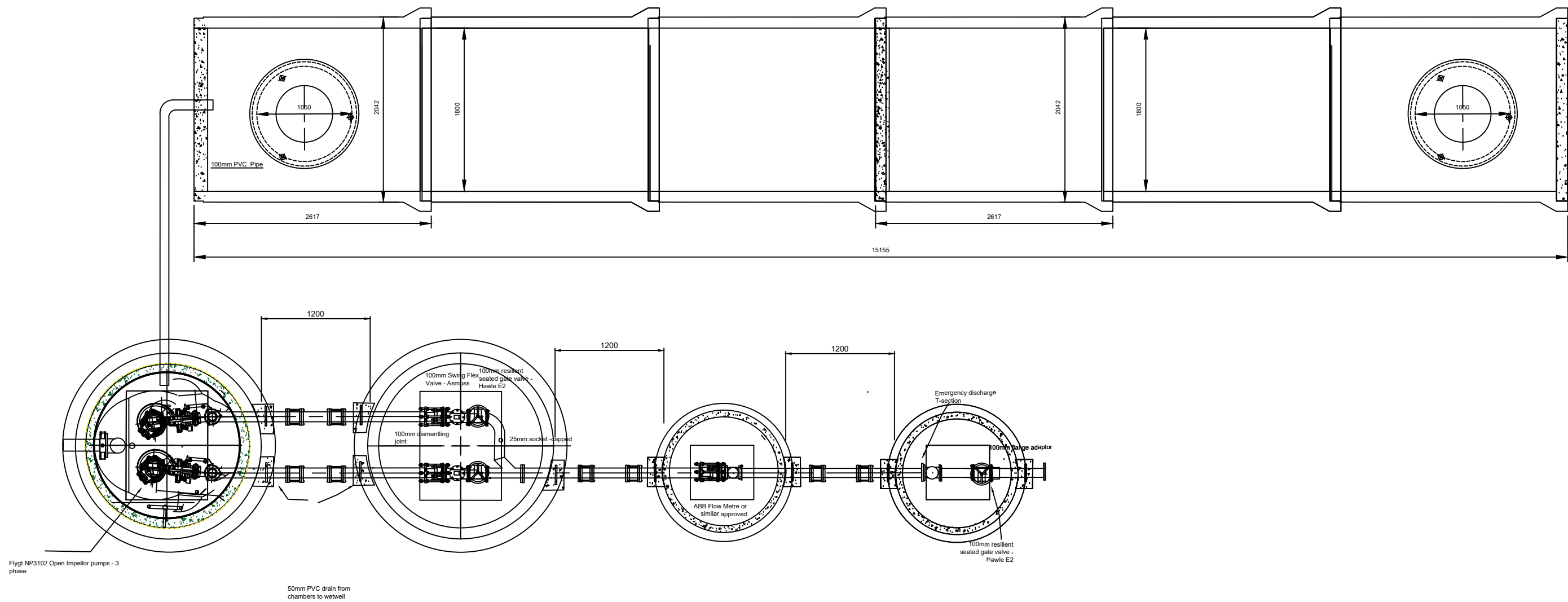
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of 4

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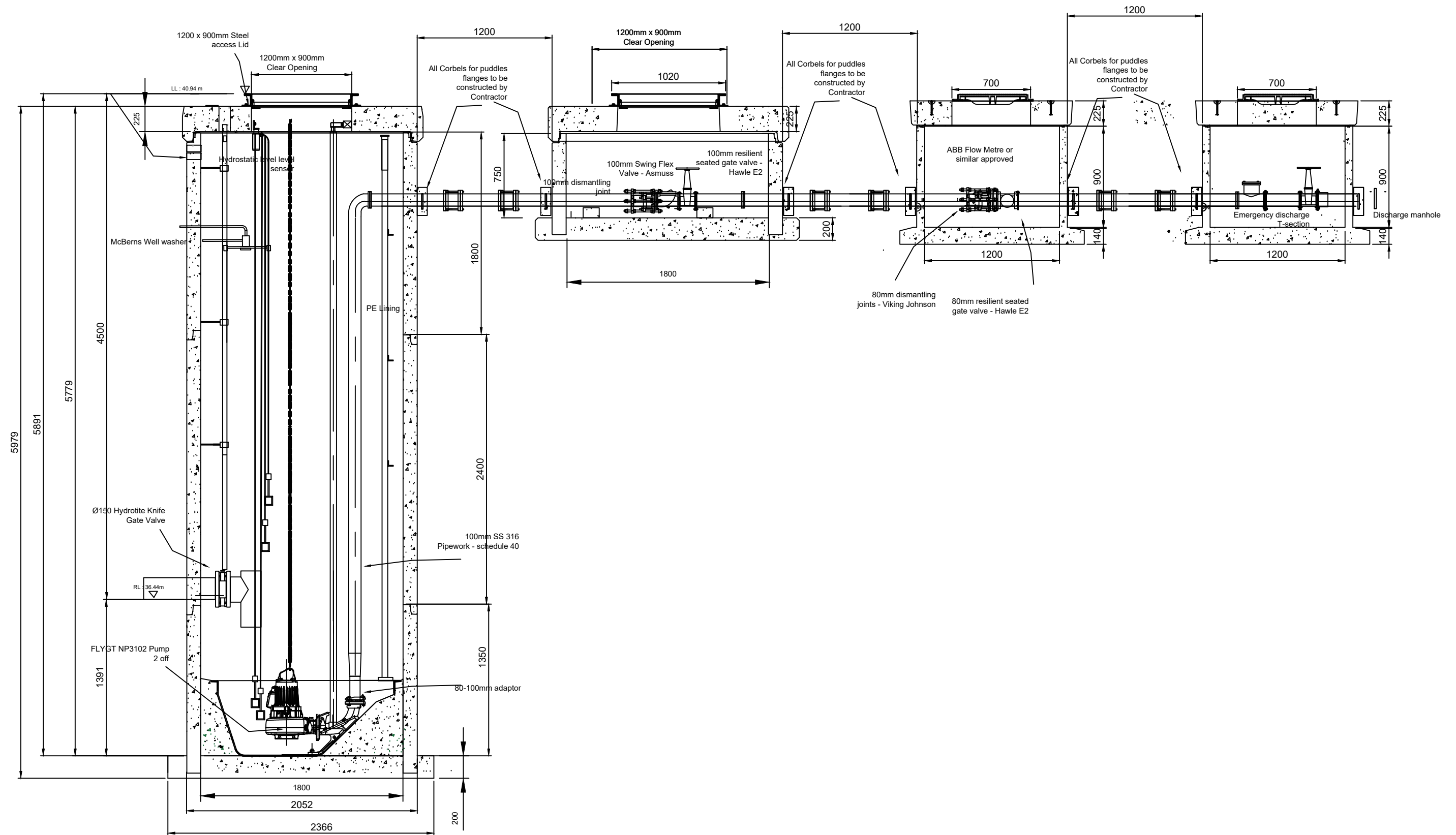
PROJECT:

Southern Links Residential
Hamilton
Wastewater Pump Station WWPS-B

DRAWING TITLE:

Plan View with tank

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ISO 9001 CERTIFIED MANAGEMENT SYSTEM



PROJECT:

Southern Links Residential
Hamilton
Wastewater Pump Station WWPS-B

DRAWING TITLE:

Section View

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AQ2283A

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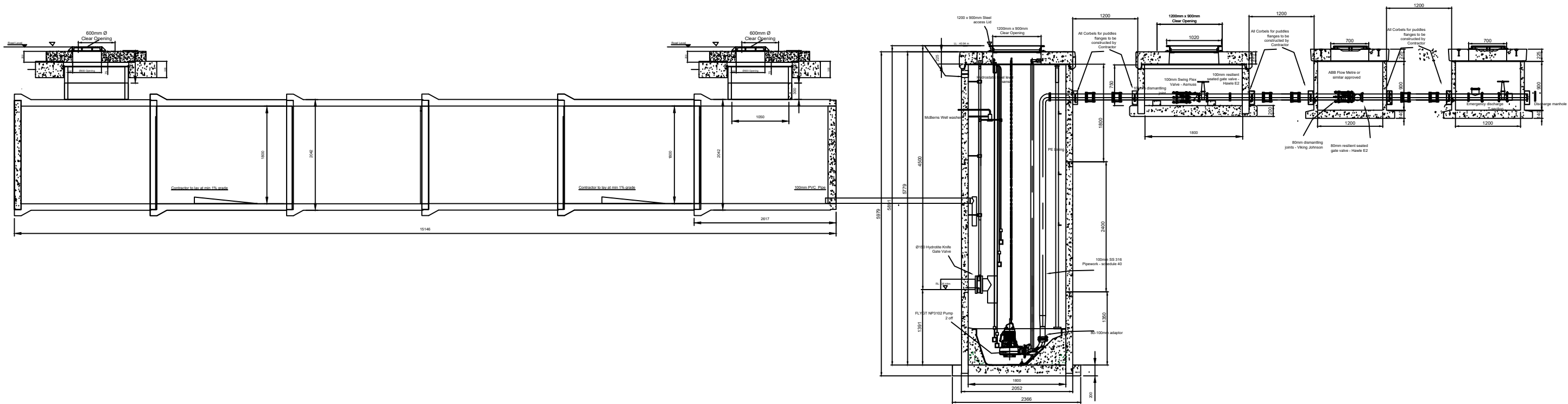
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21/5/26

DRAWING NUMBER:
AQ2283A 3

SHEET NUMBER:
of 4

REVISION NUMBER:
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ISO 9001 CERTIFIED MANAGEMENT SYSTEM

PROJECT:

Southern Links Residential
Hamilton
Wastewater Pump Station WWPS-B

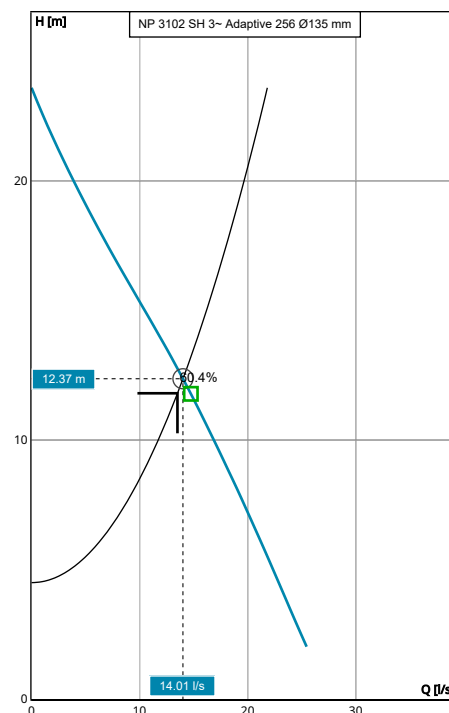
DRAWING TITLE:
Section View with tank

REFERENCE/QUOTE NUMBER:		AQ2283A	
DRAWN: PC	DESIGN: PC	CHECKED: JB	
SIGNATURE:	SIGNATURE:	SIGNATURE:	
SCALE: As Shown	Note: Do not scale drawing if in doubt ASK!!!	DATE:	
PAPER SIZE: A3		21/5/26	
DRAWING NUMBER:	SHEET NUMBER:	REVISION NUMBER:	
AQ2283A 4	of 4	A	

NP 3102 SH 3~ Adaptive 256 | Configuration Summary



Flygt's self-cleaning non-clog N-pumps feature innovative designs and functions that deliver high sustained efficiency and the most reliable operation. This makes them the most reliable choice available for a broad range of wastewater applications for tough applications such as unscreened sewage, wastewater and sludge up to an 8 percent solids concentration. Impeller material available in Hardened cast Iron, Hard Iron and Stainless Steel to fit any wastewater application.



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

GENERAL

Explosion Proof	Impeller Diameter
No	135 mm
Max. Pumped Media Temp.	
40 °C	

MATERIAL AND COATING

Impeller Material	Stator Cover Material
Hard-Iron	Grey Cast Iron
Volute Material	
Grey Cast Iron	

MOTOR

Rated Voltage	Motor Efficiency Class
400 V	Standard
Coupling	Rated Power
Y	4.2 kW

INSTALLATION

Installation Type
P - Semi-Permanent, Wet

NP 3102 SH 3~ Adaptive 256 | Product Details

Description

N 3102

Wastewater N-Technology Pump With Adaptive N® Impeller

Flygt N-pumps take on the toughest applications and get the job done. Every component is designed and manufactured to deliver sustained high efficiency. Thanks to patented N-technology with its innovative self-cleaning impeller, Flygt N-pumps deliver the highest total efficiency. They lower your energy bill and reduce unplanned maintenance costs. That adds up to total peace of mind – and big savings over the long term. Most solid objects entering the pump will pass through the impeller between the impeller vanes. If an object gets caught on the leading edge of one of the vanes, it will slide along the backswept shape towards the perimeter of the inlet. Due to the mechanical self-cleaning design, a sludge concentration up to 8% can easily be pumped.

Flexible and Modular Design

- This self-cleaning pump features innovative functions that make it the best choice for a broad range of applications. The modular hydraulic design enables you to tailor the hydraulics to meet the requirements of virtually any application.
- Replaceable wear ring in two materials, gray iron or Hard-Iron, for different operation conditions
- Hardened gray iron impeller for typical wastewater applications
- Hard-Iron impeller for abrasive and corrosive applications
- Stainless steel impeller for special applications that require duplex stainless steel
- Short shaft overhang reduces shaft deflection and increases seal and bearing life
- Motor designed for submersible use. Heat is concentrated to the stator core for improved cooling properties
- The double mechanical seal system consists of two sets of mechanical shaft seals that work independently to provide double security. Available in Tungsten carbide (WCCR) or Silicone carbide (SiC) depending on pumped media.
- Griploc mechanical face seal system secures locking to the shaft, no rubber friction, no grub screws and no shaft damage
- Motor cable SUBCAB ® specially developed for submersible use.

Product Features

- Sustained high efficiency
- Hardened cast iron, optional Duplex stainless steel and Hard-Iron impellers
- State-of-the-art wastewater pump with enhanced Adaptive N® hydraulic
- Sustained high efficiency with energy savings up to 25%
- Flexible and modular design
- Robust and reliable

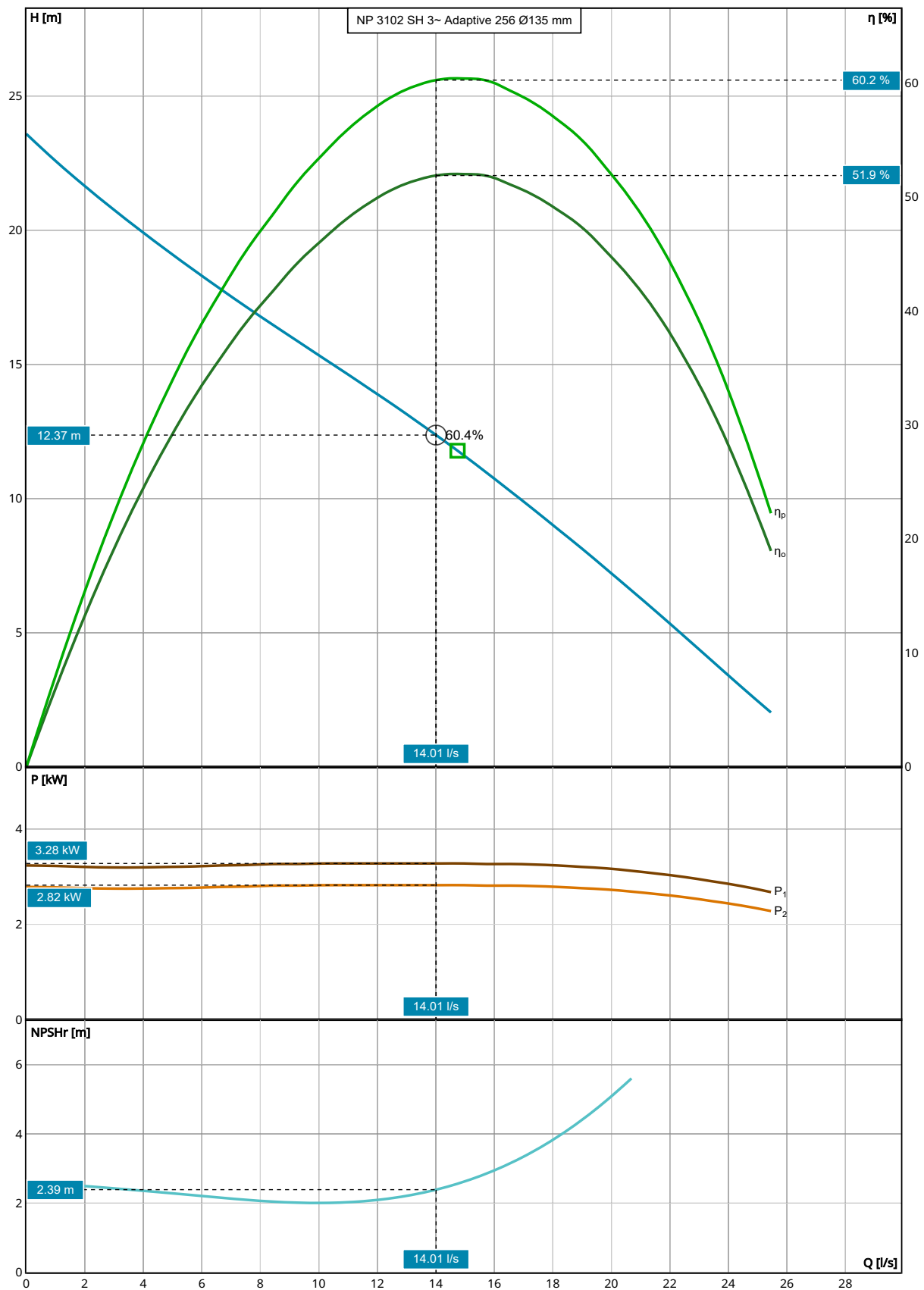
Construction Materials

Impeller Material	Volute Material	Stator Cover Material
Hard-Iron	Grey Cast Iron	Grey Cast Iron

Motor

Rated Power	Number Of Phases	Start Current Ratio	Motor Issue
4.2 kW	3	8.63	19
Motor Denomination	Rated Motor Speed	Insulation Class	Locked Rotor Code
18-10-2AL	2,905 RPM	H	K
Motor Efficiency Class	Rated Voltage	Approval	Max starts per hour
Standard	400 V	STD	30
Version Code	Rated Current	Total moment of inertia	Power Factor 100%
060	7.9 A	0.01 kgm ²	0.9
Frequency	Start Current	Type of duty	Power Factor 75%
50 Hz	68 A	S1	0.86
Max P2 (1x)	Starting Current, Direct Starting	Stator Variant	Power Factor 50%
2.82 kW	68 A	62	0.78
Number Of Poles	Starting Current, Star Delta	Motor Module	Efficiency 100%
2	22.67 A	150	85.9 %
			Efficiency 75%
			86.4 %
			Efficiency 50%
			85.4 %

NP 3102 SH 3~ Adaptive 256 | Hydraulic Data & Performance Curve



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

Selection

Series	Curve Code
N 3000	256
Name	Impeller Diameter
NP 3102 SH 3~ Adaptive 256	135 mm
Frequency	Inlet Diameter
50 Hz	100 mm
Total Flow	Outlet Diameter
13.5 l/s	80 mm
Total Head	Number Of Vanes
11.81 m	2
Pump Flow	
13.5 l/s	
Pump Head	
11.81 m	
System Type	
Single Pump	
Operating Pumps	
1	
Standby Pumps	
No Standby Pump	

Design Point

Flow	Shaft power (P2)
14.01 l/s	2.82 kW
Head	NPSHR
12.37 m	2.39 m
Overall Efficiency (η_o)	Speed
51.87 %	2,940 RPM
Pump Efficiency (η_p)	Static Head
60.24 %	4.5 m
Input Power (P1)	Flow To BEP Ratio
3.28 kW	95.02 %

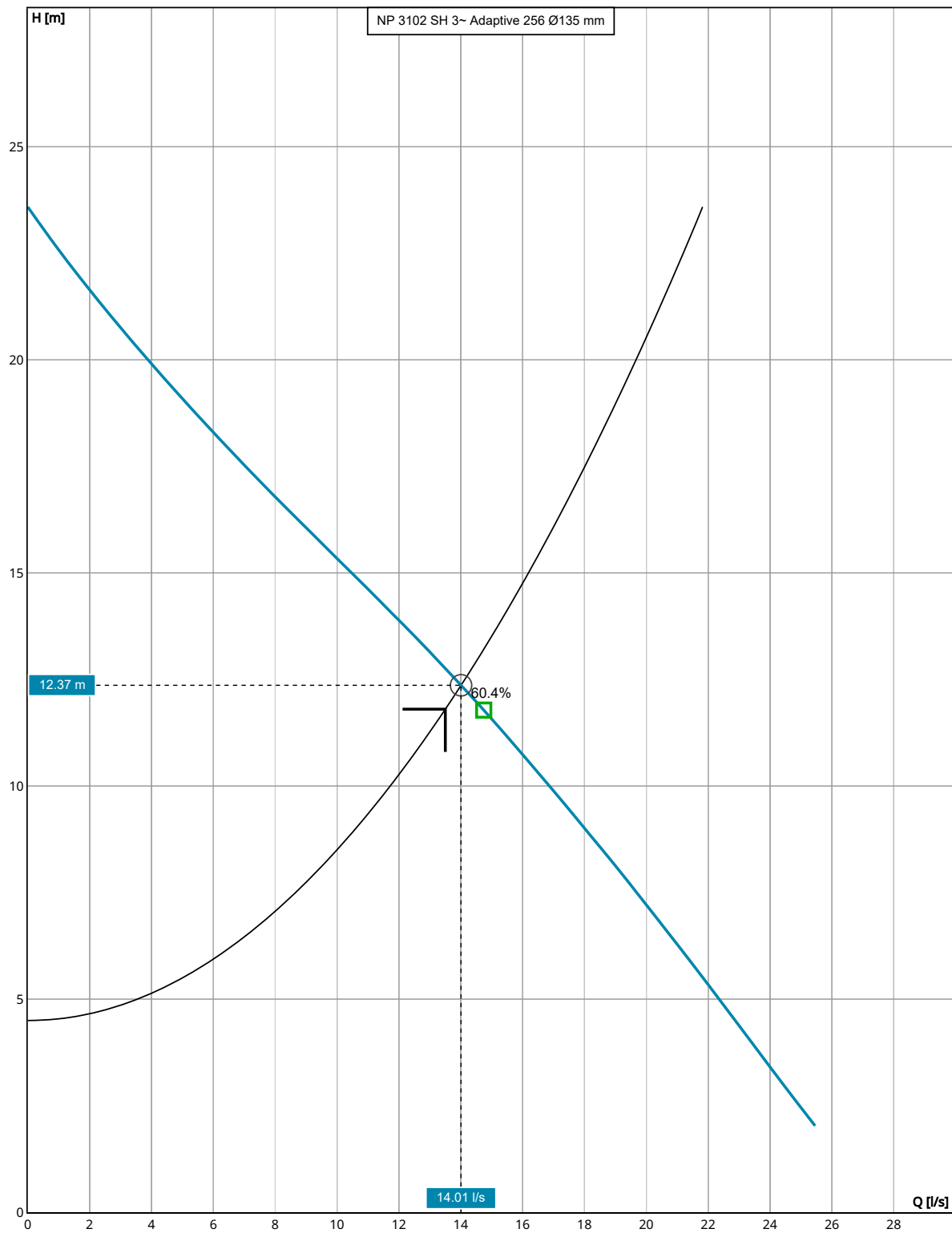
Fluid and Operating Conditions

Fluid Type	Density
Water	1,000 kg/m ³
Fluid Temperature	Dynamic Viscosity
4 °C	0.002 Pa·s
Specific Gravity	Fluid Vapor Pressure
1	8.14 mbar
	Atmospheric Pressure
	1,013.53 mbar
	Elevation
	0 m
	Ambient Temperature
	20 °C
	NPSH Available
	10.27 m
	Submergence
	0 m

Design Curve

Rated Speed	BEP Flow
50 Hz	14.74 l/s
Max Flow	BEP Head
25.45 l/s	11.78 m
H@QMin	Max P2
23.59 m	2.82 kW
H@QMax	Specific Energy
2.03 m	0.06 kWh/m ³
BEP	
60.38 %	

NP 3102 SH 3~ Adaptive 256 | Duty Analysis

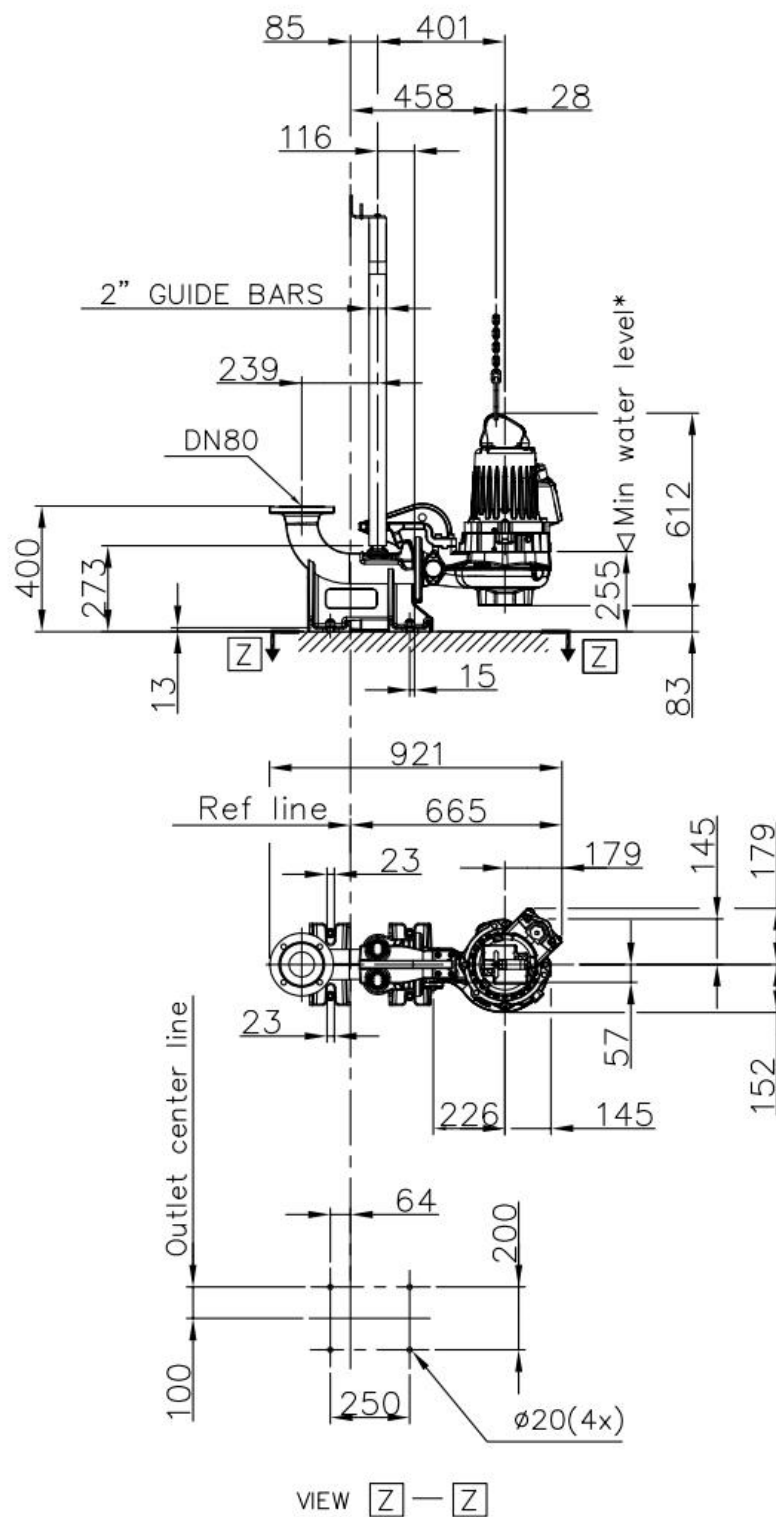


Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

Name	Q (1x) [l/s]	H (1x) [m]	P2 (1x) [kW]	Q [l/s]	H [m]	P2 [kW]	η_p [%]	SE [kWh/m ³]	NPSHr [m]
DP @ 1x	14.01	12.37	2.82	14.01	12.37	2.82	60.24	0.06	2.39

NP 3102 SH 3~ Adaptive 256 | Dimensional Data & Drawing



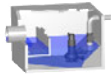
* Consult the IOM for more info.

Weight	Pump	Stand
kg	105	35
Discharge outlet DN 80	Scale	Date
Pump outlet DN 80	1:20	250407
Pump inlet	Drawing number	Revision
Suction inlet	5385500	14



NP 3102 SH
060,070,160,190,900,910,920,930

NP 3102 SH 3~ Adaptive 256 | Headloss Calculation



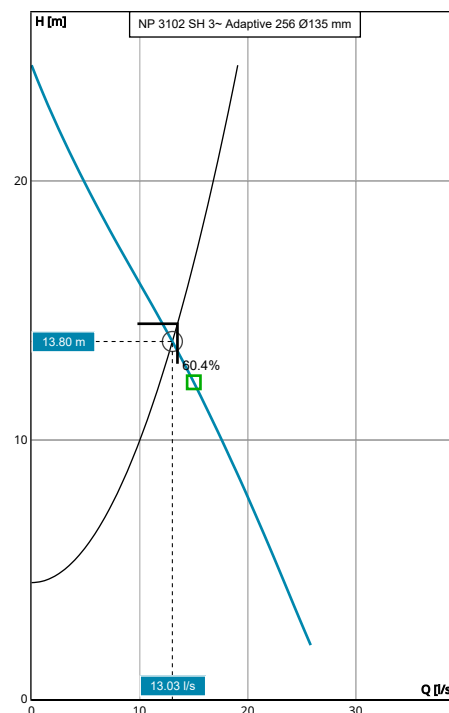
Fluid Type	Total Flow	Kinematic Viscosity
Water	13.5 l/s	0.000002 m ² /s
Static Head	Operating Pumps	System Type
4.5 m	1	Single Pump
Layout	Calculation Model	
Wet Installed Submersible Pumps	Colebrook-White	

Type	Pipe Inner Diameter [mm]	Length / K Factor	Quantity	Velocity [m/s]	Pipe Roughness [mm]	Headloss [m]
Individual Discharge Piping / Wetwell SS / Stainless steel / PN 10 / DN 100 (104x2.0 mm) / New Pipes						
Pipe Length	100 mm	15 m	1	1.72 m/s	0.5 mm	0.71 m
90 Elbow	100 mm	0.3	1	1.72 m/s		0.05 m
Tee Line →  →	100 mm	0.1	1	1.72 m/s		0.02 m
Check Valve	100 mm	0.9	1	1.72 m/s		0.14 m
Gate Valve	100 mm	0.2	1	1.72 m/s		0.03 m
Total Head						0.93 m
Individual Discharge Piping / Rising main / PE100 (HDPE) PE 4710 / SDR 11 (PN 16) / DN 150 (160x14.6 mm) / New Pipes						
Pipe Length	130.8 mm	552 m	1	1 m/s	0.5 mm	6.37 m
Total Head						6.37 m
Friction Loss Head						7.31 m
Static Head						4.5 m
Total Head						11.81 m

NP 3102 SH 3~ Adaptive 256 | Configuration Summary



Flygt's self-cleaning non-clog N-pumps feature innovative designs and functions that deliver high sustained efficiency and the most reliable operation. This makes them the most reliable choice available for a broad range of wastewater applications for tough applications such as unscreened sewage, wastewater and sludge up to an 8 percent solids concentration. Impeller material available in Hardened cast Iron, Hard Iron and Stainless Steel to fit any wastewater application.



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

GENERAL

Explosion Proof	Impeller Diameter
No	135 mm
Max. Pumped Media Temp.	
40 °C	

MATERIAL AND COATING

Impeller Material	Stator Cover Material
Hard-Iron	Grey Cast Iron
Volute Material	
Grey Cast Iron	

MOTOR

Rated Voltage	Motor Efficiency Class
400 V	Premium (IE3)
Coupling	Rated Power
Y	4.5 kW

INSTALLATION

Installation Type
P - Semi-Permanent, Wet

NP 3102 SH 3~ Adaptive 256 | Product Details

Description

N 3102

Wastewater N-Technology Pump With Adaptive N® Impeller

Flygt N-pumps take on the toughest applications and get the job done. Every component is designed and manufactured to deliver sustained high efficiency. Thanks to patented N-technology with its innovative self-cleaning impeller, Flygt N-pumps deliver the highest total efficiency. They lower your energy bill and reduce unplanned maintenance costs. That adds up to total peace of mind – and big savings over the long term. Most solid objects entering the pump will pass through the impeller between the impeller vanes. If an object gets caught on the leading edge of one of the vanes, it will slide along the backswept shape towards the perimeter of the inlet. Due to the mechanical self-cleaning design, a sludge concentration up to 8% can easily be pumped.

Flexible and Modular Design

- This self-cleaning pump features innovative functions that make it the best choice for a broad range of applications. The modular hydraulic design enables you to tailor the hydraulics to meet the requirements of virtually any application.
- Replaceable wear ring in two materials, gray iron or Hard-Iron, for different operation conditions
- Hardened gray iron impeller for typical wastewater applications
- Hard-Iron impeller for abrasive and corrosive applications
- Stainless steel impeller for special applications that require duplex stainless steel
- Short shaft overhang reduces shaft deflection and increases seal and bearing life
- Motor designed for submersible use. Heat is concentrated to the stator core for improved cooling properties
- The double mechanical seal system consists of two sets of mechanical shaft seals that work independently to provide double security. Available in Tungsten carbide (WCCR) or Silicone carbide (SiC) depending on pumped media.
- Griploc mechanical face seal system secures locking to the shaft, no rubber friction, no grub screws and no shaft damage
- Motor cable SUBCAB ® specially developed for submersible use.

Product Features

- Sustained high efficiency
- Hardened cast iron, optional Duplex stainless steel and Hard-Iron impellers
- State-of-the-art wastewater pump with enhanced Adaptive N® hydraulic
- Sustained high efficiency with energy savings up to 25%
- Flexible and modular design
- Robust and reliable

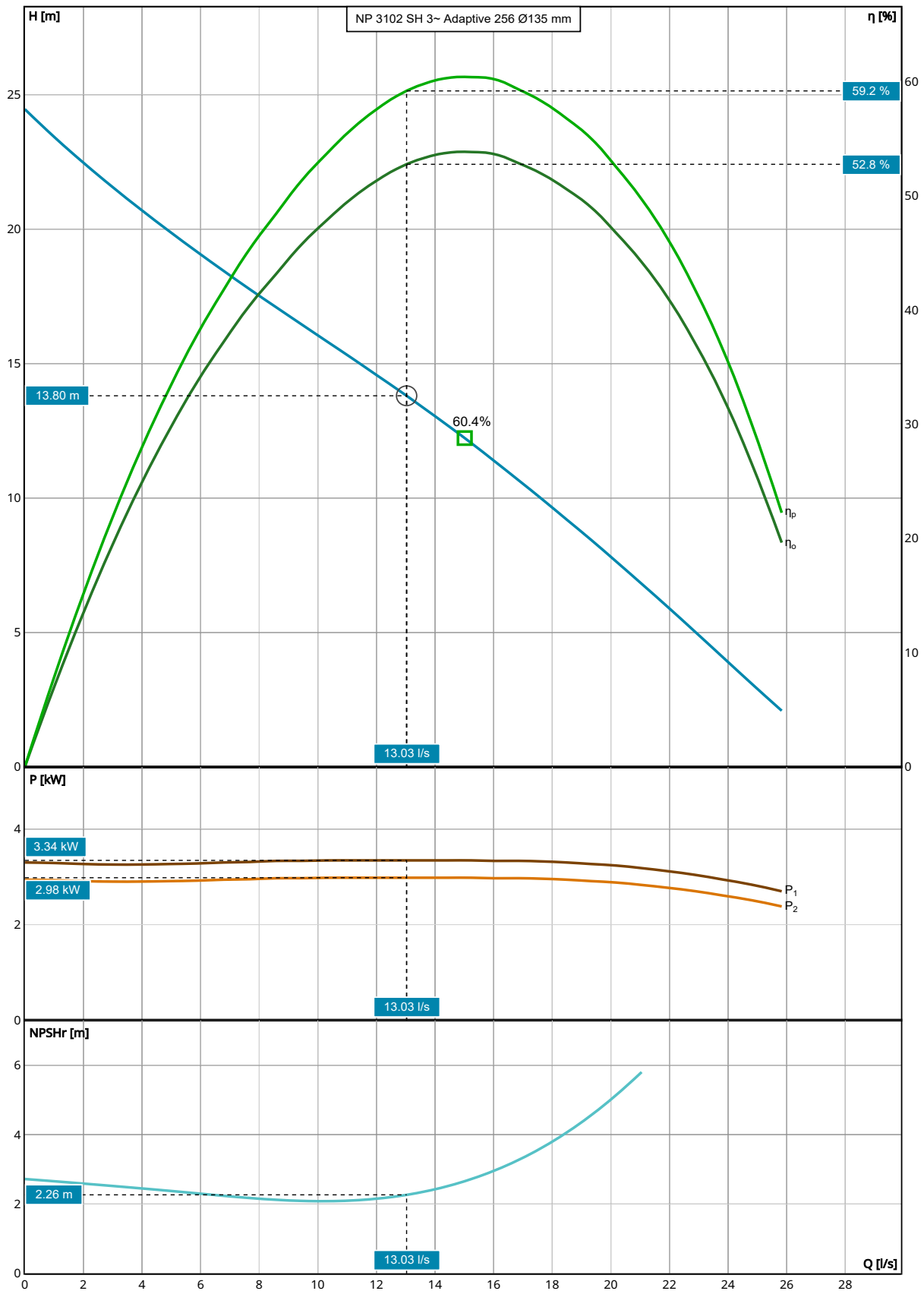
Construction Materials

Impeller Material	Volute Material	Stator Cover Material
Hard-Iron	Grey Cast Iron	Grey Cast Iron

Motor

Rated Power	Number Of Phases	Start Current Ratio	Motor Issue
4.5 kW	3	7.6	10
Motor Denomination	Rated Motor Speed	Insulation Class	Locked Rotor Code
18-10-2AS	3,000 RPM	H	J
Motor Efficiency Class	Rated Voltage	Approval	Max starts per hour
Premium (IE3)	400 V	STD	30
Version Code	Rated Current	Total moment of inertia	Power Factor 100%
920	8.6 A	0.01 kgm ²	0.85
Frequency	Start Current	Type of duty	Power Factor 75%
50 Hz	65 A	S1	0.8
Max P2 (1x)	Starting Current, Direct Starting	Stator Variant	Power Factor 50%
2.98 kW	65 A	62	0.69
Number Of Poles	Starting Current, Star Delta	Motor Module	Efficiency 100%
2	21.67 A	150	89.1 %
			Efficiency 75%
			89.2 %
			Efficiency 50%
			87.6 %

NP 3102 SH 3~ Adaptive 256 | Hydraulic Data & Performance Curve



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

Selection

Series	Curve Code
N 3000	256
Name	Impeller Diameter
NP 3102 SH 3~ Adaptive 256	135 mm
Frequency	Inlet Diameter
50 Hz	100 mm
Total Flow	Outlet Diameter
13.5 l/s	80 mm
Total Head	Number Of Vanes
14.49 m	2
Pump Flow	
13.5 l/s	
Pump Head	
14.49 m	
System Type	
Single Pump	
Operating Pumps	
1	
Standby Pumps	
No Standby Pump	

Design Point

Flow	Shaft power (P2)
13.03 l/s	2.98 kW
Head	NPSHR
13.8 m	2.26 m
Overall Efficiency (η_o)	Speed
52.75 %	3,000 RPM
Pump Efficiency (η_p)	Static Head
59.18 %	4.5 m
Input Power (P1)	Flow To BEP Ratio
3.34 kW	86.79 %

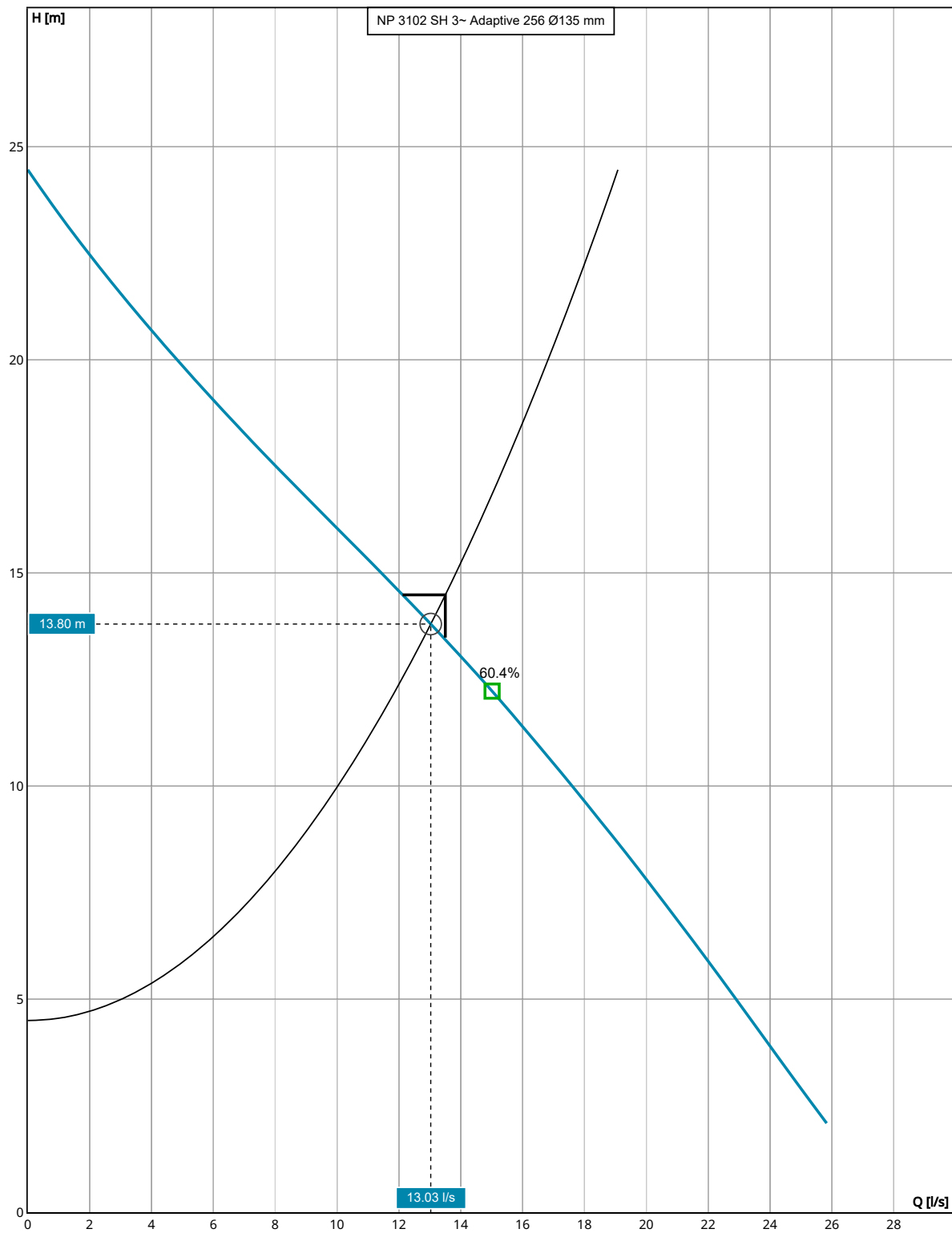
Fluid and Operating Conditions

Fluid Type	Density
Water	1,000 kg/m ³
Fluid Temperature	Dynamic Viscosity
4 °C	0.002 Pa·s
Specific Gravity	Fluid Vapor Pressure
1	8.14 mbar
	Atmospheric Pressure
	1,013.53 mbar
	Elevation
	0 m
	Ambient Temperature
	20 °C
	NPSH Available
	10.27 m
	Submergence
	0 m

Design Curve

Rated Speed	BEP Flow
50 Hz	15.01 l/s
Max Flow	BEP Head
25.83 l/s	12.23 m
H@QMin	Max P2
24.46 m	2.98 kW
H@QMax	Specific Energy
2.09 m	0.07 kWh/m ³
BEP	
60.39 %	

NP 3102 SH 3~ Adaptive 256 | Duty Analysis

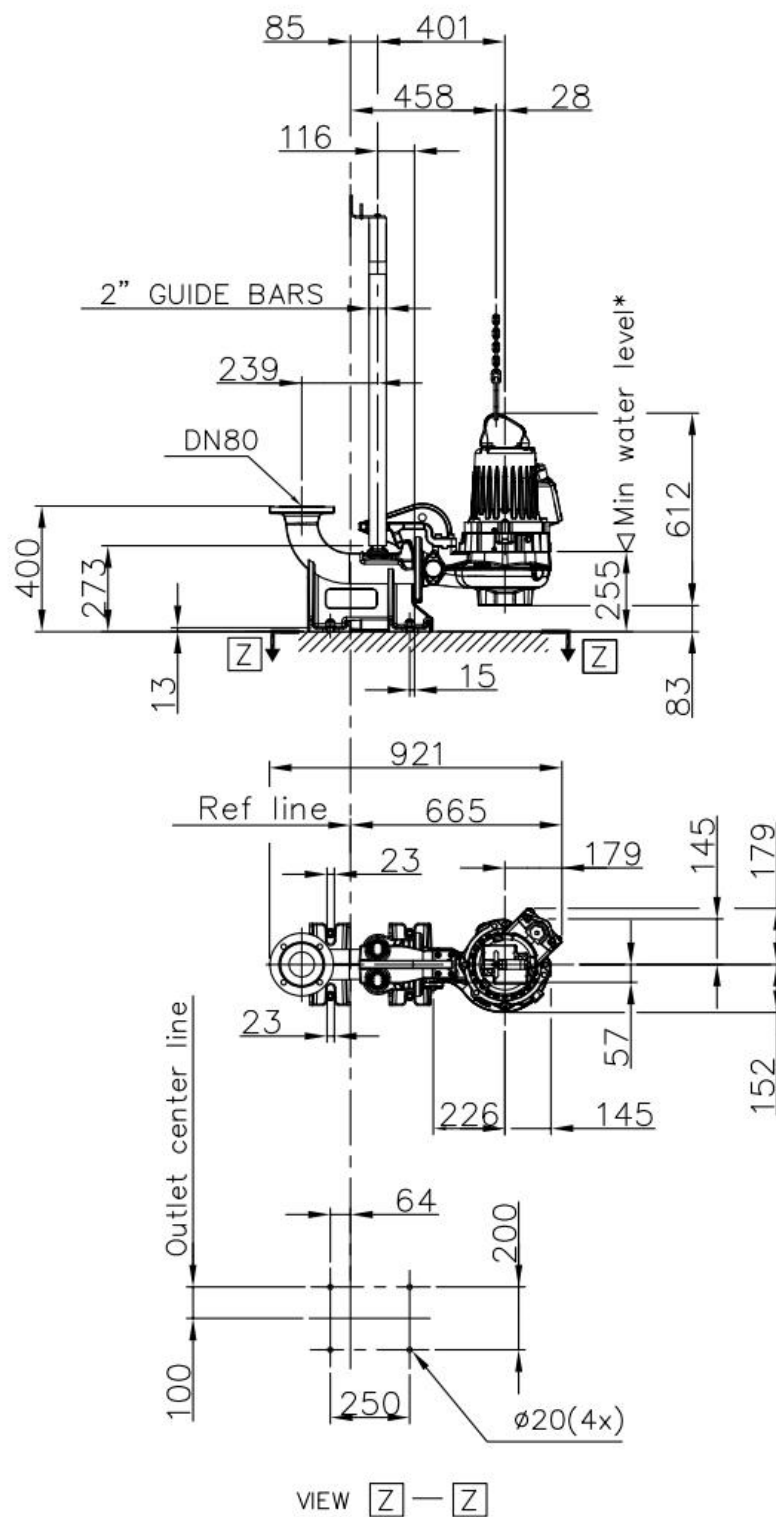


Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for additional performance guarantees.

Name	Q (1x) [l/s]	H (1x) [m]	P2 (1x) [kW]	Q [l/s]	H [m]	P2 [kW]	η_p [%]	SE [kWh/m³]	NPSHr [m]
DP @ 1x	13.03	13.8	2.98	13.03	13.8	2.98	59.18	0.07	2.26

NP 3102 SH 3~ Adaptive 256 | Dimensional Data & Drawing



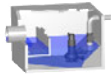
* Consult the IOM for more info.

Weight	Pump	Stand
kg	105	35
Discharge outlet DN 80	Scale	Date
Pump outlet DN 80	1:20	250407
Pump inlet	Drawing number	Revision
Suction inlet	5385500	14



NP 3102 SH
060,070,160,190,900,910,920,930

NP 3102 SH 3~ Adaptive 256 | Headloss Calculation



Fluid Type	Total Flow	Kinematic Viscosity
Water	13.5 l/s	0.000002 m ² /s
Static Head	Operating Pumps	System Type
4.5 m	1	Single Pump
Layout	Calculation Model	
Wet Installed Submersible Pumps	Colebrook-White	

Type	Pipe Inner Diameter [mm]	Length / K Factor	Quantity	Velocity [m/s]	Pipe Roughness [mm]	Headloss [m]
Individual Discharge Piping / Wetwell SS / Stainless steel / PN 10 / DN 100 (104x2.0 mm) / New Pipes						
Pipe Length	100 mm	15 m	1	1.72 m/s	1.5 mm	1 m
90 Elbow	100 mm	0.3	1	1.72 m/s		0.05 m
Tee Line →  →	100 mm	0.1	1	1.72 m/s		0.02 m
Check Valve	100 mm	0.9	1	1.72 m/s		0.14 m
Gate Valve	100 mm	0.2	1	1.72 m/s		0.03 m
Total Head						1.22 m
Individual Discharge Piping / Rising main / PE100 (HDPE) PE 4710 / SDR 11 (PN 16) / DN 150 (160x14.6 mm) / New Pipes						
Pipe Length	130.8 mm	552 m	1	1 m/s	1.5 mm	8.77 m
Total Head						8.77 m
Friction Loss Head						9.99 m
Static Head						4.5 m
Total Head						14.49 m

MCBERNS

INNOVATIVE SOLUTIONS

WELL WASHERS



Why choose a McBerns Well Washer?

- Eliminates fat & grease build up on infrastructure & Walls
- No power required
- Operates with mains pressure water
- Uses less than 100 lts water per/day
- Cleaner level sensor probes
- Reduces overflows caused by fogs
- Reduces odour
- Reduces confined space entries
- Reduces infrastructure corrosion
- Reduces maintenance
- Improved safety at pump stations
- Reduces customer complaints
- Healthier environment
- Optional pre-programmed with 5 cleaning cycle durations

McBerns Well Washers

The Well Washer has been in the Australasian marketplace for 25 years and is still the preferred method in keeping pump stations fat free. The AutoWellWasher™ will reduce maintenance in wet wells and tanks that accumulate fats, oils and greases (FOGs). Our design uses town water or recycled treated effluent at mains pressure to keep pump stations clean.

It can be installed using existing telemetry or with our pre-programmed timing device that activates towards the end of the pump out cycle.

Installing a wellwasher will eliminate large fatty build-up in pump stations, this then reduces blockages in pumps

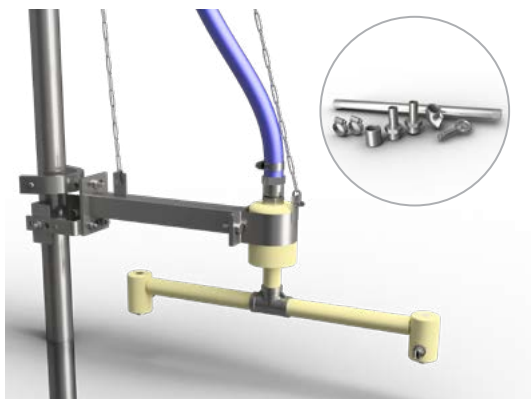
and downstream sewers. The level sensors remain clean so the pumps work more efficiently, reducing the risk of overflows due to FOG build-up. It has also been shown to significantly reduce sulphide corrosion on concrete walls, pumps and other internal infrastructure components. There are fewer confined space entries required, only when essential maintenance tasks are needed.

The Well Washer is wholly designed and manufactured in Australia and has Australian, United States & International Patents.

'The total water usage for a single washer is as little as 100 litres per day.'

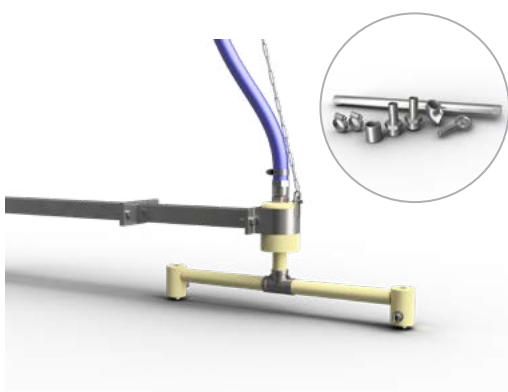
The principle behind the design is simple:
The Well Washer cleans the fat and grease away before it solidifies.





Well Washer Kit Guide Rail Mount

Part Number:	WWKITGRMOUNT
Description:	Kit includes washer, brackets and install hose & fittings
Application:	Eliminates fat & grease build up on infrastructure and walls
Material / Finish:	Austlon, 316 S/S
Dimensions:	Taking the infrastructure into account we can design to specific requirements
Weight:	6 kg
General Specifications:	40/60 PSI, 30 l/min, 5-6m (Diameter)



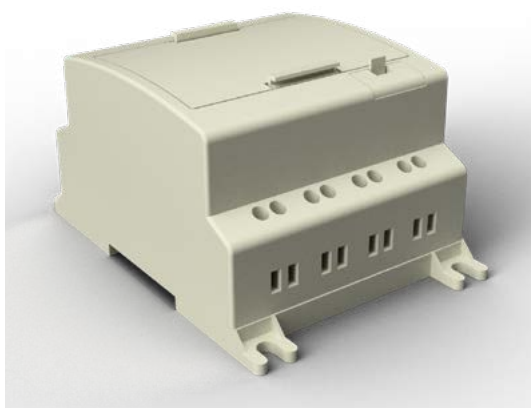
Well Washer Kit Wall Mount

Part Number:	WWKITWALLMOUNT
Description:	Kit includes washer, brackets and install hose & fittings
Application:	Eliminates fat & grease build up on infrastructure and walls
Material / Finish:	Austlon, 316 S/S
Dimensions:	600mm to 900mm Diameter
Weight:	6 kg
General Specifications:	40/60 PSI, 30 l/min, 5-6m (Diameter)



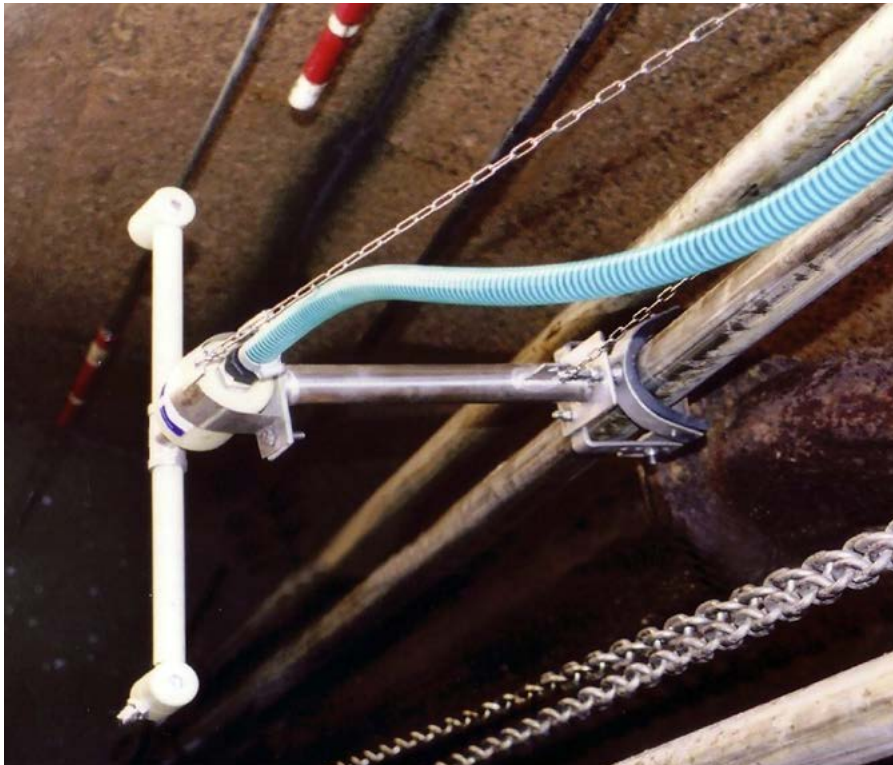
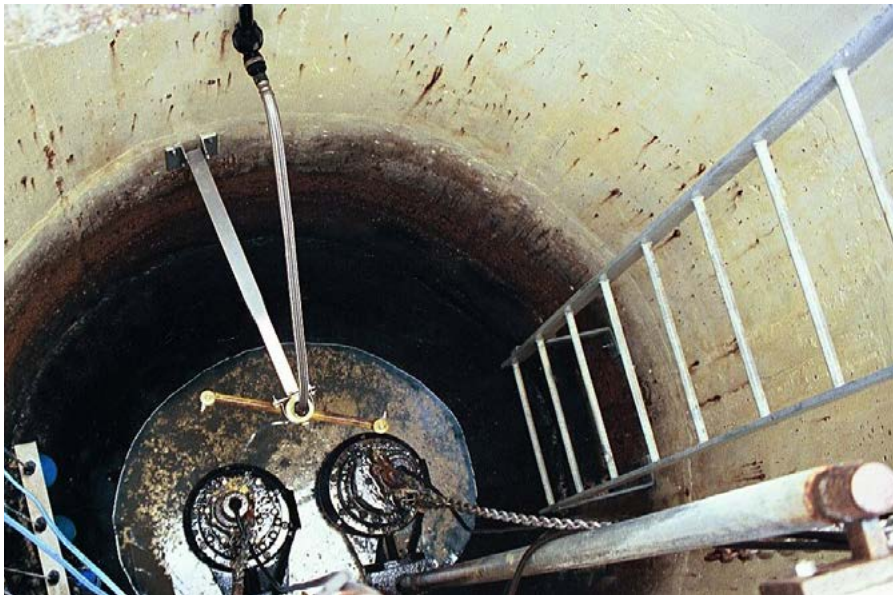
Optional Solenoid Valve

Part Number:	WWSOLENROID
Description:	Optional Solenoid Valves for water supply
Application:	Once energised allows water to flow to wellwasher
Material / Finish:	Glass reinforced nylon
Dimensions:	600mm to 900mm Diameter
Weight:	500 g
General Specifications:	Continuous operation 100% ED c/w LED connector plug IP65



Optional Pre-Programmed Allen-Bradley Micro810 Smart Relay

Part Number:	WWTIMER
Description:	Pre programmed with 5 cleaning cycle durations
Application:	Water Conservation, Minimise manual control
Material / Finish:	PVC
Dimensions:	600mm to 900mm Diameter
Weight:	500 g
General Specifications:	Less than 100 L daily



MCBERNS

INNOVATIVE SOLUTIONS

ODOUR MANAGEMENT
SAFETY ACCESS COVERS
DESIGN & FABRICATION
DATA ANALYTICS

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Noel Southern: 
Paul O'Kane: 
Stuart Darby: 

www.mcbarns.com



Aquate Commercial Pump Station

Technical Guide WW 10

Aquate Pump Stations are ideal for civil infrastructure applications where sewage or stormwater needs to be discharged into a reticulation network or wastewater treatment plant.



06.22 | WASTEWATER | WW10 AQUATE COMMERCIAL PUMP STATIONS

Applications

From residential subdivisions, schools, factories and commercial developments to stormwater networks, our complete range of pump stations is the solution for any sewer, stormwater or trade waste application.

Approvals/Standards

Concrete components designed and manufactured to AS/NZS 4058:2007
Precast Concrete Pipes

AS/NZS 1546:1 2008 – tank certification

AS/NZS3000 – electrical controller

AS/NZS 3500.2:2021 Sanitary plumbing and drainage

Built under ISO9001:2008 QA System

We are the supply partner of choice for New Zealand's civil construction industry, specialising in water and infrastructure based solutions.

Aquate Pump Stations are ideal for civil infrastructure applications where conventional gravity systems are impractical or not cost effective.

Introduction

Hynds offers a wide range of high performance and durable Aquate packaged pump stations. These systems include chambers, pumps, level controls, control equipment, piping and valves etc. Aquate Pump stations are manufactured in Hynds Precast Factories and available in either concrete or polyethylene.

Our dedicated design team at Aquate provide a complete design and specification for consulting engineers and contractors. No matter what challenges your project presents, Aquate's expert engineers will work with you step by step to custom design the perfect pump station solution. Safety in design, environmental risk mitigation and ease of maintenance for servicing is always front of mind.

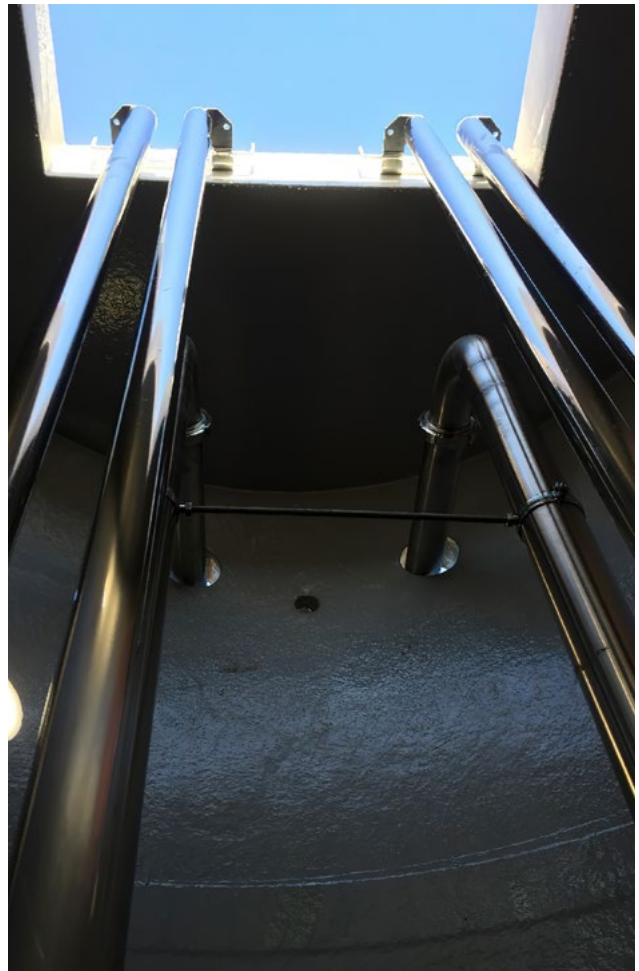
Hynds' dedicated Project Manager oversees the entire pump station project, including supply, on site installation, commissioning and quality assurance. Together with Aquate's world standard design service, the whole process from design through to installation is seamless.

Residential Aquate Pump Systems are also available for domestic applications.

See our website for more information: www.hynds.co.nz/product/aquate-residential-pump-station/

Features & Benefits

1. Flexible design: Aquate Pump Stations are designed to provide the required on-site storage and optimal pump performance.
2. Easy installation: The systems are prefabricated in the factory providing easy installation on site.
3. High quality pumps: Brands include Flygt, Grundfos, Domo and Zenit. Pumps are designed to meet the site specific requirements.



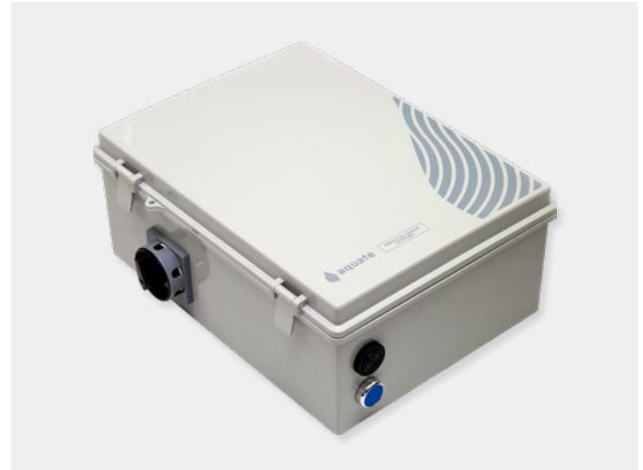
Technical data

Aquate Model No.	AQ1200	AQ1500	AQ1800	AQ2050	AQ2500	AQ3000
Internal diameter (mm)	1200	1500	1800	2020	2550	3000
Max chamber depth (m)	4.8	4.8	6.0	6.0	8.0	10.0
Min. riser sections (mm)	300	300	300	300	300	300
Valve chamber diameter (m)	1.2	1.2	1.5	1.5	1.8	1.8
Min volume wet-well (L)	2000	3500	5000	7000	10000	17000
Volume per additional metre depth (L)	1130	1760	2550	3100	5100	7050
Maximum pipework size (mm)	100	150	200	250	300	300

Control Panel

Hynds Aquate Pump Stations come complete with an electrical controller. This can be located on the pump chamber or installed at a nearby building. Features include:

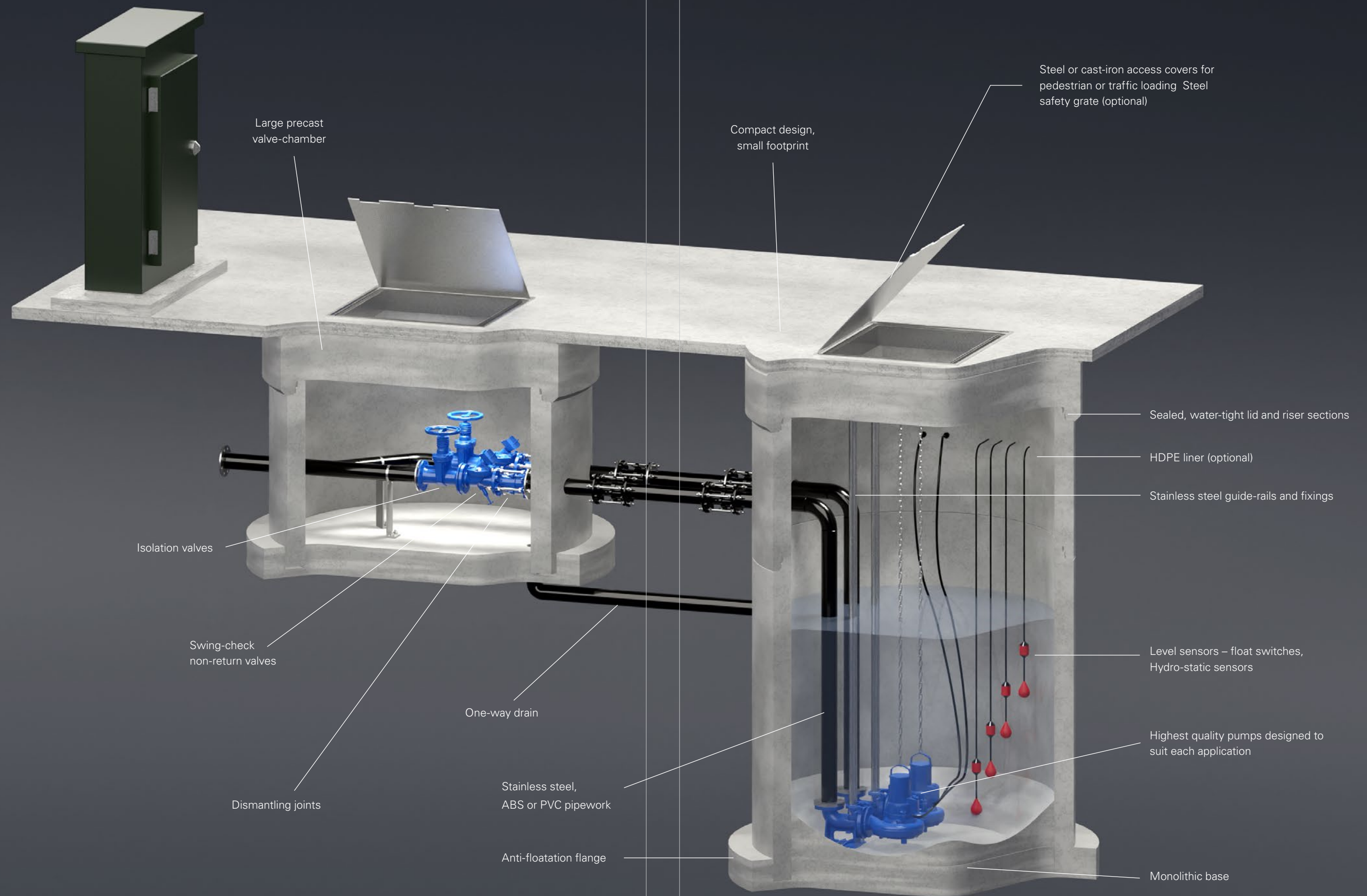
- Single or three phase option
- Simplex or duplex pump operation
- Lockable IP 65 rated enclosure
- Visual and audible pump failure alarm system
- High level alarm
- Over pressure protection
- Pump motor protection against variable electricity supply
- Performance data recorded



Options

- Web Based monitoring
- Float switches, hydrostatic transducers or ultrasonic level sensors
- Steel cabinets
- Hour run and start count
- Integration into a SCADA System
- Mag Flow Metres
- Alarm telemetry (SMS alarms), radio transmission, or outputs to BMS





Options cont...

- Flow Meters to monitor usage
- Auto well-washer for automatic station cleaning
- Odour filters
- Internal linings to prevent corrosion
- Lifting arm socket to simplify maintenance procedures
- Storage tank for emergency storage

Back up and support

Hynds has service agents throughout New Zealand. In the unlikely event of an alarm activation there is typically sufficient storage in the tank for 24 hours of normal operation. In the event of an alarm, either Hynds or the Local Council's Utility Services Team can provide onsite service.

Design Assistance

A dedicated Aquate Design Team will assist engineers design the ultimate pump station for their project.

The following information will need to be considered to complete the full design:

- Expected daily wastewater volumes
- Emergency storage requirements
- Private or Council owned
- Static lift of rising main
- Length of rising main
- Special requirements for the controller (see options available)
- Depth of inlet pipes
- Pedestrian or traffic loading

Based on the information provided, Aquate will supply a design and specification including :

- Size of wet-well required
- Emergency storage tank if required
- Pump model and design
- Rising main sizing
- GA drawings of the pump station and valve chamber

Contact

Contact our Project Manager to discuss your project

E: [REDACTED]

M: [REDACTED]





Branches Nationwide *Support Office & Technical Services* 0800 93 7473

Disclaimer: While every effort has been made to ensure that the information in this document is correct and accurate, users of Hynds product or information within this document must make their own assessment of suitability for their particular application. Product dimensions are nominal only, and should be verified if critical to a particular installation. No warranty is either expressed, implied, or statutory made by Hynds unless expressly stated in any sale and purchase agreement entered into between Hynds and the user.

hyndswastewater.co.nz
0800 425 433





Scan for more information

Hynds Retention Tank with Mul-T-Level™ Outlet

Technical Guide D5.15

Hynds strong and reliable retention tanks are available in Ring Joint Pipe Internal Base or Flange Base manhole types.



03.15 | DRAINAGE | D5.15 HYND'S RETENTION TANK

Applications

Stormwater retention & detention

Sewer storage

Product Attributes

Versatile Mul-T-Level™ outlet

Highly durable

Simple installation

Various design layouts and large capacity options available

Water tight

Proven history

Approvals/Standards

AS/NZS 4058:2007 Precast concrete pipes (pressure and non-pressure)

Quality

ISO 9001:2008 Quality Management

The go to organisation for civil and rural water product solutions

HYNDS

Hynds strong and reliable retention tanks are available in Ring Joint Pipe, Internal Base or Flange Base Manhole types.

Design Specifications and Applications

RJ Retention Tank

- Generally used when the location permits the installation of a long narrow tank.
- Comprised of Hyspec reinforced concrete rubber ring joint pipes.
- Usually includes a spigot-plugged pipe, standard intermediate pipes and a collar-plugged pipe.
- The spigot and collar plugs are factory cast to ensure water tightness and integrity.
- A manhole offtake is factory fitted to one or more pipes to provide easy access for maintenance.

IB or FB Retention Tank

- Generally used in compact site conditions where relatively small volumes is required.
- Comprised of Hynds internal base or flange base manhole risers and a precast concrete lid.

Mul-T-Level™ outlet

- Enables the tank to be used for both detention and retention.
- Both the RJ and IB/FB retention tanks have a standard 100 or 150mm diameter PVC slip coupler and Mul-T-Level™ outlet cast-in or fitted during manufacturing.
- The required retention/detention volume is set by an orifice hole (of specified diameter) being drilled on the Mul-T-Level™ outlet at a pre-determined height.

General Specifications

- Manufactured from Hyspec spun concrete pipes, using the centrifugal spinning process.
- When the tank is installed in an aggressive environment, such as tidal areas, sewerage or mild acid solutions, the use of a special grade concrete is recommended. Contact Hynds Technical Team for more information.
- Retention tanks are available in various class types to suit specific site conditions, loading and applications.
- The diameter and length of the retention tank is dependent on:
 - Storage volume required
 - Site configuration and access equipment available
- Inspection and maintenance access is provided by a fitted inspection chamber or manhole riser starter.
- PVC slip couplers are fitted to end plugs to provide inlet and outlet connections to the retention tank.
- Non-standard couplers or starter types can be cast-in on request.
- Orifice holes are drilled at levels to suit the design requirements.
- Standard lids are available for access risers in the RJ type tanks.
- A light or heavy duty cast iron cover and frame will fit directly onto the 600mm diameter access riser.
- The 1050 mm diameter access riser requires a 1050 mm diameter manhole lid, which can be fitted with the cast iron manhole frame and cover.
- The IB or FB tanks require a lid, which can be fitted with a cast iron frame and cover to suit the riser diameter.
 - Note: Lid thickness is dependent on loads and application
 - Refer to Table 1 for RJ tank capacities and Tables 2 and 3 for IB/FB tank capacities.

TABLE 1 RJ type retention tank

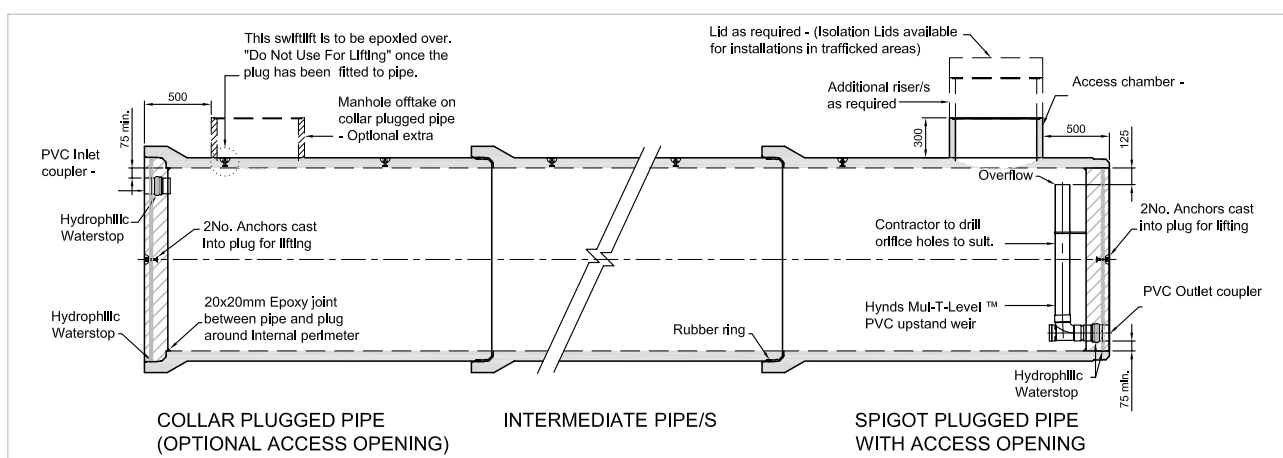
Nom Pipe Diameter and Joint Type	Pipe Effective Length (m)	Nom Vol per Pipe Length (m ³)	Nom Vol per Pipe Length (Litres)	Suggested Offtake Dia (mm)	Lifting plugged pipe anchor req.	Handling intermediate pipe anchor req.
675RJ	2.440	0.72	720	600	A1	A2
750RJ	2.440	0.92	920	600	A1	A2
825RJ	2.436	1.14	1140	600	A1	A2
900RJ	2.448	1.38	1380	600	A1	A2
975RJ	2.440	1.67	1670	600	B1	B2
1050RJ	2.440	1.94	1940	600	B1	B2
1200RJ	2.440	2.58	2580	600	B1	B2
1350RJ	2.454	3.31	3310	600/1050	B1	B2
1600RJ	2.440	4.51	4510	1050	C1	B2*
1800RJ	2.438	6.13	6130	1050	C1	C2
1950SRJ	2.440	7.05	7050	1050	C1	C2
2100SRJ	2.397	8.02	8020	1050	C1	C2
2300SRJ	2.735	11.01	11010	1050	C1	C2
2550SRJ	2.470	12.18	12180	1050	C1	C2

Key

- **A1** 1 Tonne
2 no. in plug
1 no. in pipe
- **A2** 1 Tonne
2 no. in pipe
- **B1** 2.5 Tonne
2 no. in plug
1 no. in pipe
- **B2** 2.5 Tonne
2 no. in pipe
- **C1** 5 Tonne
2 no. in plug
1 no. in pipe
- **C2** 5 Tonne
1 no. in pipe

Notes:

- All dimensions refer to Class 2 (X) pipes
- Outlet 75 mm minimum above bottom invert of pipe
- Overflow 125mm below top
- *1600 Ø retention tanks require both B2 & C1 type lifting clutches for offloading and installation
- See Fig 6 for 3 point lift on typical plugged end pipe

**FIG. 1** General layout of typical RJ type retention tank with Mul-T-Level™ outlet

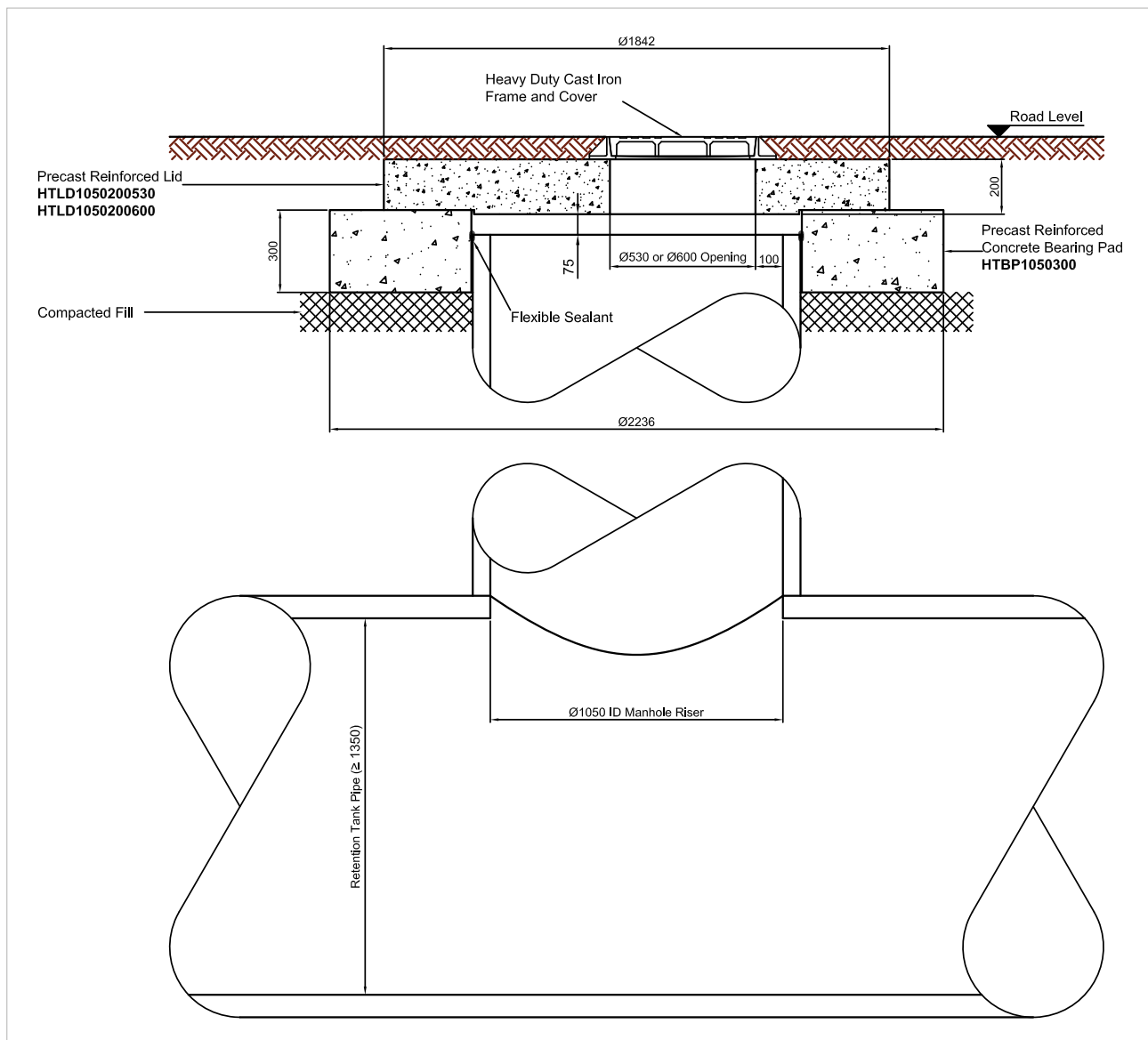
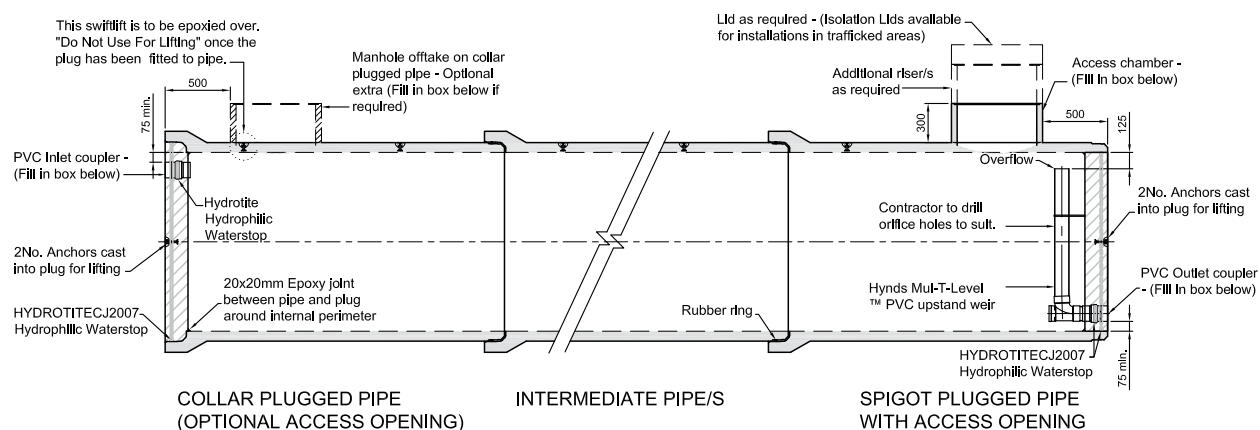


FIG. 2 Recommended detail for roadway installation



PIPE Ø

Mn Recommended Ø 675mm

JOB DETAILS

PIPE CLASS

TOTAL No. OF PIPES
(Incl. ends)

QUOTE No.

COVER TO INVERT

Inlet	Outlet

CO No.

PVC INLET FITTING Ø

Pipe Ø	Standard Fitting Ø	Ø Required
Ø675 to 1200mm	Ø100mm	
Ø1350 to 3000mm	Ø150mm	

PVC OUTLET FITTING Ø

Ø Pipe	Standard Fitting Ø	Ø Required
Ø675 to 1200mm	Ø100mm	
Ø1350 to 3000mm	Ø150mm	

ACCESS CHAMBER -
OUTLET SIDE Ø

Ø Pipe	Standard Offtake Ø	Ø Required
Ø675 to 1200mm	Ø600mm	
Ø1350 to 3000mm	Ø1050mm	
Ø1350 to 3000mm	Specify	

ACCESS CHAMBER
- OPTIONAL
INLET SIDE Ø

Ø Pipe	Standard Offtake Ø	Ø Required
Ø675 to 1200mm	Ø600mm	
Ø1350 to 3000mm	Ø1050mm	
Ø1350 to 3000mm	Specify	

I AUTHORISE HYNDS PIPE SYSTEMS LTD TO PROCEED WITH THE MANUFACTURING OF THIS PIPE SPECIAL AS DETAILED ABOVE. I ACKNOWLEDGE THAT ANY SPECIALS, ONCE MANUFACTURED, ARE DEEMED TO BE MY (CONTRACTOR'S) PROPERTY & ARE NON REFUNDABLE. STORAGE & HANDLING FEES WILL BE INCURRED FOR PRODUCTS THAT ARE NOT DELIVERED/COLLECTED WITHIN 1 MONTH OF THE DATE AGREED AT THE TIME OF ORDER. PRODUCT NOT DELIVERED/COLLECTED WITHIN 3 MONTHS OF THE DATE AGREED WILL BE DESTROYED AT MY EXPENSE.

NAME :- SIGNATURE :-

DATE :-

FIG. 3 RJ Retention Tank Order Form

Internal base type

TABLE 2 Internal base retention tank

Riser Height (mm)			450	600	900	1200	1500	1800	2100	2400
O/A Height Incl 150mm Thick Lid			580	730	1030	1330	1630	1930	2230	2530
O/A Height Incl 200mm Thick Lid			630	780	1080	1380	1680	1980	2280	2580
Effective Depth (mm)			225	375	675	975	1275	1575	1875	2175
Nominal Diameter	A = Riser OD (m)	B = Riser ID (m)	IB Capacity (m3)							
1050	1.194	1.066	0.20	0.33	0.60	0.87	1.14	1.41	1.67	1.94
1200	1.347	1.207	0.26	0.43	0.77	1.12	1.46	1.80	2.15	2.49
1400	1.524	1.372	0.33	0.55	1.00	1.44	1.88	2.33	2.77	3.22
1500	1.677	1.523	0.41	0.68	1.23	1.78	2.32	2.87	3.42	3.96
1650	1.842	1.676	0.50	0.83	1.49	2.15	2.81	3.47	4.14	4.80
1800	2.007	1.829	0.59	0.99	1.77	2.56	3.35	4.14	4.93	5.71
2050	2.236	2.036	0.73	1.22	2.20	3.17	4.15	5.13	6.10	7.08

Effective Depth (mm)			-	-	625	925	1225	-	-	2125
Nominal Diameter	A = Riser OD (m)	B = Riser ID (m)	IB Capacity (m³)							
2300	2.58	2.30	-	-	-	3.84	-	-	-	8.83
2550	2.85	2.55	-	-	3.19	-	6.26	-	-	10.85

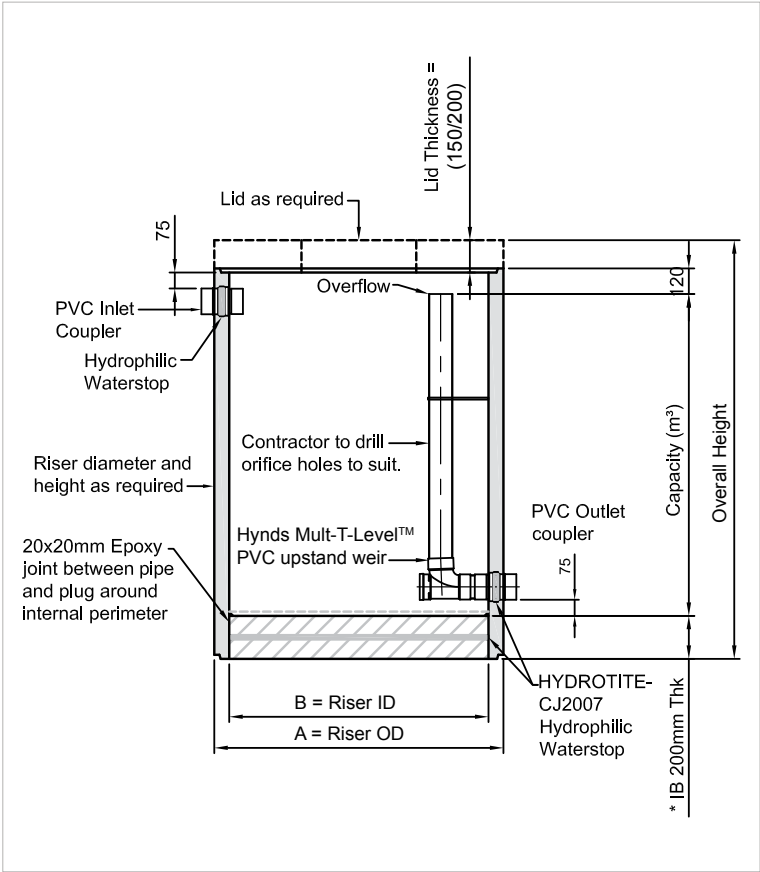


FIG. 4 Internal base

Flange base type

TABLE 3 Flange base retention tank

Riser Height (mm)			450	600	900	1200	1500	1800	2100	2400
O/A Height Incl 150mm Thick Lid			530	680	980	1280	1580	1880	2180	2480
O/A Height Incl 200mm Thick Lid			580	730	1030	1330	1630	1930	2230	2530
Effective Depth (mm)			225	375	675	975	1275	1575	1875	2175
Nominal Diameter	A = Riser OD (m)	B = Riser ID (m)	FB Capacity (m ³)							
1050	1.194	1.066	0.20	0.33	0.60	0.87	1.14	1.41	1.67	1.94
1200	1.347	1.207	0.26	0.43	0.77	1.12	1.46	1.80	2.15	2.49
1400	1.524	1.372	0.33	0.55	1.00	1.44	1.88	2.33	2.77	3.22
1500	1.677	1.523	0.41	0.68	1.23	1.78	2.32	2.87	3.42	3.96
1650	1.842	1.676	0.50	0.83	1.49	2.15	2.81	3.47	4.14	4.80
1800	2.007	1.829	0.59	0.99	1.77	2.56	3.35	4.14	4.93	5.71
2050	2.236	2.036	0.73	1.22	2.20	3.17	4.15	5.13	6.10	7.08

Effective Depth (mm)			-	-	625	925	1225	-	-	2125
Nominal Diameter	A = Riser OD (m)	B = Riser ID (m)	FB Capacity (m ³)							
2300	2.58	2.30	-	-	-	3.84	-	-	-	8.83
2550	2.85	2.55	-	-	3.19	-	6.26	-	-	10.85

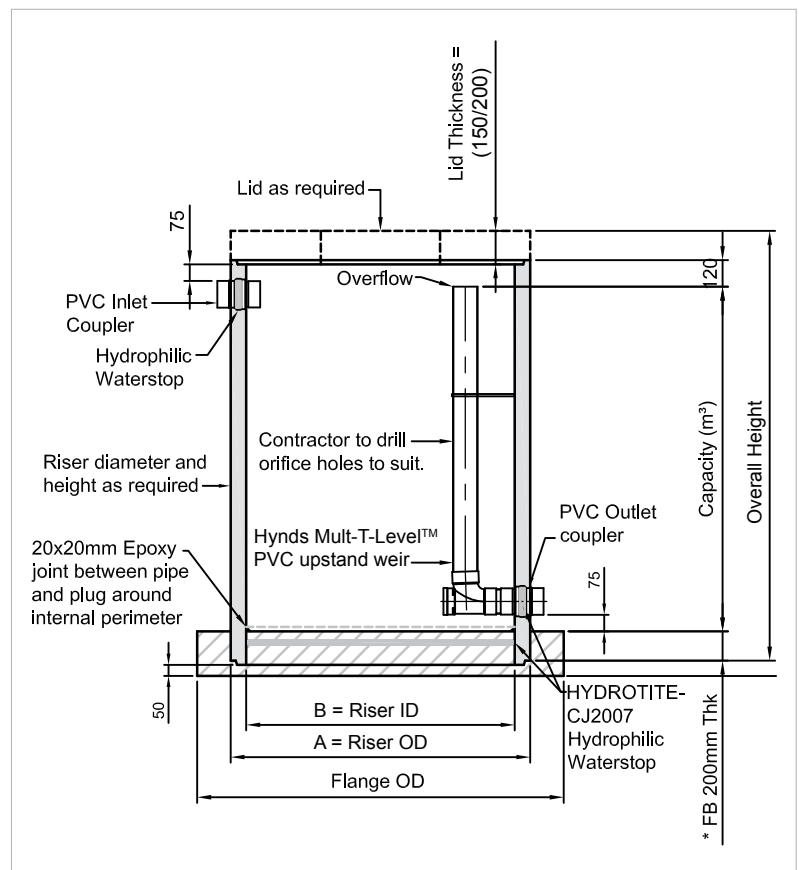


FIG. 5 Flange base

Installation

Mul-T-Level™ outlet

- Installation is simple and normally carried out by a drain layer using the same equipment and procedures as for the installation of concrete pipelines, or manholes.

RJ Retention Tank

- Similar installation to reinforced concrete rubber ring jointed pipes (including bedding requirements) and are dependent on site conditions and loading.
- Once the pipe sections have been installed and backfilled, the additional access risers are epoxied to the starter risers and brought up to the finished levels.
- The installation is then completed by fitting the required lids.
- The contractor must then drill the orifice holes at the required design levels.

Note: Refer to Figure 1 for a general layout of a typical RJ type tank.

RJ Retention Tank – Roadway Installation

- To minimise the effects of traffic, isolation of the manhole lid from the access riser is recommended.
- The depth of the modified flange base and riser must be kept to a minimum to enable maximum distribution of load above the tank.
- Refer to Figure 6 for 3 point lift of typical plugged end pipe.

IB or FB Retention Tank

- Similar installation to concrete manholes.
- Foundations should be prepared with compacted hardfill to prevent excessive settlement.
- Once the IB or FB tank is backfilled, the installation is completed by fitting the relevant concrete lid with the appropriate cast iron frame.



FIG. 6 Point lift of typical plugged end pipe

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Disclaimer: While every effort has been made to ensure that the information in this document is correct and accurate, users of Hynds product or information within this document must make their own assessment of suitability for their particular application. Product dimensions are nominal only, and should be verified if critical to a particular installation. No warranty is either expressed, implied, or statutory made by Hynds unless expressly stated in any sale and purchase agreement entered into between Hynds and the user.

Hyliner AKS HDPE Lining

Technical Guide D1.12

HyLiner AKS HDPE is used as corrosion protection lining in precast and cast in-situ concrete elements or structures to increase durability and reduce the risk of abrasion.



04.20 | DRAINAGE | D1.12 HYLINER AKS HDPE LINING

Applications

Corrosion protection lining for precast concrete pipes in sewer pipelines

Corrosion protection lining for in-situ concrete structures in wastewater treatment plants

Abrasion protection lining in high abrasion environments

Broad range of application in both precast and cast in-situ concrete

Product Attributes

Available in white (sewer applications) and black (where high UV resistance is required)

12 mm long anchors are integrally formed with the sheet

Factory QA tested and welding of joints is 100% quality tested onsite

Quality

ISO 9001:2008 Quality Management Standard

We are the supply partner of choice for New Zealand's civil construction industry, specialising in water and infrastructure based solutions.

HYNDS
PIPE SYSTEMS

HyLiner AKS HDPE is used as corrosion protection lining in precast and cast in-situ concrete elements or structures to increase durability and reduce the risk of abrasion.

Lining systems are able to bridge discontinuities in pipe or structure walls unlike other coating systems that rely on the integrity of the surface and quality of the surface preparation and the installer's expertise for functionality.

HyLiner AKS HDPE is a thermoplastic lining used to reduce the risk of sulphide attack or corrosion in sewage applications.

The high density polyethylene (*HDPE*) lining suits both precast and in-situ applications. Firmly anchored to the concrete surface of the pipe or structure, the lining requires only welding of joints to form a durable, chemically resistant concrete protection membrane with high abrasion resistance.

Installation

Installation procedures vary depending on the product:

Spun concrete pipe

The liner is inserted into the pipe prior to the completion of manufacture, with the pipe spinning process completed with the liner installed. This ensures that all the anchor knobs are well embedded in the spun concrete prior to the concrete curing and hardening.

Wet cast concrete pipe

The liner is securely attached to the inner mould before placement of reinforcement and casting of the pipe. The pipe once cast is cured in the normal manner using heat to accelerate the hardening process.

Precast concrete

This follows a similar process to the wet cast concrete pipe whereby the liner is attached to the mould prior to casting of the element.

In-situ concrete

This follows the same process as for precast concrete whereby the liner is attached to the formwork prior to casting of the concrete.

Installation Detail

In the case of concrete pipes, the liner need only be applied to the pipe's internal surface above low flow level during normal operating conditions as shown in fig 3.

Where 360° cover is required, the liner is fitted with an overlap at the invert (50 mm min) as shown in fig 4 & 5. This joint is not usually welded as it allows any accumulation of moisture from external hydrostatic pressure to dissipate from behind the liner.

Where the fluid contents are themselves aggressive, such as trade waste discharges, a longitudinal weld can be provided to seal the pipe invert.



FIG. 1 Where 360° cover is required, the liner is fitted with an overlap at the invert (50 mm min)

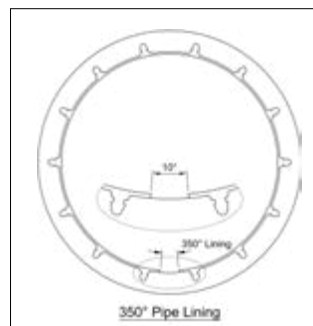


FIG. 3 Most concrete pipes only require the liner applied to the pipe's internal surface above low flow level during normal operating conditions.

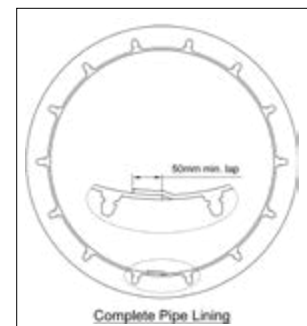


FIG. 2 Invert overlap in a 1050Ø pipe.

Jointing

A continuous lining system is created through the use of extrusion welding carried out by trained, qualified operators. Generally overlapped welds are recommended.

Various details for welded joints for precast concrete pipes and components are shown in Figures 4 to 6. Other details for site installation and fixing of brackets are shown in Figures 7 to 12.

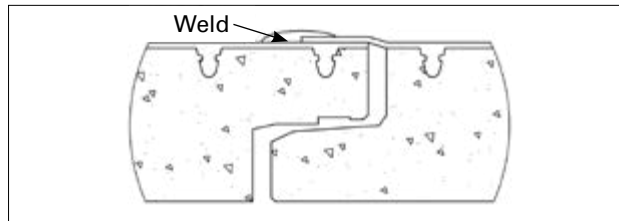


FIG. 4 HyLiner lined SRJ pipe (Lapped Joint)

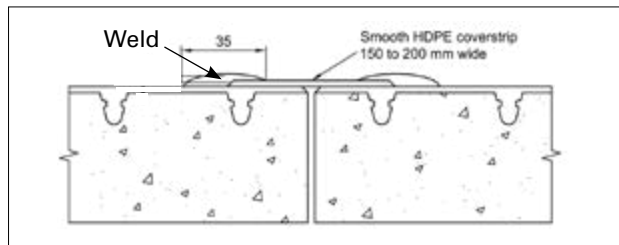


FIG. 5 Cover strip with 2 overlap welds

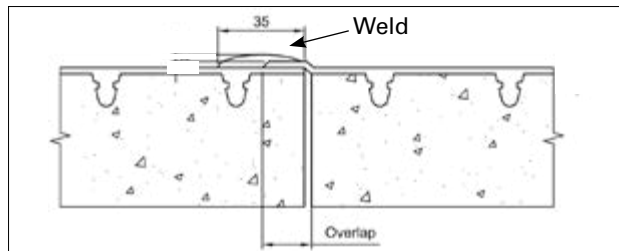


FIG. 6 Single overlap weld

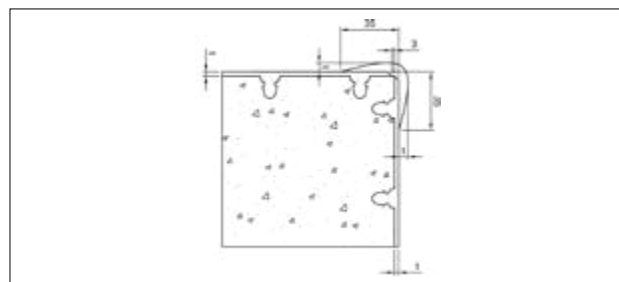


FIG. 7 Outside Corner Weld

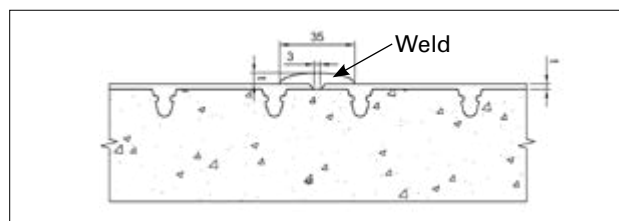


FIG. 8 Flat Extrusion Butt Weld

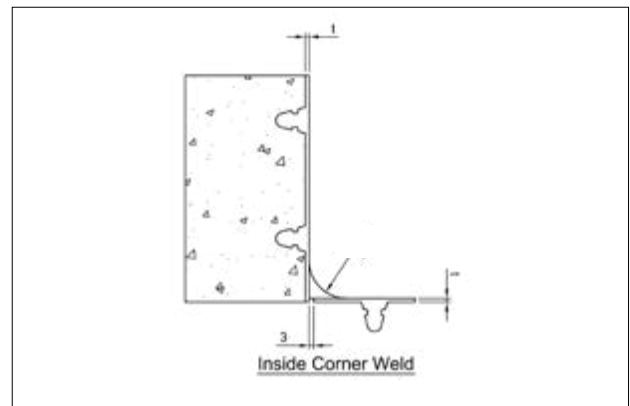


FIG. 9 Inside Corner Weld

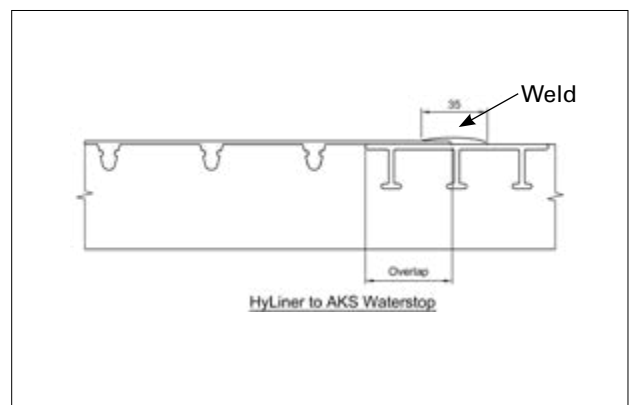


FIG. 10 HyLiner to AKS Waterstop

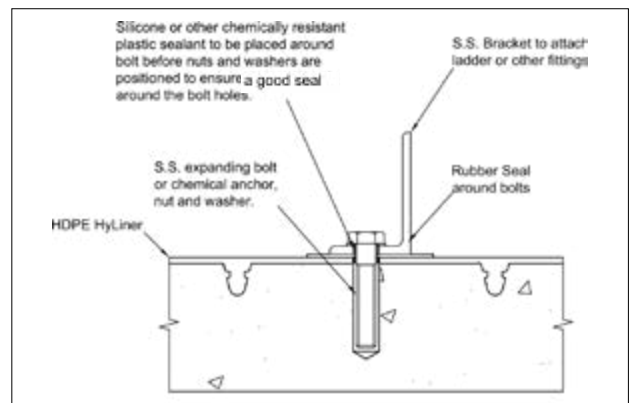


FIG. 11 Sealing of Brackets and Fittings to HyLiner Lined Structures

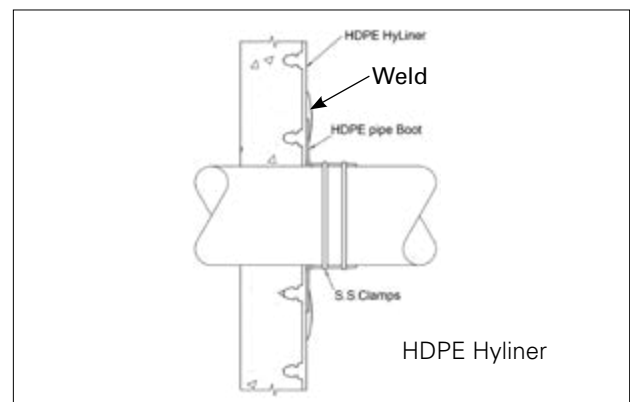


FIG. 12 Pipe Penetration Detail

Quality Control

In-plant quality control for the manufacture of the liner includes waviness, surface finish, knob shape and alignment, crimp height and depth of knobs, sheet thickness, density and tensile values.

Quality checks after casting into precast concrete pipes and components include effective anchor embedment, liner positioning on the product and spark testing for pin holes or damage.

All joints and the liner are spark tested after jointing is completed on site. This ensures the quality of the joints and identifies any damage in the liner as a result of handling and installation.

Abrasion resistance

HyLiner AKS HDPE has a good abrasion resistance when compared to other materials. A typical abrasion test value for HDPE liners is 0.3mm after 400 000 cycles (*Kirschmer, O., "Problems of Abrasion in Pipes", Steinzeugin Formationen, 1966, No 1, pp3-13*).

Wear rates are very slow even under continuous flow of abrasive slurry. Most drainage applications would have intermittent exposure to abrasion.

Suitable Structures for Lining

HyLiner AKS HDPE is suitable for installation in spun and wet cast concrete pipes from 1050–3000 mm diameter. HyLiner AKS HDPE is also suitable for lining a range of other concrete structures:

- Manhole risers and lids
- Rectangular or square precast concrete chambers and lids
- Precast concrete channels and lids
- Precast concrete pumpstations
- Insitu concrete structures such as tanks and chambers



FIG. 13 2300 Diameter Manhole Riser

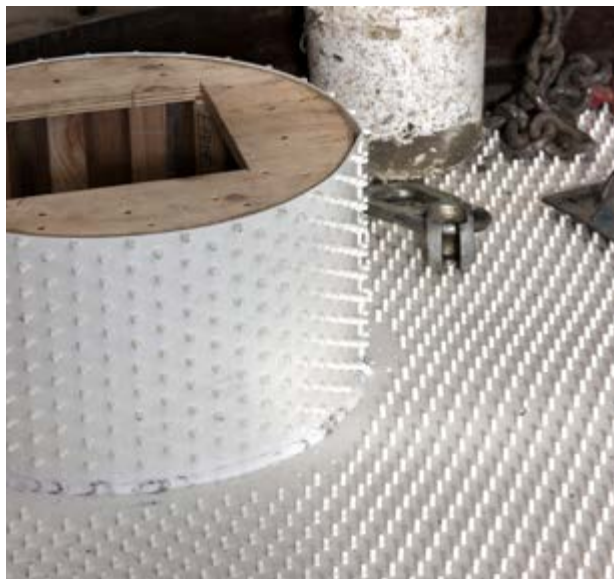


FIG. 14 Liner being installed for a manhole lid

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BluSeal AKS

HDPE CONCRETE PROTECTION MEMBRANE



BluSeal Anchor Knob Sheet (AKS) is supplied and installed as a fully sealed and welded robust chemically resistant concrete protection lining.

BluSeal AKS is a synthetic membrane of HDPE sheet with integral anchors which are cast into concrete to form a flexible and durable corrosion protection lining. BluSeal AKS is used to protect concrete surfaces in chemically aggressive environments in sewerage tunnels, treatment works, pump stations, manholes and chemical retention bunds. It comes in a range of colours and thicknesses and can be applied to new and existing structures for protection or enhancement.

Application Advantages

- Fully welded homogenous lining
- Complete before 28-day concrete cure
- Factory assured thickness and absence of pinholes
- Retro-fitted lining is moisture compatible with assured bond

Lifecycle Advantages

- 100 year design life
- Membrane drainage eliminates negative pressure
- Chemical and impact resistant
- High anchor pull-out resistance
- Potable Water use to AS/NZS 4020:200
- Low coefficient of friction in lined conduits

About the Product

BluSeal AKS is supplied and installed as a fully sealed and welded, chemically resistant concrete protection system. The system includes propriety details for sealing around penetrations and against non-HDPE surfaces. Skilled applicators can fabricate the product into various shapes to suit irregular concrete formwork. All seams and joins are extrusion welded and then tested by spark or vacuum box testing. BluSeal AKS is designed and installed by approved applicators to international standards which are outlined in a manufacturer's installation manual. The elasticity of the membrane allows free drainage and relief of any hydrostatic pressure build-up in underground structures. The membrane can be cast into new structures or retrofitted by cement grouting onto the prepared surface of existing structures. AKS lined structures have an outstanding track record in aggressive environments, demonstrating a design life in excess of 100 years for the most demanding applications.

Application solutions

- Segmental sewer tunnels
- Inlet works and bioreactor tanks in WWTP
- Pump stations and manholes
- Tunnel waterproofing
- Chemical retention bunds
- Piles and foundation lining in aggressive ground conditions
- Sewer pipelines
- Slide pads on pipe plinths
- Concrete protection for industrial applications

Project Specification Clause

HDPE CORROSION PROTECTION LINING - The HDPE CPL membrane used for this project shall be supplied and installed as a fully sealed and welded ROBUST continuous membrane system. It shall be a factory produced product that has independent testing to validate the performance outlined in the technical data table on the following pages. BluSeal AKS supplied by Bluey Technologies or equivalent shall be acceptable.

Project Examples

Sewerage treatment plants, sewer pump stations, sewer manholes, trunk sewer mains, chemical processing plant bunds and trenches, gas pipelines (pipe plinths).





BluSeal AKS

HDPE CONCRETE PROTECTION MEMBRANE

Application Specification

PREPARATION

- I.1 BluSeal AKS must be installed onto formwork under the direction of an approved, specialised applicator who will plan layout configurations of sheets and weld seam locations. The applicator may also prefabricate some corner or seam sections and pipe penetration pieces offsite.
- I.2 At joins in sheets the edge knobs are removed from one edge and the sheet is overlapped by 50mm to prevent egress of concrete fines and to provide a sound foundation for welding the seams.
- I.3 Formwork shall be cleaned and free of defects. Form release oils are not necessary where BluSeal AKS is applied. Formwork should be designed to avoid leaking.
- I.4 The sheets must be tensioned over the form within the yield elongation limit, prior to securing to the forms.
- I.5 BluSeal Formtak can be used to assist in holding the sheet against timber formwork. Securing against the formwork is by nailing or stapling through the sheets at edges where extrusion welds will cover later or into edges that will be redundant and trimmed after the pour.
- I.6 On circular forms, the sheets are wrapped and tensioned around and secured at the overlap by wires around the knobs and/or temporary speed welding along the seam.
- I.7 In precast concrete applications the moulds may be designed to secure the membrane at the edges.
- I.8 When BluSeal AKS is applied to an existing structure all corroded concrete and contaminants must be removed, leaving a surface profile greater or equal to CSP4 in accordance with ACI guidelines.
- I.9 Treat or replace exposed reinforcement in accordance with ACI guidelines.
- I.10 Refer to Bluey Technical Notes for recommendations regarding proving grout bond strength and design criteria.

APPLICATION

- 2.1 Always pour concrete or grout at a cooler ambient temperature than the temperature when the sheets were applied to the formwork. This will ensure the membrane is taut on the forms.
- 2.2 Anticipated maximum concrete temperature or accelerated curing temperature should not exceed 60 degrees Centigrade. Contact Bluey to discuss exceptions.
- 2.3 When grouting the sheets onto an existing structure, only grouts approved by Bluey such as BluCem HS200 shall be used, and mixing and placement shall be strictly in accordance with Bluey instructions. Fast set grouts, such as BluCem HE80, are recommended to be used for retrofitting the membrane in short time frames where assets must be returned to service quickly.
- 2.4 When grouting the membrane to floors, plan pours at times of the day where temperature changes before initial set of the grout are minimal. Avoid these pours in direct sunlight.
- 2.5 Concrete mix design, mixing, placement and compaction of concrete should follow standard civil construction practice to minimise voids and ensure full encapsulation of the anchors on the membrane.
- 2.6 Extrusion welding and weld testing at seams will be undertaken by approved applicators and in accordance with installation guidelines provided by the manufacturer and generally in accordance with DVS 2227. This includes proper preparation of the sheet surfaces to be welded and daily destructive seam peel tests sampled from trial welds. Welding technicians shall have formal industry training in extrusion welding techniques.
- 2.7 Non-destructive testing of completed welds will be either by vacuum box or spark testing.
- 2.8 Repairs and patching will be completed by extrusion welding over small defects or applying a minimum 200mm diameter patch over larger defects, with a minimum 80mm edge distance to the defect.
- 2.9 Destructive pull testing of anchors should be avoided.
- 2.10 Encapsulation of anchors can be easily checked by tapping across the surface of the membrane to detect any hollow sounds that indicate voids under the membrane. If voids are detected, they can be filled by injection of BluCem HS200 high flow grout through the lining. Repair by extrusion welding over the injection hole.



BluSeal AKS

HDPE CONCRETE PROTECTION MEMBRANE

Product Data

Please refer to Important Notice on following page

Length of Knobs (nominal)	12mm
Knobs per m ²	1230
Pull-off Resistance	>700N per knob or 850kPa (short term loading)
Membrane Thickness	2.0mm to 10mm*
Roll Widths	Up to 3.2m
Colours	Black for UV exposed applications and light colours (such as white) for underground or covered structures.

TESTED CHARACTERISTIC	STANDARD	RESULT			
Density	ASTM D 505/D 792	≥940kg/m ³			
Carbon Black Content**	ASTM D 1603	2.0 - 3.0%			
Carbon Black Dispersion**	ASTM D 5596	Category 1 or Category 2			
ESCR (NCTL)	ASTM D 5397	>300 hours			
OIT	D 3895	>100 minutes			
Coefficient of Linear Expansion	ASTM E 831	1.1 - 1.4E-4cm/cm/deg C			
Tensile Properties (Sheet Material)	ASTM D 6693-04	Yield Stress 15MPa	Break Stress 27MPa	Yield Elongation 12%	Break Elongation 700%
Shore Hardness	DIN 53505	>50 Shore D			
Tear Resistance	ASTM D 1004	120N/mm			
Puncture Resistance	ASTM D 4833	300N/mm			
Dimensional Stability	ASTM D 1204	<2.0% change			
Water Absorption	ASTM D 570	<0.09%			
Flammability	UL94***	V0			

* Average minimum thickness to ASTM D 5199. Minimum thickness membrane made to order

** Black AKS only

*** Plastics flammability standard released by Underwriters Laboratories of the USA



BluSeal AKS

HDPE CONCRETE PROTECTION MEMBRANE

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ProcessMaster electromagnetic flowmeter

The perfect fit for the oil and gas industry



ABB has responded to the oil and gas industry's need for a rugged, reliable electromagnetic flowmeter

Measurement made easy

—
ProcessMaster
flowmeters – perfect for
the oil and gas industry

Expertise in measurement technology

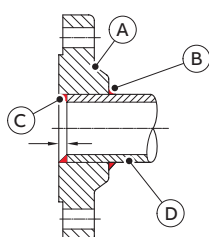
ABB's high pressure electromagnetic flowmeters are reliable, accurate and easily maintained. Customers worldwide have benefited from our application-oriented know-how and comprehensive service.

To learn more about our extensive portfolio, visit www.abb.com/measurement.

Designed specifically for oil and gas

We have added a two-tier, high-pressure version to our comprehensive range of electro-magnetic ProcessMaster flowmeters. It is available with either weld neck or slip-on flanges with RTJ and raised face connections.

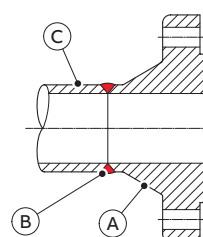
There are differences between X-Ray and dye penetrant test. For weld neck design we offer both dye penetrant and X-Ray tests; for slip-on design we offer only dye penetrant test.



(A) Slip-on flange (B) Fillet weld (outside) (C) Fillet weld (inside) (D) Pipe

Applications

- Slurries such as drilling mud
- Mixtures of fluids such as oil/water plus sand or produced water plus sand
- Injection fluids including sand and chemical additives for lubrication and corrosion prevention
- Sludge or sludge-like wastewater from produced water treatment
- Operating conditions such as high pressure or entrained gas in the fluid
- Harsh environmental conditions such as heat, moisture or vibration and explosive or corrosive atmospheres



(A) Weld neck flange (B) Butt weld (C) Pipe

Robust design for long life

The ProcessMaster flow sensor is designed for reliability in the demanding operating conditions found in oil and gas industry applications.

- Long lasting sensor lining materials withstand abrasion and corrosion, resulting in longer sensor service life and minimal maintenance requirements
- No additional pressure drop caused by protrusions into the pipe
- Optional self-cleaning measuring electrodes prevent issues caused by build-up of deposits
- Double sealed measuring electrodes minimize the risk of leakage and enhance reliability
- Optional all-316 stainless steel construction for corrosive offshore atmosphere
- Optional fully-welded sensor made from 316 material
- Protection of internal sensor components against moisture and vibration with potted Ex sensor

Range of certificates and test reports

- 3.1 material certificates and/or PMI certificates
- Certificates for non-destructive testing, X-Ray and/or dye penetration test
- Welder qualifications and procedures
- Hydrostatic pressure testing

Specification

Accuracy	Standard: 0.4 % of rate Enhanced: 0.2 % of rate
Nominal size range	DN 25 to 400 (1 to 18 in)
Nominal pressure	ASME CL 600 to 2500
Lining	Hard rubber, ETFE
Electrodes	Stainless steel, Hastelloy C
Process connection	Steel, stainless steel
IP rating	IP67, IP68
Fluid temperature	–25 to 130 °C (–13 to 266 °F)
Power supply	100 to 230 V AC, 24 V AC/DC
I/Os	Current, pulse status output
Communication *	HART protocol, PROFIBUS PA, FOUNDATION Fieldbus
Sensor housing material	Stainless steel 316
Transmitter housing material	Stainless steel
Wetted parts material	Option for NACE
Ex approvals	ATEX/IEC Zone 1.2, FM/cFM Cl1 Div.1, Cl1 Div.2
Marine approval	DNV
Verification	ScanMaster

* Acknowledgements

HART is a registered trademark of FieldComm Group, Austin, Texas, USA.

PROFIBUS is a registered trademark of PROFIBUS and PROFINET International (PI).



FEP630 high pressure magnetic flowmeter



FEP610 high pressure magnetic flowmeter

BLACKBOX

Technical Specifications:

Blackbox 130 is a compact low-cost intelligent controller that allows users to locally program the unit and give a readout of level. Economical and simple to program and operate, users benefit from extremely accurate and reliable digital echo processing with access to the dB and dBR range of transducers, measuring from 125 mm (4.9 in) right through to 40 m (131.2 ft).



PHYSICAL: MOUNTING OPTION SPECIFIC

Mounting Option:	Standard Wall Mount:	Large Wall Mount:
Controller Body Dimensions:	130 mm x 150 mm x 63.5 mm (5.1 in x 5.9 in x 2.5 in)	130 mm x 180 mm x 85 mm (5.1 in x 7.09 in x 3.3 in)
Weight:	Nominal 0.7 kg (1.4 lb)	Nominal 0.8 kg (1.7 lb)
Enclosure Material/Description:		ABS Base with polycarbonate lid, flammability rating UL 94 HB
Cable Entry Detail:	Underside fitted with 3 x M20, nylon cable glands suitable for 6 mm to 12 mm (0.2 in to 0.5 in) cable	Underside fitted with 3 x M20, nylon cable glands suitable for 6 mm to 12 mm (0.2 in to 0.5 in) cable
Transducer Cable Extensions:	2-core screened (2 conductor 20 AWG screened)	
Nominal Separation:	1,000 m (3,280 ft), for greater separation distances please contact us	

ENVIRONMENTAL

IP Rating:	IP66/67
Max. & Min. Temperature (Electronics):	-20 °C to +55 °C (-4 °F to +131 °F)
Flammable Atmosphere Approval:	All Blackbox units must be mounted in a safe area. Compatible with approved dB Transducers
CE Approval:	See EU Declaration of Conformity in the manual
UL Approval:	UL Listed. UL Listed to Canadian Safety Standards. Certificate Number E257330.

PERFORMANCE

Accuracy/Repeatability:	0.25% of the measured range or 6 mm (0.2 in), <i>whichever is greater</i>
Resolution:	dBMAH3 0.3 mm (0.01 in), dB3 0.5 mm (0.02 in), dB6 and dB10 1 mm (0.04 in), dB15 1.5 mm (0.06 in), dB25 2.5 mm (0.1 in), and dB40 5 mm (0.2 in).
Min. & Max. Range:	Dependent on Transducer. Nominally 125 mm to 40 m (4.9 in to 130 ft)
Echo Processing:	DATM (Digital Adaptive Tracking of Echo Movement)
Rate Response:	Fully Adjustable

OUTPUTS

Analog Output:	Isolated output of 4-20mA or 0-20mA into 1 kΩ (user programmable and adjustable) 0.1% resolution
Digital Output:	RS232 for programming and data extraction
Volt Free Contacts, Number, & Rating:	2 form "C" (SPDT) rated at 2 A at 240 V AC
Display:	2 x 12 alpha numeric

PROGRAMMING

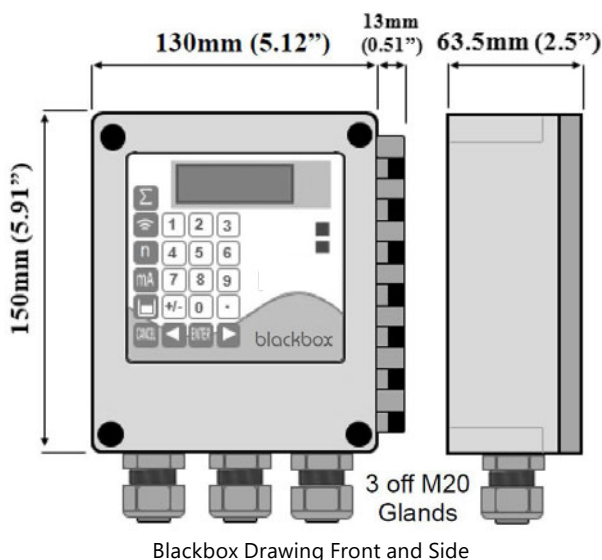
On-board Programming:	Via RS232 using supplied software
PC Programming:	Via RS232 using supplied software
Programming Security:	Via Passcode (user selectable and adjustable)
Programmed Data Integrity:	Via non-volatile RAM
Remote Programming:	Via RS232 using optional handheld calibrator

SUPPLY

Power Supply:	115 V AC +5% / -10% 50/60 Hz, 230 V AC +5% / -10% 50/60 Hz, 10-28 V DC, 10 W maximum power (typically 5 W)
Fuses:	50mA at 230 V AC, 100mA at 115 V AC

REMOTE COMMUNICATIONS

Power Supply:	Power supplied via Blackbox RS232 interface
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Rev 4.0

dB ULTRASONIC TRANSDUCERS

Technical Specifications:

The dB Transducer Series is a range of non-contacting ultrasonic transducers for level, volume, and flow measurement. Available in a variety of models and compatible with all Pulsar controllers so that you have a specific solution to suit your application requirements.



PHYSICAL: TRANSDUCER SPECIFIC

Model:	Dimensions:	Dia Face:	Weight:	Measurement Range:	Frequency:	Beam Angle:
dB3	78 (D) mm x 115 (H) mm (3.1 in x 4.5 in)	19 mm (0.7 in)	1.1 kg (2.4 lb)	125 mm to 3 m (4.9 in to 9.8 ft)	125kHz	<10°
dB6	86 (D) mm x 106 (H) mm (3.4 in x 4.2 in)	30 mm (1.2 in)	1.1 kg (2.4 lb)	300 mm to 6 m (11.8 in to 19.7 ft)	75kHz	<10°
dB56	86 (D) mm x 106 (H) mm (3.4 in x 4.2 in)	45 mm (1.8 in)	1.1 kg (2.4 lb)	200 mm to 6 m (7.9 in to 19.7 ft)	50kHz	<10°
dB10	86 (D) mm x 106 (H) mm (3.4 in x 4.2 in)	45 mm (1.8 in)	1.1 kg (2.4 lb)	300 mm to 10 m (11.8 in to 32.8 ft)	50kHz	<10°
dB15	86 (D) mm x 122 (H) mm (3.4 in x 4.8 in)	60 mm (2.4 in)	1.2 kg (2.6 lb)	500 mm to 15 m (19.7 in to 49.2 ft)	41kHz	<8°
dB25	105 (D) mm x 142 (H) mm (4.1 in x 5.6 in)	78 mm (3.1 in)	1.4 kg (3.1 lb)	600 mm to 25 m (23.6 in to 82 ft)	30kHz	<6°
dB40	205 (D) mm x 223 (H) mm (8.1 in x 8.8 in)	160 mm (6.3 in)	6 kg (13.2 lb)	1.2 m to 40 m (3.9 ft to 131.2 ft)	20kHz	<5°

PHYSICAL: ALL TRANSDUCERS

Sensor Body Material:	Valox 357 U and syntactic foam face
Cable Lengths:	Standard = 5 m, 10 m, 20 m, or 30 m (16.4 ft, 32.8 ft, 65.6 ft, or 98.4 ft). Optional: up to 150 m (492 ft) maximum (increments of 10 m (32.8 ft) only)
Maximum Separation:	500 m (1,640 ft)
Mounting Connection:	BSP or 1" NPT

ENVIRONMENTAL

Enclosure Protection:	IP68 / NEMA 6P
Max. And Min. Temperature (Electronics):	Standard: -40° C to +90° C (-40° F to +194° F) Hazardous area versions: -40° C to +75° C (-40° F to +167° F)

APPROVALS

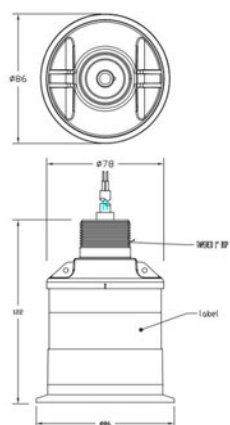
CE Approval:	2014/30/EU to EMC & 2014/34/EU ATEX Directives. Standards applied: EN 60079-0:2012+A11:2013/ EN 60079-11:2012 / EN 60079-18:2009 / EN 60079-26:2007 / EN 61326-1:2013
ATEX Approval:	Standard ATEX EEx m II T6 or optional EEx ia IIC T6. FM/FMC approval.

TRANSDUCER OPTIONS

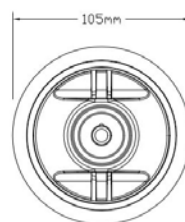
Model:	dB3	dBs6	dB6	dB10	dB15	dB25	dB40
PVDF		✓	✓	✓			
Front Threaded / PVDF	✓	✓	✓	✓			
Submergence Shield	✓	✓	✓	✓	✓	✓	
Flanged DIN/ANSI		✓	✓	✓	✓		
Foam Face		✓		✓	✓	✓	✓
Sanitary Flange		✓	✓	✓			
Intrinsically Safe of All the Above	✓	✓	✓	✓	✓	✓	✓

PERFORMANCE

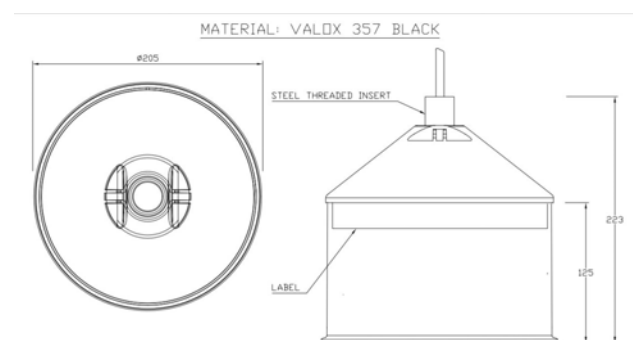
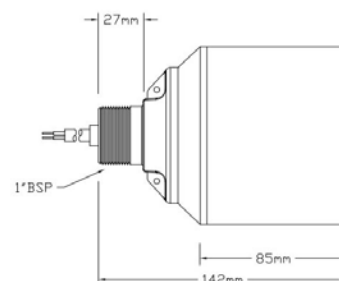
Accuracy:	0.25% or 6 mm (0.2 in) whichever is greater
Resolution:	0.01% or 2 mm (0.08 in) whichever is greater
Temp. Compensation:	Automatic, internal temperature sensor, ± 0.5 °C/°F



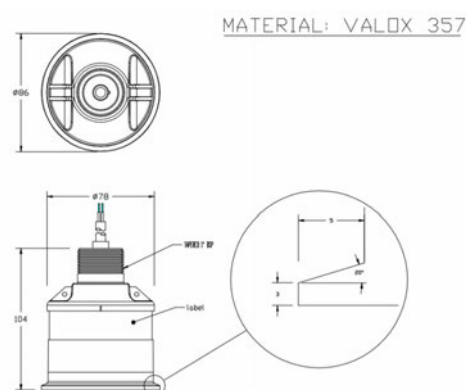
dB15 Transducer Drawing



dB25 Transducer Drawing



dB40 Transducer Drawing



dB6 & dB10 Transducer Drawing



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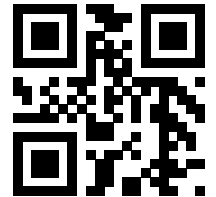
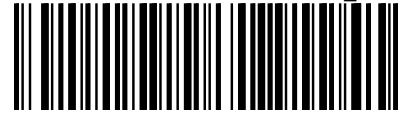
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Rev 7.0

Technical Specification

891480_17.0



ENM 10

Level switch

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1 Product Description

1.1 Product design

Usage

ENM-10 is a level regulator for level control applications. The level regulator starts and stops a pump or activates an alarm device when the liquid level reaches the regulator.

Materials

Denomination	Standard version	Ex version
Regulator casing	Polypropylene	Polypropylene with black conductive casing
Bend relief	EPDM rubber	NBR-PVC rubber
Cable sheath	PVC	NBR-PVC rubber

The plastic components are welded and screwed together.

1.2 Technical data

Application limits

Feature	Value
Liquid temperature	Minimum 0°C (32°F) Maximum 60°C (140°F)
Liquid density	Minimum 0.65 g/cm ³ Maximum 1.5 g/cm ³

Electrical specifications

Feature	Value
Degree of protection	IP68, 20 m (65 ft), 2 bars
Interrupting capacity of micro switch	AC, resistive load, 250 V 10 A AC, inductive load, 250 V 3 A $\cos \phi = 0.5$ DC, 30 V 5 A
Interrupting capacity of gold-plated micro switch	AC, resistive load, 250 V 10 A AC, inductive load, 250 V 3 A $\cos \phi = 0.5$ DC, 24 V 10 mA

Voltage limits are subject to local regulations.

Density ranges

Density g/cm ³	Regulator length mm (in.)	Diameter mm (in.)
0.65 – 0.80	194 (7 10/16)	100 (4)
0.80 – 0.95	177 (7)	100 (4)
0.95 – 1.10	162 (6 3/8)	100 (4)
1.05 – 1.20	142 (5 9/16)	100 (4)
1.20 – 1.30	133 (5 1/4)	100 (4)
1.30 – 1.40	130 (5 2/16)	100 (4)

Density g/cm ³	Regulator length mm (in.)	Diameter mm (in.)
1.40 - 1.50	126 (5)	100 (4)

Weight

A regulator with standard density and 20 m cable weighs approximately 2 kg (4.5 lb).

1.3 Cables

Lengths

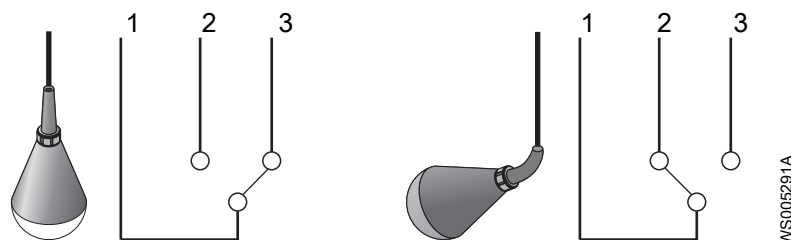
For liquids with specific density between 0.95 and 1.10 g/cm³, the following cables are available:

Version	Lengths m (ft)
Standard	• 6 m (20 ft) • 13 m (42 ft) • 20 m (65 ft) • 30 m (100 ft) • 50 m (167 ft)
Ex	• 6 m (20 ft) • 13 m (42 ft) • 20 m (65 ft) • 30 m (98 ft) • 50 m (164 ft)

Diameter

The cable diameter for all product variants is 6.7 mm (0.26 in), +/- 0.2 mm (0.00787 in).

Color codes



Cable	1	2	3
Color	Grey	Black	Brown

1.4 Approvals and standards

Standard approvals

LVD approval according to EN61058
 CSA approval: Certificate Number 1330172
 Cl. I Zone 0, Gr. IIC
 CL.I Div.1 Gr A, B, C and D
 Cl.II Gr. E, F, and G

Ex approvals

IECEX ia IIC T4 Ga: -20°C ≤ Ta ≤ 60°C
 IECEX NEMKO 09.0008
 ATEX II 1G Ex ia IIC T4 Ga

NEMKO 10 ATEX 1082

Applied standards for ATEX and IEC

- EN 60079-0:2012 / IEC 60079-0:2011
- EN 60079-11:2012 / IEC 60079-11:2011

Intrinsically safe circuits are required for the automatic control system. Use a Zener barrier, for example, part number 84 01 07.

The electrical connections must comply with the Ex regulations of the national submitter.



2 References

2.1 Chemical resistance tables

The tables show the degree of resistance the level regulator has to different chemicals at two different temperatures. The density of the liquid determines the buoyancy of the regulator.

Acids

Acid	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Acetic acid 50%	1	2	0	0
Acetic acid 75%	2	2	0	0
Benzoic acid	2	2	0	0
Boric acid 5%	0	–	0	0
Butyric acid	2	2	2	2
Chromic acid 10%	0	2	2	2
Citric acid	0	1	0	0
Hydrobromic acid 5%	1	2	0	0
Hydrochloric acid 10%	0	1	0	1
Hydrochloric acid 37%	1	2	0	2
Hydrocyanic acid 10%	0	0	1	2
Hydrofluoric acid 5%	0	2	0	1
Hypochloric acid	1	2	2	2
Maleic acid	2	2	2	2
Nitric acid 5%	1	1	1	1
Nitric acid 65%	2	2	2	2
Oleic acid	1	2	2	2
Oxalic acid 50%	1	1	1	2
Phosphoric acid 25%	0	0	1	2
Phosphoric acid 85%	0	0	1	2
Sulphuric acid 10%	1	2	1	2
Sulphuric acid 78%	2	2	2	2
Tannic acid	0	0	0	0
Tartaric acid	1	1	1	1

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Alkalis

Alkali	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Ammonium hydroxide	0	–	0	0
Calcium hydroxide	0	0	0	0

Alkali	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Potassium hydroxide	1	2	0	0
Sodium hydroxide	1	2	0	0

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Salts

Salt	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Aluminum chloride	0	0	0	0
Calcium sulphate	0	0	0	0
Calcium chloride	0	0	0	0
Calcium nitrate	0	0	0	0
Copper chloride	0	0	0	0
Copper sulphate	0	0	0	0
Ferric chloride	0	0	0	0
Ferrous sulphate	0	0	0	0
Magnesium chloride	0	0	0	0
Potassium sulphate	0	0	0	0
Potassium nitrate	0	0	0	0
Potassium carbonate	1	1	1	1
Potassium bicarbonate	0	0	0	0
Sodium sulphate	0	0	0	0
Sodium chloride	0	0	0	0
Sodium nitrate	0	0	0	0
Sodium bicarbonate	0	0	0	0
Sodium carbonate	0	0	0	0
Tin chloride	1	1	1	1
Zinc sulphate	0	0	0	0
Zinc chloride	0	0	0	0

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Oils

Oil	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Castor oil	1	1	1	1
Coconut oil	0	–	0	2
Corn oil	2	2	2	2
Diesel oil	2	2	2	2
Linseed oil	2	2	2	2
Mineral oils	2	2	2	2
Olive oil	1	1	1	1
Silicone oils	0	0	0	0

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Solvents and miscellaneous

Chemical	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Acetone	2	2	2	2
Aniline	2	2	1	2
Benzene	2	2	2	2
Butyl alcohol	2	2	0	1
Carbon tetrachloride	2	2	2	2
Chlorobenzene	2	2	2	2
Chloroform	2	2	2	2
Ethyl alcohol	2	2	0	1
Ethyl ether	2	2	2	2
Ethyl acetate	2	2	2	2
Ethylene dichloride	2	2	2	2
Ethylene chloride	2	2	2	2
Formaldehyde 37%	1	2	0	0
Gasoline	2	2	2	2
Kerosene	2	2	2	2
Methyl alcohol	2	2	0	0
Methyl ethyl ketone	2	2	2	2
Methylene chloride	2	2	2	2
Nitrobenzene	2	2	2	2
Phenol	2	2	2	2
Toluene	2	2	2	2
Trichlorethylene	2	2	2	2
Turpentine	2	2	2	2
Xylene	2	2	2	2

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

Gases

Gas	PVC cable		NBR/PVC cable	
	20°C (68°F)	60°C (140°F)	20°C (68°F)	60°C (140°F)
Carbon dioxide	0	0	0	0
Carbon monoxide	0	0	0	0
Chlorine - wet	2	2	2	2
Hydrogen sulfide	0	0	1	1
Sulphur dioxide - wet	1	1	2	2

0 = No effect. 1 = Minor to moderate effect. 2 = Severe effect. – = No available information.

2.2 Product range

Version	For density (g/cm ³)	Color of level switch	Length of cable (m)	Type of cable ¹	Approvals	For market
582 88 00	0.65–0.80	Blue	20	1	CE	International
582 88 01	0.80–0.95	Blue	20	1	CE	International
582 88 02	0.95–1.10	Blue	6	1	CE	International
582 88 03	0.95–1.10	Blue	13	1	CE	International
582 88 04	0.95–1.10	Blue	20	1	CE	International
582 88 05	1.05–1.20	Blue	20	1	CE	International
582 88 06	1.20–1.30	Blue	20	1	CE	International
582 88 07	1.30–1.40	Blue	20	1	CE	International
582 88 08	1.40–1.50	Blue	20	1	CE	International
582 88 09	0.65–0.80	Gray	20	3	CSA/CE	Canada
582 88 10	0.80–0.95	Gray	20	3	CSA/CE	Canada
582 88 11	0.95–1.10	Gray	6	3	CSA/CE	Canada
582 88 12	0.95–1.10	Gray	13	3	CSA/CE	Canada
582 88 13	0.95–1.10	Gray	20	3	CSA/CE	Canada
582 88 14	1.05–1.20	Gray	20	3	CSA/CE	Canada
582 88 15	1.20–1.30	Gray	20	3	CSA/CE	Canada
582 88 16	1.30–1.40	Gray	20	3	CSA/CE	Canada
582 88 17	1.40–1.50	Gray	20	3	CSA/CE	Canada
582 88 18	0.65–0.80	Gray	20	1	CSA/CE	Canada
582 88 19	0.80–0.95	Gray	20	1	CSA/CE	Canada
582 88 20	0.95–1.10	Gray	6	1	CSA/CE	Canada
582 88 21	0.95–1.10	Gray	13	1	CSA/CE	Canada
582 88 22	0.95–1.10	Gray	20	1	CSA/CE	Canada
582 88 23	1.05–1.20	Gray	20	1	CSA/CE	Canada
582 88 24	1.20–1.30	Gray	20	1	CSA/CE	Canada
582 88 25	1.30–1.40	Gray	20	1	CSA/CE	Canada
582 88 26	1.40–1.50	Gray	20	1	CSA/CE	Canada
582 88 36	0.95–1.10	Gray	30	3	CSA/CE	Canada
582 88 37	0.95–1.10	Gray	50	3	CSA/CE	Canada
582 88 38	0.95–1.10	Gray	100	3	CSA/CE	Canada
582 88 39	0.95–1.10	Gray	150	3	CSA/CE	Canada
582 88 51	0.95–1.10	Red	65	2	CE	International
582 88 52	0.95–1.10	Red	6	2	CE	International
582 88 53	0.95–1.10	Red	13	2	CE	International
582 88 54	0.95–1.10	Red	20	2	CE	International
582 88 57	0.95–1.10	Red	20	2	CE	Canada
582 88 70	0.65–0.80	Blue	20	3	CE	International
582 88 71	0.80–0.95	Blue	20	3	CE	International
582 88 72	0.95–1.10	Blue	6	3	CE	International
582 88 73	0.95–1.10	Blue	13	3	CE	International

¹ See *Type of cables* on page 9.

Version	For density (g/cm ³)	Color of level switch	Length of cable (m)	Type of cable ¹	Approvals	For market
582 88 74	0.95–1.10	Blue	20	3	CE	International
582 88 75	1.05–1.20	Blue	20	3	CE	International
582 88 76	1.20–1.30	Blue	20	3	CE	International
582 88 77	1.30–1.40	Blue	20	3	CE	International
582 88 78	1.40–1.50	Blue	20	3	CE	International
582 88 79	0.95–1.10	Blue	65	1	CE	International
582 88 80	0.95–1.10	Blue	30	1	CE	International
582 88 81	0.95–1.10	Blue	50	1	CE	International
582 88 82	0.95–1.10	Gray	30	1	CSA/CE	Canada
582 88 83	0.95–1.10	Gray	50	1	CSA/CE	Canada
582 88 86	0.95–1.10	Red	30	2	CE	International
582 88 87	0.95–1.10	Red	50	2	CE	International
582 88 90	0.95–1.10	Blue	30	3	CE	International
582 88 91	0.95–1.10	Blue	50	3	CE	International
582 88 92	0.95–1.10	Red	6	2	CE	Japan
582 88 93	0.95–1.10	Red	13	2	CE	Japan
582 88 94	0.95–1.10	Red	20	2	CE	Japan
582 88 95	0.95–1.10	Blue	6	1	CE	Japan
582 88 96	0.95–1.10	Blue	13	1	CE	Japan
582 88 98	0.95–1.10	Blue	50	1	CE	Japan
594 79 10	0.95–1.10	Blue	70	3	CE	International
594 79 13	0.95–1.10	Blue	100	3	CE	International
594 79 18	0.95–1.10	Blue	150	3	CE	International
594 79 19 ²	0.95–1.10	Blue	20	3	CE	International
594 79 20 ²	0.95–1.10	Gray	20	3	CSA/CE	International
594 79 21 ²	0.95–1.10	Transparent	6	3	CE	For demonstration only.
594 79 40 ²	0.95–1.10	Black	6	3	ATEX/IECEX ³	International
594 79 41 ²	0.95–1.10	Black	13	3	ATEX/IECEX ³	International
594 79 42 ²	0.95–1.10	Black	20	3	ATEX/IECEX ³	International
594 79 49 ²	0.95–1.10	Black	30	3	ATEX/IECEX ³	International
594 79 50 ²	0.95–1.10	Black	50	3	ATEX/IECEX ³	International

Type of cables

Type of cable	Jacket	Color coding of wires
1	Blue polyvinyl chloride (PVC)	Grey/Brown/Black
2	Red PVC	Grey/Brown/Black
3	Black nitrile rubber (NBR)/PVC	Grey/Brown/Black

¹ See *Type of cables* on page 9.

² Designed for low current, slow movements and oil. Includes micro switch with gold plated contacts.

³ Zener barrier 84 01 07 required.

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- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

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The original instruction is in English. All non-English
instructions are translations of the original instruction.

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Appendix F – EPANET Modelling

	Project Number	Project	Date	Author	Checked
	298001	SL1-Residential	24-08-2026	JPK	SM

Water Supply Modelling Report

for staged development

Draft report prepared for internal review

Summary of Stages

Table 1: Summary of stages from the tested results

Stage	Pressure Requirement
Stage 1	All nodes above 200 kPa
Stage 1 + 2	All nodes above 200 kPa
Stage 1 + 2 + 3	All nodes above 200 kPa
Stage 1 + 2 + 3 + 4	All nodes above 200 kPa
Stage 1 + 2 + 3 + 4 + 5	All nodes above 200 kPa

Water Supply standards as per RITS,

6.1.3.1 On Demand Water Supply Area

The design of the network shall conform to the Code of Practice for Fire Fighting Water Supplies (SNZ PAS 4509), and shall be such that a water supply connection can be provided for each lot.

The water supply network shall achieve the following standards:

- a) The residual pressure and flow at point of supply to residential lots shall be a minimum of 200 kPa (20m) and 25 L/min. Some specific areas may require a higher Level of Service – check with the relevant Council.
- b) The minimum fire supply service level shall be FW2 for residential areas and FW3 for all other areas. Some specific areas may require a higher level of service.

FW2 standards from SNZ PAS 4509:2008 – Table 2

Fire water classification	Reticulated water supply			Non-reticulated water supply	
	Required water flow within a distance of 135 m	Additional water flow within a distance of 270 m	Maximum number of fire hydrants to provide flow	Minimum water storage within a distance of 90 m (see Note 8)	
				Time (firefighting) (min)	Volume (m ³)
FW1	450 L/min (7.5 L/s) (See Note 3)	–	1	15	7
FW2	750 L/min (12.5 L/s)	750 L/min (12.5 L/s)	2	30	45

Requirement: All lots to have at least 200kPa (20m) of pressure at supply point

Assumptions: The calculation is modelled based on the assumption that the existing water supply connection points will be 250kPa.

Stage 1

Reservoir total head assumed 25m above the proposed ground level

Table 2: Stage 1 results

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n1	39.933	0	66.81	26.88	Junc n92	41.47	0	66.42	24.95
Junc n9	41.216	0.22	66.93	25.71	Junc n123	39.477	0.04	65.70	26.23
Junc n10	41.995	0.18	66.56	24.57	Junc n125	39.559	0.04	65.35	25.79
Junc n11	41.010	0	66.81	25.80	Junc n134	39.425	0.23	65.69	26.27
Junc n12	40.511	0	66.84	26.33	Junc n135	39.86	0	65.78	25.92
Junc n17	41.270	0	66.93	25.66	Junc n136	39.991	12.5	65.88	25.89
Junc n18	41.104	12.5	66.83	25.72	Junc n137	40.224	0	66.91	26.69
Junc n24	40.927	0	66.92	25.99	Junc n138	40.064	0.15	66.77	26.71
Junc n25	40.812	12.5	66.68	25.87	Junc n139	40.361	0.04	66.91	26.55
Junc n26	40.763	0.15	66.49	25.73	Junc n140	40.174	0.16	66.87	26.70
Junc n27	41.428	0	66.48	25.05	Junc n142	40.565	0	66.87	26.31
Junc n28	40.874	0.09	66.92	26.04	Junc n167	40.141	0	65.78	25.64
Junc n29	40.598	0.09	66.86	26.26	Junc n168	39.782	0	66.71	26.93
Junc n30	40.852	0.02	66.71	25.86	Junc n169	39.767	12.5	66.61	26.84
Junc n41	41.935	0	66.93	25.00	Junc n171	39.343	12.5	65.53	26.18
Junc n55	41.428	0	66.41	24.99	Junc n172	39.229	0	65.31	26.08
Junc n64	39.885	0	66.83	26.94	Junc n173	39.970	12.5	65.10	25.13
Junc n65	39.392	0	65.67	26.28	Junc n175	40.090	0	65.10	25.01
Junc n66	39.256	0.11	65.32	26.06	Junc n176	39.447	0.05	65.34	25.89
Junc n67	39.508	0.09	65.74	26.23	Junc n177	0	0	65.34	65.34
Junc n70	39.723	12.5	65.36	25.64	Junc n178	41.470	0	66.48	25.01
Junc n75	41.321	0	66.56	25.24	Junc n179	40.578	0.05	66.85	26.27
Junc n85	39.880	0.18	66.84	26.96	Junc n180	39.861	12.5	65.70	25.84
Junc n86	39.940	0	66.74	26.80	Junc n181	0	0	65.75	65.75
Junc n87	39.933	0	66.77	26.83	Junc n182	39.850	0.1	65.75	25.90
Junc n88	39.559	0.15	65.88	26.32	Junc n183	40.215	12.5	65.92	25.70
Junc n89	40.150	0.07	65.10	24.95	Junc n185	41.041	12.5	66.47	25.43
Junc n90	40.691	0.11	65.65	24.96	Junc n186	41.110	12.5	66.81	25.70
Junc n92	41.47	0	66.42	24.95	Junc 16	39.628	0	66.91	27.28
Junc n123	39.477	0.04	65.70	26.23	Resvr 2	66.935	#N/A	66.93	0.00
Junc n125	39.559	0.04	65.35	25.79	Resvr 3	66.47	#N/A	66.47	0.00
Junc n134	39.425	0.23	65.69	26.27	Resvr 4	66.47	#N/A	66.47	0.00
Junc n135	39.86	0	65.78	25.92	Resvr 5	65.09	#N/A	65.09	0.00

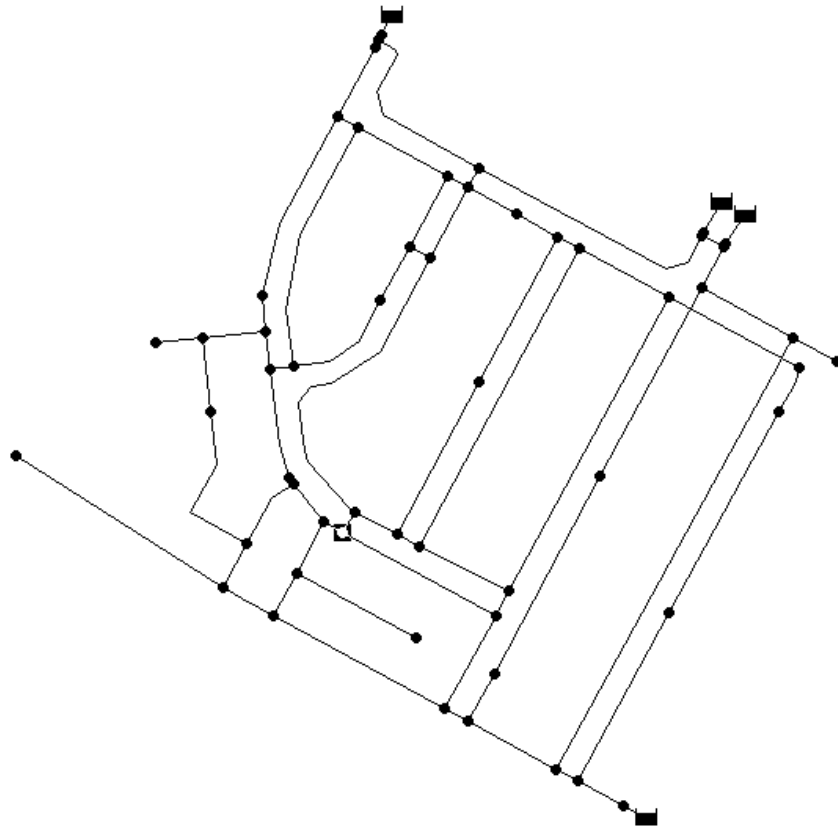


Figure 1: Stage 1 network layout

Stage 1 + 2

Reservoir total head assumed 25m above the proposed ground level

Table 3: Stage 2 results

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n1	39.933	0	65.83	25.89	Junc n75	41.321	0	66.49	25.17
Junc n3	40.199	0	64.38	24.18	Junc n79	39.888	0.05	64.37	24.49
Junc n4	40.173	0.05	64.37	24.20	Junc n80	40.588	0.18	64.23	23.64
Junc n5	39.205	0.09	64.57	25.36	Junc n81	39.58	0.05	64.52	24.94
Junc n6	39.369	12.5	64.52	25.15	Junc n82	40.365	0.15	64.22	23.86
Junc n9	41.216	0.22	66.66	25.44	Junc n83	39.9	0.18	63.66	23.76
Junc n10	41.995	0.18	66.49	24.49	Junc n84	38.575	0	63.19	24.62
Junc n11	41.010	0	66.35	25.34	Junc n85	39.880	0.18	66.23	26.35
Junc n12	40.511	0	66.24	25.72	Junc n86	39.940	0	65.90	25.96
Junc n17	41.270	0	66.73	25.46	Junc n87	39.933	0	65.82	25.89
Junc n18	41.104	12.5	66.48	25.37	Junc n88	39.559	0.15	65.01	25.45
Junc n24	40.927	0	66.38	25.45	Junc n89	40.150	0.07	65.07	24.92
Junc n25	40.812	12.5	66.26	25.45	Junc n90	40.691	0.11	65.58	24.89
Junc n26	40.763	0.15	66.45	25.69	Junc n92	41.47	0	66.42	24.95
Junc n27	41.428	0	66.47	25.04	Junc n95	39.363	0.14	64.38	25.02
Junc n28	40.874	0.09	66.31	25.44	Junc n96	40.099	0.07	64.26	24.16
Junc n29	40.598	0.09	66.22	25.62	Junc n123	39.477	0.04	64.84	25.36
Junc n30	40.852	0.02	65.81	24.96	Junc n125	39.559	0.04	65.03	25.47
Junc n39	39.715	0.18	64.77	25.06	Junc n127	38.573	0	63.19	24.61
Junc n40	40.366	0.03	64.44	24.07	Junc n128	40.588	0.04	64.23	23.64
Junc n41	41.935	0	66.88	24.95	Junc n129	39.213	0	64.58	25.36
Junc n42	0	0	64.66	64.66	Junc n130	39.597	0.06	64.61	25.01
Junc n43	39.942	0.07	64.21	24.27	Junc n131	39.666	0	64.61	24.94
Junc n44	39.095	0	64.12	25.03	Junc n134	39.425	0.23	65.12	25.70
Junc n47	40.751	0.14	64.24	23.49	Junc n135	39.86	0	65.14	25.28
Junc n50	40.161	12.5	63.29	23.13	Junc n136	39.991	12.5	65.16	25.17
Junc n51	39.848	0.05	64.37	24.53	Junc n137	40.224	0	65.67	25.45
Junc n52	40.057	12.5	64.22	24.16	Junc n138	40.064	0.15	65.63	25.56
Junc n55	41.428	0	66.41	24.98	Junc n139	40.361	0.04	65.82	25.46
Junc n64	39.885	0	65.80	25.92	Junc n140	40.174	0.16	65.81	25.64
Junc n65	39.392	0	65.13	25.74	Junc n142	40.565	0	65.81	25.24
Junc n66	39.256	0.11	65.05	25.80	Junc n145	40.776	12.5	64.23	23.46
Junc n67	39.508	0.09	65.16	25.65	Junc n146	40.415	0.05	64.22	23.81
Junc n70	39.723	12.5	65.02	25.30	Junc n147	40.243	12.5	64.33	24.09

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n147	40.243	12.5	64.33	24.09
Junc n149	39.539	12.5	64.53	24.99
Junc n151	40.059	12.5	64.21	24.15
Junc n154	38.563	12.5	63.18	24.62
Junc n155	39.195	12.5	64.44	25.24
Junc n156	39.130	0.14	64.50	25.37
Junc n159	39.301	12.5	64.65	25.35
Junc n160	39.337	0	64.70	25.36
Junc n161	39.368	0	64.76	25.39
Junc n164	39.566	0	64.99	25.43
Junc n167	40.141	0	65.14	25.00
Junc n168	39.782	0	65.61	25.83
Junc n169	39.767	12.5	65.55	25.78
Junc n171	39.343	12.5	65.06	25.72
Junc n172	39.229	0	65.05	25.82
Junc n173	39.970	12.5	65.05	25.08
Junc n175	40.090	0	65.07	24.98
Junc n176	39.447	0.05	65.04	25.59
Junc n177	0	0	65.04	65.04
Junc n178	41.470	0	66.46	24.99
Junc n179	40.578	0.05	66.21	25.64
Junc n180	39.861	12.5	64.84	24.98
Junc n181	0	0	64.88	64.88
Junc n182	39.850	0.1	64.88	25.03
Junc n183	40.215	12.5	65.05	24.83
Junc n185	41.041	12.5	66.24	25.20
Junc n186	41.110	12.5	66.35	25.24
Junc 14	39.843	0	64.85	25.01
Junc 16	39.628	0	65.47	25.84
Resvr 1	64.095	#N/A	64.10	0.00
Resvr 2	66.935	#N/A	66.93	0.00
Resvr 3	66.47	#N/A	66.47	0.00
Resvr 4	66.47	#N/A	66.47	0.00
Resvr 5	65.09	#N/A	65.09	0.00

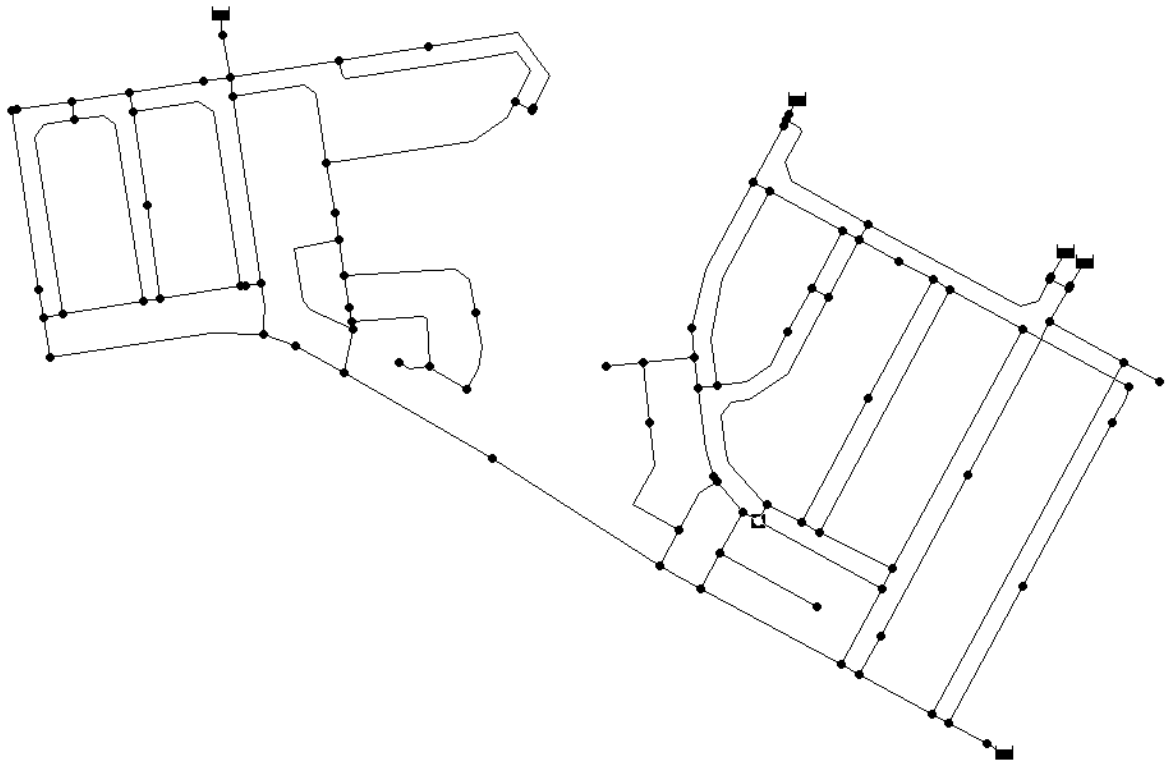


Figure 2: Stage 2 network layout

Stage 1 + 2 + 3

Reservoir total head assumed 25m above the proposed ground level

Table 4: Stage 3 Results

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n1	39.933	0	65.67	25.74	Junc n61	40.056	0	64.80	24.75
Junc n3	40.199	0	64.34	24.14	Junc n64	39.885	0	65.64	25.75
Junc n4	40.173	0.05	64.34	24.17	Junc n65	39.392	0	65.05	25.66
Junc n5	39.205	0.09	64.50	25.29	Junc n66	39.256	0.11	65.00	25.75
Junc n6	39.369	12.5	64.44	25.07	Junc n67	39.508	0.09	65.07	25.56
Junc n9	41.216	0.22	66.62	25.40	Junc n70	39.723	12.5	64.96	25.24
Junc n10	41.995	0.18	66.47	24.48	Junc n74	39.884	0	65.09	25.20
Junc n11	41.010	0	66.29	25.28	Junc n75	41.321	0	66.47	25.15
Junc n12	40.511	0	66.14	25.63	Junc n77	40.115	0.03	64.74	24.62
Junc n17	41.270	0	66.70	25.43	Junc n79	39.888	0.05	64.34	24.45
Junc n18	41.104	12.5	66.43	25.33	Junc n80	40.588	0.18	64.21	23.63
Junc n24	40.927	0	66.30	25.37	Junc n81	39.58	0.05	64.48	24.90
Junc n25	40.812	12.5	66.20	25.39	Junc n82	40.365	0.15	64.21	23.84
Junc n26	40.763	0.15	66.44	25.68	Junc n83	39.9	0.18	63.64	23.74
Junc n27	41.428	0	66.46	25.03	Junc n84	38.575	0	63.18	24.60
Junc n28	40.874	0.09	66.22	25.35	Junc n85	39.880	0.18	66.14	26.26
Junc n29	40.598	0.09	66.12	25.52	Junc n86	39.940	0	65.76	25.82
Junc n30	40.852	0.02	65.67	24.82	Junc n87	39.933	0	65.67	25.74
Junc n35	39.873	12.5	65.12	25.25	Junc n88	39.559	0.15	64.87	25.31
Junc n36	39.783	0.04	65.12	25.34	Junc n89	40.150	0.07	65.05	24.90
Junc n37	40.718	0	64.80	24.08	Junc n90	40.691	0.11	65.56	24.87
Junc n39	39.715	0.18	64.71	25.00	Junc n92	41.47	0	66.42	24.95
Junc n40	40.366	0.03	64.40	24.04	Junc n94	40.202	0.03	64.80	24.60
Junc n41	41.935	0	66.88	24.94	Junc n95	39.363	0.14	64.34	24.98
Junc n42	0	0	64.61	64.61	Junc n96	40.099	0.07	64.24	24.14
Junc n43	39.942	0.07	64.20	24.26	Junc n99	40.747	0.09	64.80	24.05
Junc n44	39.095	0	64.12	25.03	Junc n100	40.465	0	64.80	24.33
Junc n47	40.751	0.14	64.22	23.47	Junc n102	40.404	12.5	64.74	24.34
Junc n50	40.161	12.5	63.27	23.11	Junc n105	40.62	0.01	64.79	24.17
Junc n51	39.848	0.05	64.34	24.50	Junc n107	39.852	12.5	64.82	24.97
Junc n52	40.057	12.5	64.20	24.15	Junc n108	40.138	0.05	64.79	24.65
Junc n53	40.202	0.14	65.03	24.83	Junc n109	40.141	0.06	64.80	24.66
Junc n54	39.905	0.05	65.09	25.18	Junc n110	39.762	0.04	65.12	25.36
Junc n55	41.428	0	66.41	24.98	Junc n111	39.942	12.5	65.05	25.11

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n123	39.477	0.04	64.73	25.26	Junc n173	39.970	12.5	65.03	25.06
Junc n125	39.559	0.04	64.96	25.40	Junc n175	40.090	0	65.05	24.96
Junc n127	38.573	0	63.17	24.60	Junc n176	39.447	0.05	64.98	25.53
Junc n128	40.588	0.04	64.21	23.62	Junc n177	0	0	64.98	64.98
Junc n129	39.213	0	64.50	25.29	Junc n178	41.470	0	66.46	24.99
Junc n130	39.597	0.06	64.53	24.93	Junc n179	40.578	0.05	66.11	25.54
Junc n131	39.666	0	64.53	24.87	Junc n180	39.861	12.5	64.73	24.87
Junc n134	39.425	0.23	65.04	25.62	Junc n181	0	0	64.77	64.77
Junc n135	39.86	0	65.05	25.19	Junc n182	39.850	0.1	64.77	24.92
Junc n136	39.991	12.5	65.06	25.07	Junc n183	40.215	12.5	64.92	24.71
Junc n137	40.224	0	65.48	25.26	Junc n185	41.041	12.5	66.19	25.15
Junc n138	40.064	0.15	65.45	25.38	Junc n186	41.110	12.5	66.29	25.18
Junc n139	40.361	0.04	65.65	25.29	Junc n187	39.772	0.14	64.84	25.07
Junc n140	40.174	0.16	65.64	25.47	Junc n188	39.488	12.5	64.95	25.46
Junc n142	40.565	0	65.64	25.08	Junc n190	39.437	0.08	64.99	25.55
Junc n145	40.776	12.5	64.22	23.44	Junc n193	40.158	12.5	65.12	24.96
Junc n146	40.415	0.05	64.21	23.79	Junc n214	40.243	12.5	64.80	24.55
Junc n147	40.243	12.5	64.31	24.06	Junc n216	40.54	12.5	64.77	24.23
Junc n149	39.539	12.5	64.49	24.95	Junc 6	40.718	0.22	64.78	24.06
Junc n151	40.059	12.5	64.20	24.14	Junc 7	40.836	12.5	64.74	23.90
Junc n154	38.563	12.5	63.17	24.61	Junc 8	40.821	0.05	64.74	23.92
Junc n155	39.195	12.5	64.39	25.19	Junc 9	40.423	0	64.74	24.32
Junc n156	39.130	0.14	64.44	25.31	Junc 10	40.814	0	64.74	23.93
Junc n159	39.301	12.5	64.57	25.27	Junc 12	39.212	0.1	64.79	25.58
Junc n160	39.337	0	64.62	25.28	Junc 13	39.903	0.17	65.06	25.16
Junc n161	39.368	0	64.67	25.30	Junc 11	39.812	0	64.81	25.00
Junc n164	39.566	0	64.89	25.32	Junc 14	39.843	0	64.79	24.94
Junc n167	40.141	0	65.05	24.91	Junc 15	39.597	0.06	65.14	25.54
Junc n168	39.782	0	65.44	25.66	Junc 16	39.628	0	65.24	25.61
Junc n169	39.767	12.5	65.39	25.62	Resvr 1	64.095	#N/A	64.10	0.00
Junc n171	39.343	12.5	65.00	25.66	Resvr 2	66.935	#N/A	66.93	0.00
Junc n172	39.229	0	65.00	25.77	Resvr 3	66.47	#N/A	66.47	0.00
Junc n173	39.970	12.5	65.03	25.06	Resvr 4	66.47	#N/A	66.47	0.00
Junc n175	40.090	0	65.05	24.96	Resvr 5	65.09	#N/A	65.09	0.00

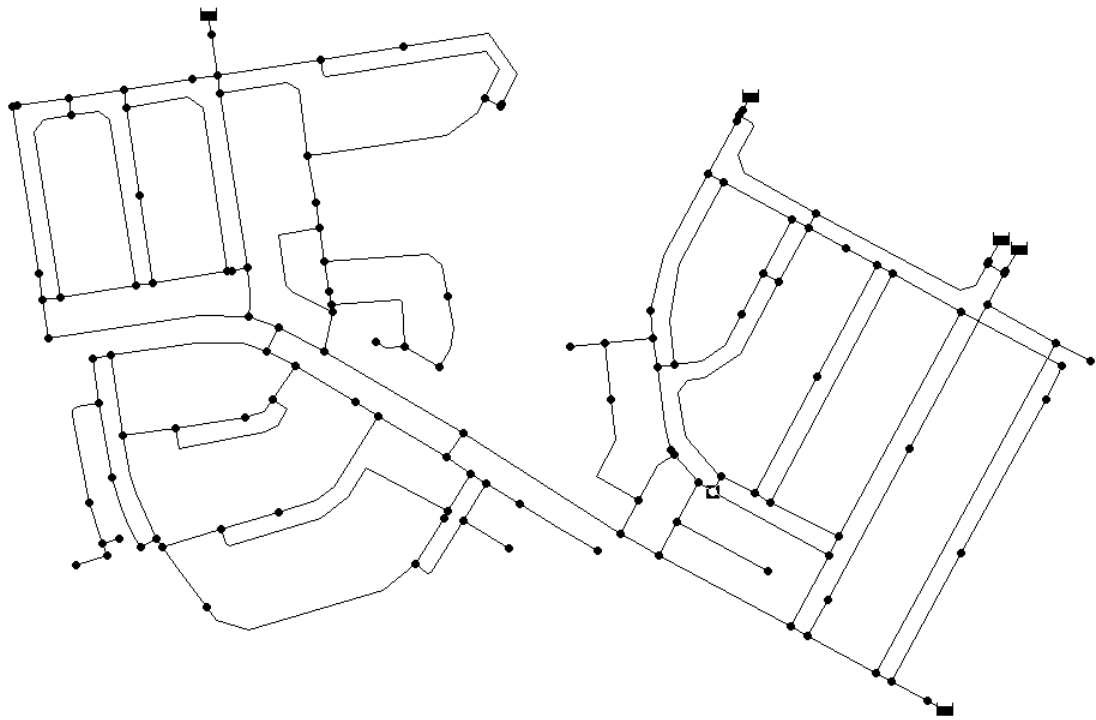


Figure 3: Stage 3 network layout

Stage 1 + 2 + 3 + 4

Reservoir total head assumed 25m above the proposed ground level

Table 5: Stage 4 Results

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n1	39.933	0	65.65	25.72	Junc n57	40.766	0	62.26	21.50
Junc n3	40.199	0	64.32	24.12	Junc n58	40.442	0.07	62.26	21.82
Junc n4	40.173	0.05	64.32	24.15	Junc n59	40.256	0.17	62.07	21.82
Junc n5	39.205	0.09	64.47	25.26	Junc n60	40.437	0	62.07	21.64
Junc n6	39.369	12.5	64.41	25.04	Junc n61	40.056	0	64.68	24.63
Junc n9	41.216	0.22	66.62	25.40	Junc n64	39.885	0	65.61	25.73
Junc n10	41.995	0.18	66.47	24.48	Junc n65	39.392	0	65.04	25.65
Junc n11	41.010	0	66.28	25.27	Junc n66	39.256	0.11	65.00	25.74
Junc n12	40.511	0	66.13	25.62	Junc n67	39.508	0.09	65.06	25.55
Junc n17	41.270	0	66.69	25.42	Junc n70	39.723	12.5	64.95	25.23
Junc n18	41.104	12.5	66.42	25.32	Junc n71	40.25	0.19	62.08	21.83
Junc n24	40.927	0	66.29	25.36	Junc n72	39.782	0.19	62.06	22.28
Junc n25	40.812	12.5	66.19	25.38	Junc n74	39.884	0	65.05	25.17
Junc n26	40.763	0.15	66.44	25.68	Junc n75	41.321	0	66.47	25.15
Junc n27	41.428	0	66.46	25.03	Junc n76	40.376	12.5	62.31	21.93
Junc n28	40.874	0.09	66.21	25.33	Junc n77	40.115	0.03	63.43	23.32
Junc n29	40.598	0.09	66.10	25.51	Junc n79	39.888	0.05	64.32	24.43
Junc n30	40.852	0.02	65.65	24.80	Junc n80	40.588	0.18	64.20	23.61
Junc n35	39.873	12.5	65.09	25.22	Junc n81	39.58	0.05	64.45	24.87
Junc n36	39.783	0.04	65.10	25.31	Junc n82	40.365	0.15	64.20	23.83
Junc n37	40.718	0	64.67	23.95	Junc n83	39.9	0.18	63.63	23.73
Junc n39	39.715	0.18	64.67	24.96	Junc n84	38.575	0	63.17	24.59
Junc n40	40.366	0.03	64.38	24.01	Junc n85	39.880	0.18	66.13	26.25
Junc n41	41.935	0	66.88	24.94	Junc n86	39.940	0	65.74	25.80
Junc n42	0	0	64.57	64.57	Junc n87	39.933	0	65.65	25.71
Junc n43	39.942	0.07	64.19	24.25	Junc n88	39.559	0.15	64.85	25.29
Junc n44	39.095	0	64.12	25.02	Junc n89	40.150	0.07	65.05	24.90
Junc n47	40.751	0.14	64.20	23.45	Junc n90	40.691	0.11	65.56	24.87
Junc n50	40.161	12.5	63.27	23.10	Junc n92	41.47	0	66.42	24.95
Junc n51	39.848	0.05	64.32	24.47	Junc n94	40.202	0.03	64.68	24.48
Junc n52	40.057	12.5	64.19	24.13	Junc n95	39.363	0.14	64.32	24.96
Junc n53	40.202	0.14	64.98	24.78	Junc n96	40.099	0.07	64.23	24.13
Junc n54	39.905	0.05	65.05	25.15	Junc n99	40.747	0.09	64.68	23.93
Junc n55	41.428	0	66.41	24.98	Junc n100	40.465	0	64.68	24.21

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n102	40.404	12.5	64.47	24.07	Junc n164	39.566	0	64.84	25.28
Junc n105	40.62	0.01	64.67	24.05	Junc n167	40.141	0	65.03	24.89
Junc n107	39.852	12.5	64.71	24.86	Junc n168	39.782	0	65.41	25.63
Junc n108	40.138	0.05	64.64	24.50	Junc n169	39.767	12.5	65.36	25.60
Junc n109	40.141	0.06	64.68	24.54	Junc n171	39.343	12.5	64.99	25.64
Junc n110	39.762	0.04	65.10	25.33	Junc n172	39.229	0	64.99	25.77
Junc n111	39.942	12.5	65.01	25.07	Junc n173	39.970	12.5	65.02	25.05
Junc n123	39.477	0.04	64.72	25.24	Junc n175	40.090	0	65.05	24.96
Junc n125	39.559	0.04	64.95	25.39	Junc n176	39.447	0.05	64.97	25.52
Junc n126	39.782	0	62.06	22.28	Junc n177	0	0	64.97	64.97
Junc n127	38.573	0	63.16	24.59	Junc n178	41.470	0	66.46	24.99
Junc n128	40.588	0.04	64.20	23.61	Junc n179	40.578	0.05	66.10	25.52
Junc n129	39.213	0	64.47	25.26	Junc n180	39.861	12.5	64.71	24.85
Junc n130	39.597	0.06	64.50	24.90	Junc n181	0	0	64.75	64.75
Junc n131	39.666	0	64.50	24.83	Junc n182	39.850	0.1	64.75	24.90
Junc n134	39.425	0.23	65.03	25.60	Junc n183	40.215	12.5	64.90	24.69
Junc n135	39.86	0	65.03	25.17	Junc n185	41.041	12.5	66.18	25.14
Junc n136	39.991	12.5	65.04	25.05	Junc n186	41.110	12.5	66.28	25.17
Junc n137	40.224	0	65.46	25.23	Junc n187	39.772	0.14	64.78	25.01
Junc n138	40.064	0.15	65.42	25.36	Junc n188	39.488	12.5	64.89	25.41
Junc n139	40.361	0.04	65.63	25.26	Junc n190	39.437	0.08	64.94	25.50
Junc n140	40.174	0.16	65.62	25.45	Junc n206	40.593	12.5	62.05	21.46
Junc n142	40.565	0	65.62	25.06	Junc n207	40.271	0.01	62.08	21.81
Junc n145	40.776	12.5	64.20	23.43	Junc n208	40.696	12.5	62.11	21.41
Junc n146	40.415	0.05	64.20	23.78	Junc n209	40.499	0	62.28	21.78
Junc n147	40.243	12.5	64.29	24.04	Junc n210	40.44	0	62.30	21.86
Junc n149	39.539	12.5	64.46	24.92	Junc n212	39.778	12.5	62.06	22.28
Junc n151	40.059	12.5	64.19	24.13	Junc n214	40.243	12.5	64.68	24.44
Junc n154	38.563	12.5	63.16	24.60	Junc n216	40.54	12.5	64.67	24.13
Junc n155	39.195	12.5	64.36	25.17	Junc 6	40.718	0.22	64.47	23.75
Junc n156	39.130	0.14	64.41	25.28	Junc 7	40.836	12.5	63.70	22.86
Junc n159	39.301	12.5	64.54	25.24	Junc 8	40.821	0.05	63.53	22.71
Junc n160	39.337	0	64.58	25.25	Junc 9	40.423	0	63.53	23.11
Junc n161	39.368	0	64.63	25.27	Junc 10	40.814	0	63.53	22.72

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc 12	39.212	0.1	64.70	25.49
Junc 13	39.903	0.17	65.02	25.12
Junc 11	39.812	0	64.75	24.93
Junc 14	39.843	0	64.74	24.90
Junc 15	39.597	0.06	65.11	25.51
Junc 16	39.628	0	65.21	25.58
Resvr 1	64.095	#N/A	64.10	0.00
Resvr 2	66.935	#N/A	66.93	0.00
Resvr 3	66.47	#N/A	66.47	0.00
Resvr 4	66.47	#N/A	66.47	0.00
Resvr 5	65.09	#N/A	65.09	0.00

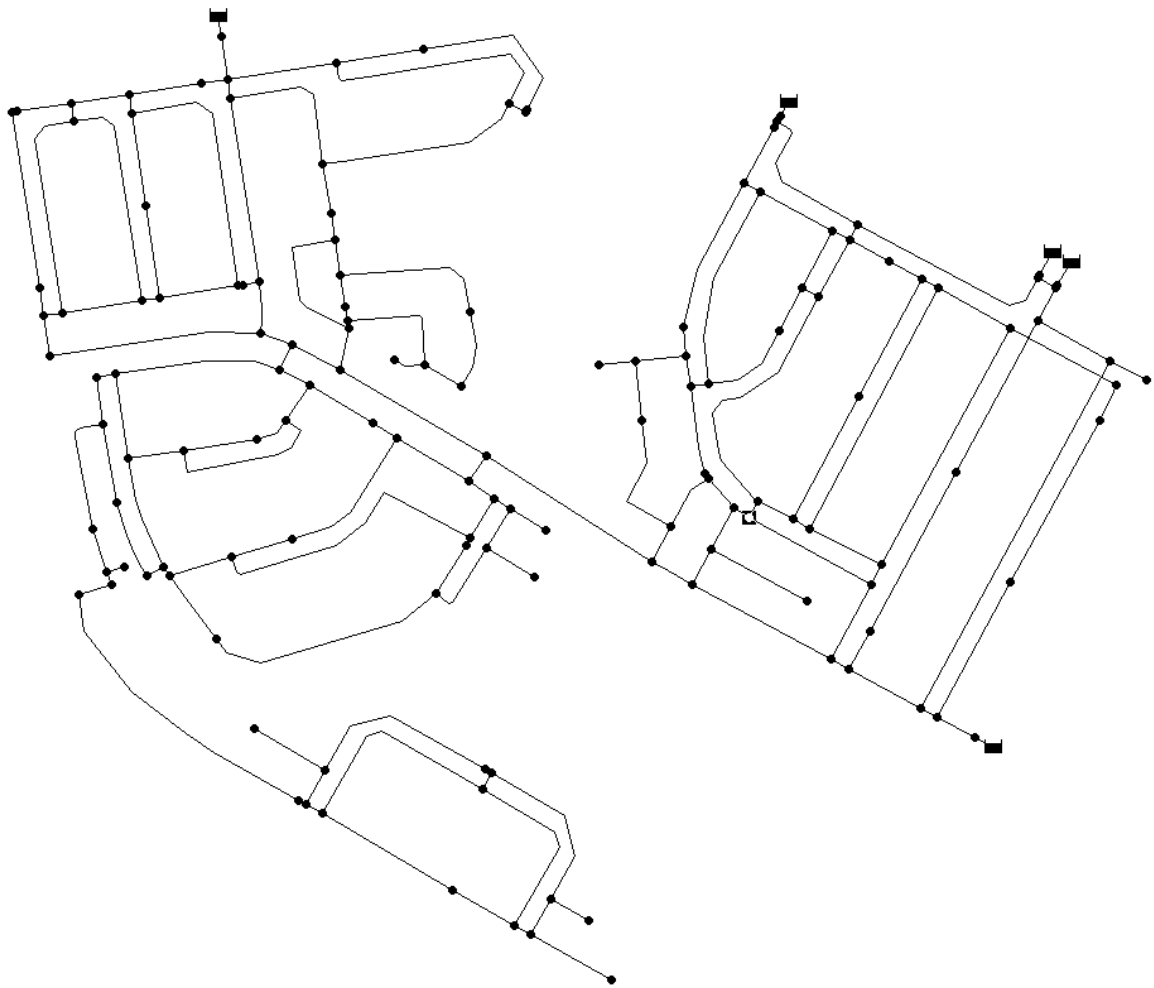


Figure 4: Stage 4 network layout

Stage 1 + 2 + 3 + 4 + 5

Reservoir total head assumed 25m above the proposed ground level

Table 6: Stage 5 Results

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n1	39.933	0	65.73	25.80	Junc n42	0	0	64.68	64.68
Junc n3	40.199	0	64.39	24.19	Junc n43	39.942	0.07	64.22	24.28
Junc n4	40.173	0.05	64.39	24.22	Junc n44	39.095	0	64.13	25.03
Junc n5	39.205	0.09	64.57	25.37	Junc n47	40.751	0.14	64.25	23.50
Junc n6	39.369	12.5	64.52	25.15	Junc n50	40.161	12.5	63.30	23.13
Junc n7	40.197	0.05	65.58	25.38	Junc n51	39.848	0.05	64.39	24.54
Junc n8	40.677	0.13	65.72	25.04	Junc n52	40.057	12.5	64.23	24.17
Junc n9	41.216	0.22	66.55	25.33	Junc n53	40.202	0.14	65.26	25.05
Junc n10	41.995	0.18	66.45	24.46	Junc n54	39.905	0.05	65.35	25.44
Junc n11	41.010	0	66.24	25.23	Junc n55	41.428	0	66.41	24.98
Junc n12	40.511	0	66.13	25.62	Junc n57	40.766	0	64.82	24.06
Junc n13	40.190	0	65.61	25.42	Junc n58	40.442	0.07	64.82	24.38
Junc n14	41.203	12.5	65.61	24.41	Junc n59	40.256	0.17	64.94	24.68
Junc n15	41.22	0	66.44	25.22	Junc n60	40.437	0	64.94	24.50
Junc n17	41.270	0	66.61	25.34	Junc n61	40.056	0	64.94	24.88
Junc n18	41.104	12.5	66.36	25.26	Junc n64	39.885	0	65.71	25.82
Junc n21	40.224	0.14	65.93	25.71	Junc n65	39.392	0	65.09	25.70
Junc n23	41.435	0	66.01	24.58	Junc n66	39.256	0.11	65.03	25.78
Junc n24	40.927	0	66.27	25.35	Junc n67	39.508	0.09	65.12	25.61
Junc n25	40.812	12.5	66.17	25.36	Junc n70	39.723	12.5	65.00	25.27
Junc n26	40.763	0.15	66.43	25.67	Junc n71	40.25	0.19	64.95	24.70
Junc n27	41.428	0	66.46	25.03	Junc n72	39.782	0.19	64.80	25.02
Junc n28	40.874	0.09	66.21	25.33	Junc n74	39.884	0	65.35	25.46
Junc n29	40.598	0.09	66.11	25.51	Junc n75	41.321	0	66.45	25.13
Junc n30	40.852	0.02	65.72	24.86	Junc n76	40.376	12.5	64.83	24.45
Junc n32	41.118	0.08	66.37	25.25	Junc n77	40.115	0.03	64.83	24.72
Junc n33	40.429	0.04	65.83	25.40	Junc n79	39.888	0.05	64.39	24.50
Junc n34	40.159	12.5	65.61	25.45	Junc n80	40.588	0.18	64.24	23.65
Junc n35	39.873	12.5	65.45	25.58	Junc n81	39.58	0.05	64.54	24.96
Junc n36	39.783	0.04	65.40	25.62	Junc n82	40.365	0.15	64.23	23.87
Junc n37	40.718	0	64.91	24.19	Junc n83	39.9	0.18	63.66	23.76
Junc n39	39.715	0.18	64.80	25.09	Junc n84	38.575	0	63.20	24.62
Junc n40	40.366	0.03	64.46	24.09	Junc n85	39.880	0.18	66.13	26.25
Junc n41	41.935	0	66.86	24.92	Junc n86	39.940	0	65.80	25.86

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n87	39.933	0	65.72	25.79	Junc n135	39.86	0	65.10	25.24
Junc n88	39.559	0.15	64.92	25.36	Junc n136	39.991	12.5	65.11	25.12
Junc n89	40.150	0.07	65.06	24.91	Junc n137	40.224	0	65.58	25.36
Junc n90	40.691	0.11	65.57	24.88	Junc n138	40.064	0.15	65.54	25.47
Junc n92	41.47	0	66.42	24.95	Junc n139	40.361	0.04	65.72	25.36
Junc n94	40.202	0.03	64.94	24.73	Junc n140	40.174	0.16	65.71	25.54
Junc n95	39.363	0.14	64.39	25.03	Junc n142	40.565	0	65.71	25.15
Junc n96	40.099	0.07	64.26	24.16	Junc n145	40.776	12.5	64.24	23.47
Junc n99	40.747	0.09	64.91	24.17	Junc n146	40.415	0.05	64.23	23.82
Junc n100	40.465	0	64.92	24.45	Junc n147	40.243	12.5	64.35	24.11
Junc n102	40.404	12.5	64.86	24.45	Junc n149	39.539	12.5	64.55	25.01
Junc n105	40.62	0.01	64.91	24.29	Junc n151	40.059	12.5	64.22	24.16
Junc n107	39.852	12.5	64.97	25.12	Junc n154	38.563	12.5	63.19	24.63
Junc n108	40.138	0.05	64.92	24.78	Junc n155	39.195	12.5	64.44	25.25
Junc n109	40.141	0.06	64.93	24.79	Junc n156	39.130	0.14	64.50	25.37
Junc n110	39.762	0.04	65.38	25.61	Junc n159	39.301	12.5	64.66	25.36
Junc n111	39.942	12.5	65.29	25.35	Junc n160	39.337	0	64.71	25.37
Junc n113	39.869	0	65.86	25.99	Junc n161	39.368	0	64.76	25.39
Junc n114	39.851	0	65.86	26.01	Junc n164	39.566	0	65.00	25.43
Junc n117	39.903	0.05	65.86	25.96	Junc n167	40.141	0	65.10	24.96
Junc n119	40.26	0	65.83	25.57	Junc n168	39.782	0	65.53	25.74
Junc n120	40.261	0	65.83	25.57	Junc n169	39.767	12.5	65.47	25.70
Junc n121	40.887	0.05	66.09	25.20	Junc n171	39.343	12.5	65.03	25.69
Junc n123	39.477	0.04	64.74	25.26	Junc n172	39.229	0	65.03	25.80
Junc n125	39.559	0.04	65.00	25.44	Junc n173	39.970	12.5	65.04	25.07
Junc n126	39.782	0	64.80	25.02	Junc n175	40.090	0	65.06	24.97
Junc n127	38.573	0	63.19	24.62	Junc n176	39.447	0.05	65.02	25.57
Junc n128	40.588	0.04	64.24	23.65	Junc n177	0	0	65.02	65.02
Junc n129	39.213	0	64.58	25.37	Junc n178	41.470	0	66.46	24.99
Junc n130	39.597	0.06	64.61	25.02	Junc n179	40.578	0.05	66.11	25.53
Junc n131	39.666	0	64.61	24.95	Junc n180	39.861	12.5	64.74	24.88
Junc n132	40.356	0	65.86	25.51	Junc n181	0	0	64.78	64.78
Junc n133	39.924	0.1	65.86	25.94	Junc n182	39.850	0.1	64.78	24.93
Junc n134	39.425	0.23	65.09	25.66	Junc n183	40.215	12.5	64.94	24.73

Node ID	Elevation m	Base Demand LPS	Head m	Pressure m	Node ID	Elevation m	Base Demand LPS	Head m	Pressure m
Junc n185	41.041	12.5	66.17	25.13	Junc n194	40.602	12.5	65.88	25.28
Junc n186	41.110	12.5	66.24	25.13	Junc n195	40.833	0.11	66.04	25.21
Junc n187	39.772	0.14	64.97	25.19	Junc n196	41.223	12.5	66.40	25.18
Junc n188	39.488	12.5	65.10	25.62	Junc n197	40.403	0.11	66.01	25.61
Junc n190	39.437	0.08	65.16	25.72	Junc n198	40.449	12.5	65.94	25.49
Junc n194	40.602	12.5	65.88	25.28	Junc n199	40.829	0.09	65.76	24.93
Junc n195	40.833	0.11	66.04	25.21	Junc n202	40.260	12.5	65.94	25.68
Junc n196	41.223	12.5	66.40	25.18	Junc n203	39.952	0.03	65.90	25.95
Junc n197	40.403	0.11	66.01	25.61	Junc n205	40.411	12.5	65.79	25.38
Junc n198	40.449	12.5	65.94	25.49	Junc n206	40.593	12.5	65.14	24.55
Junc n199	40.829	0.09	65.76	24.93	Junc n207	40.271	0.01	64.97	24.70
Junc n202	40.260	12.5	65.94	25.68	Junc n208	40.696	12.5	64.88	24.18
Junc n203	39.952	0.03	65.90	25.95	Junc n209	40.499	0	64.83	24.33
Junc n205	40.411	12.5	65.79	25.38	Junc n210	40.44	0	64.83	24.39
Junc n206	40.593	12.5	65.14	24.55	Junc n212	39.778	12.5	64.79	25.02
Junc n207	40.271	0.01	64.97	24.70	Junc n214	40.243	12.5	64.93	24.69
Junc n208	40.696	12.5	64.88	24.18	Junc n216	40.54	12.5	64.89	24.35
Junc n209	40.499	0	64.83	24.33	Junc n218	39.945	0.01	65.87	25.93
Junc n210	40.44	0	64.83	24.39	Junc 6	40.718	0.22	64.89	24.17
Junc n212	39.778	12.5	64.79	25.02	Junc 7	40.836	12.5	64.83	24.00
Junc n214	40.243	12.5	64.93	24.69	Junc 8	40.821	0.05	64.83	24.01
Junc n216	40.54	12.5	64.89	24.35	Junc 9	40.423	0	64.83	24.41
Junc n218	39.945	0.01	65.87	25.93	Junc 10	40.814	0	64.83	24.02
Junc 6	40.718	0.22	64.89	24.17	Junc 12	39.212	0.1	64.91	25.70
Junc 7	40.836	12.5	64.83	24.00	Junc 13	39.903	0.17	65.30	25.40
Junc 8	40.821	0.05	64.83	24.01	Junc 11	39.812	0	64.92	25.11
Junc 9	40.423	0	64.83	24.41	Junc 14	39.843	0	64.89	25.04
Junc 10	40.814	0	64.83	24.02	Junc 15	39.597	0.06	65.36	25.76
Junc 12	39.212	0.1	64.91	25.70	Junc 16	39.628	0	65.38	25.75
Junc 13	39.903	0.17	65.30	25.40	Resvr 1	64.095	#N/A	64.10	0.00
Junc 11	39.812	0	64.92	25.11	Resvr 2	66.935	#N/A	66.93	0.00
Junc 14	39.843	0	64.89	25.04	Resvr 3	66.47	#N/A	66.47	0.00
Junc 15	39.597	0.06	65.36	25.76	Resvr 4	66.47	#N/A	66.47	0.00
Junc 16	39.628	0	65.38	25.75	Resvr 5	65.09	#N/A	65.09	0.00

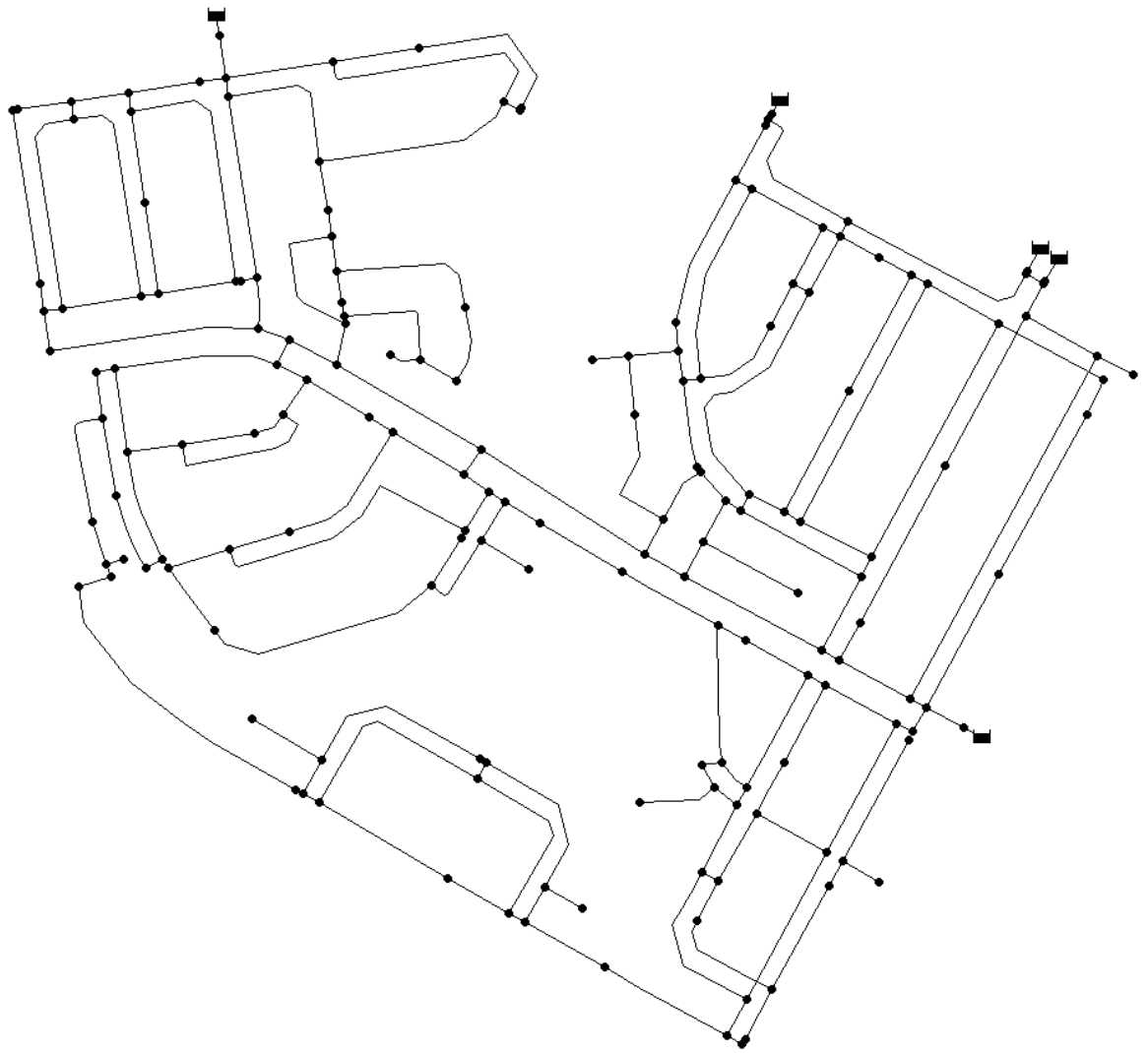


Figure 5: Stage 5 network layout

Appendix G – Mott Macdonald Water Supply Modelling

Water Supply Modelling for Fast Track

Mexted - SL1 assessment within Hamilton South

Project:	Water Supply Modelling for Fast Track – Mexted Residential development		
Our reference:	PSP 3239-2025	Revision	C
Prepared by:	David Kang	Date:	21/05/2026
Approved by:	David Taylor	Checked by:	Julie Plessis
Subject:	Mexted Residential Water Supply Modelling – Interim Report		

1 Introduction

The Fast Track Approvals Act (Fast Track), which aims to provide an accelerated pathway for projects by bypassing the standard Resource Management Act 1991 planning process, came into effect at the end of 2024.

Hamilton City Council (HCC) has engaged Mott MacDonald Limited under PS 3239-2025 to assess the impact of the various Fast Track developments areas on the water network. This memo summarises the impact of the Mexted Residential development within the Hamilton South zone.

1.1 Jurisdictional Context

IAWAI is a newly established water services Council Controlled Organisation (CCO) jointly owned by Waikato District Council (WDC) and Hamilton City Council. IAWAI's statutory jurisdiction is limited to the existing HCC and WDC administrative boundaries. This jurisdiction does not include the SL1 area, nor any fast-track development areas located within or beyond that area.

At present, IAWAI does not have authorisation to provide water or wastewater services to developments outside the HCC and WDC territories, including individual fast-track developments. Notwithstanding these limitations, the SL1 site's proximity to the Hamilton City boundary and the existing Hamilton water and wastewater networks has prompted developers to investigate whether servicing via HCC/IAWAI infrastructure may be technically feasible. Accordingly, technical assessments are underway to explore potential water and wastewater servicing options for the SL1 Mexted Block using existing and/or planned HCC/IAWAI infrastructure.

It is important to note that IAWAI does not currently have jurisdiction outside HCC and WDC areas, nor does it have the necessary commercial or statutory agreements with Waikato Waters Ltd or Waipā District Council to enable the provision of services beyond its existing boundaries.

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1.2 Disclaimers and Limitations

The water and wastewater servicing assessments, including the scope and content of the attached report, have been prepared collaboratively by HCC and IAWAI in good faith and on a without prejudice basis. This report is intended solely to assess the potential for servicing options and does not confer, imply, or guarantee any right or ability for the SL1 Mexted Block—or any other development—to connect to the HCC/IAWAI water or wastewater networks.

This assessment does not represent:

- Any commitment (actual or implied) by HCC or IAWAI to provide services
- Any confirmation of available network capacity
- Any approval for connection or use of existing or future infrastructure.

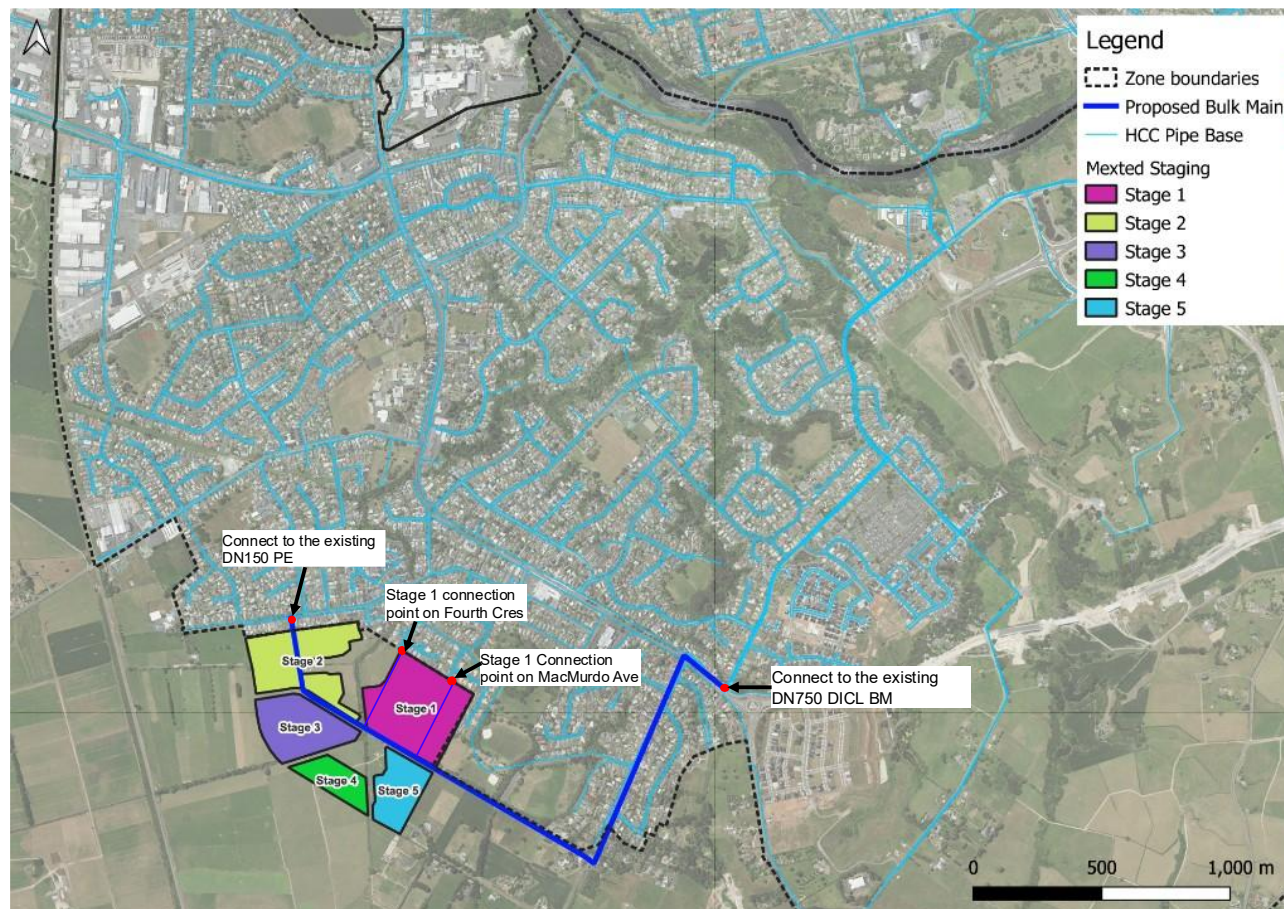
Any future servicing of developments outside the HCC and WDC territories using HCC/IAWAI infrastructure would be contingent on appropriate statutory approvals and commercial agreements being established, including agreements between IAWAI and Waikato Waters Ltd, and potentially Waipa District Council.

2 Modelling process and assumptions

The principal modelling assumptions and methodological considerations are outlined below:

- The base hydraulic model was developed using Master Plan (MP4) demand forecasts for the 2041 and 2061 horizon, with adjustments for expected demand reduction from Universal Water Metering (UWM)
- The baseline scenarios incorporate the existing network along with funded strategic upgrades (2024-34 Long Term Plan), including reservoirs, pump station upgrades, bulk mains and trunks mains throughout the city. However, only a strategic 450mm trunk main on Peacockes to Badder St was identified within the Hamilton South zone.
- The Mexted development was assessed independently; cumulative impacts from other Fast Track developments are outside the current scope.

The Mexted Residential development is located west of the Hamilton South zone. The extent of Mexted development and the proposed connection points are illustrated in Figure 2.1 below.

Figure 2.1: Mexted development staging map

The adjusted modelled demands for the 2041 and 2061 PDD scenarios, including the projected demands across the full HCC water supply network, are presented in Section 2.1 of the *Phase 1 – Base Model and System Performance* memorandum.

The demand data supplied by Maven Associates (298001-I1-WW&WS Demand Calcs) was adopted as its underlying assumptions, listed below, align with the Regional Infrastructure Technical Specification (RITS):

- 3 people per dwelling
- 260 l/person/day
- Peaking factor: 5

The demand calculation for each stage is listed in Table 2.1 below.

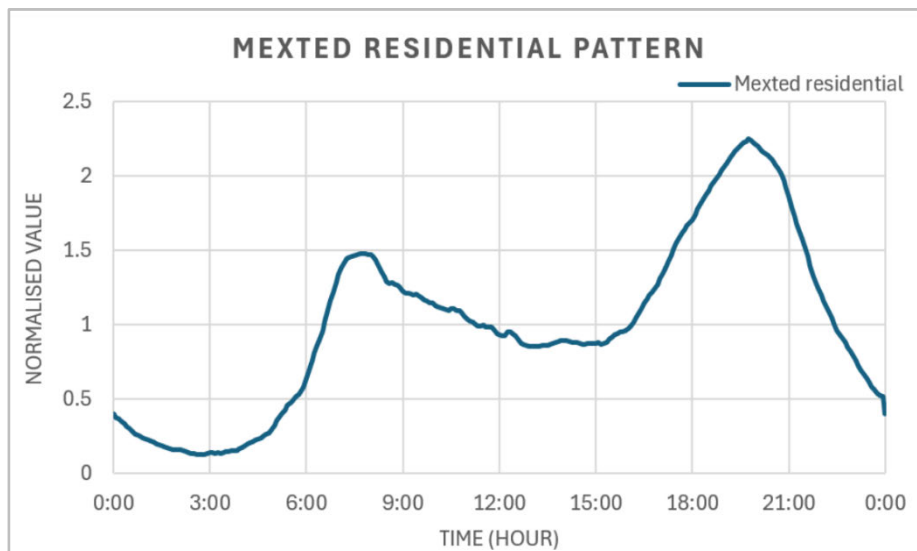
Table 2.1: Mexted development staging demand

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
Dwellings	328	247	201	96	137	1009
Occupancy	984	741	603	288	411	3027
ADD (l/s)	3.0	2.2	1.8	0.9	1.2	9.1
PDD (l/s)	14.8	11.1	9.1	4.3	6.2	45.5

The Mexted development is predominantly a residential area, and the residential demand pattern was therefore considered the most appropriate representation of water-use behaviour for this area. The pattern applied in the model, shown in Figure 2.2, was developed by averaging the observed peak day residential

demand profiles from Hamilton's District Metered Areas. This provided a representative profile of typical residential usage characteristics in Hamilton.

Figure 2.2: Residential demand pattern

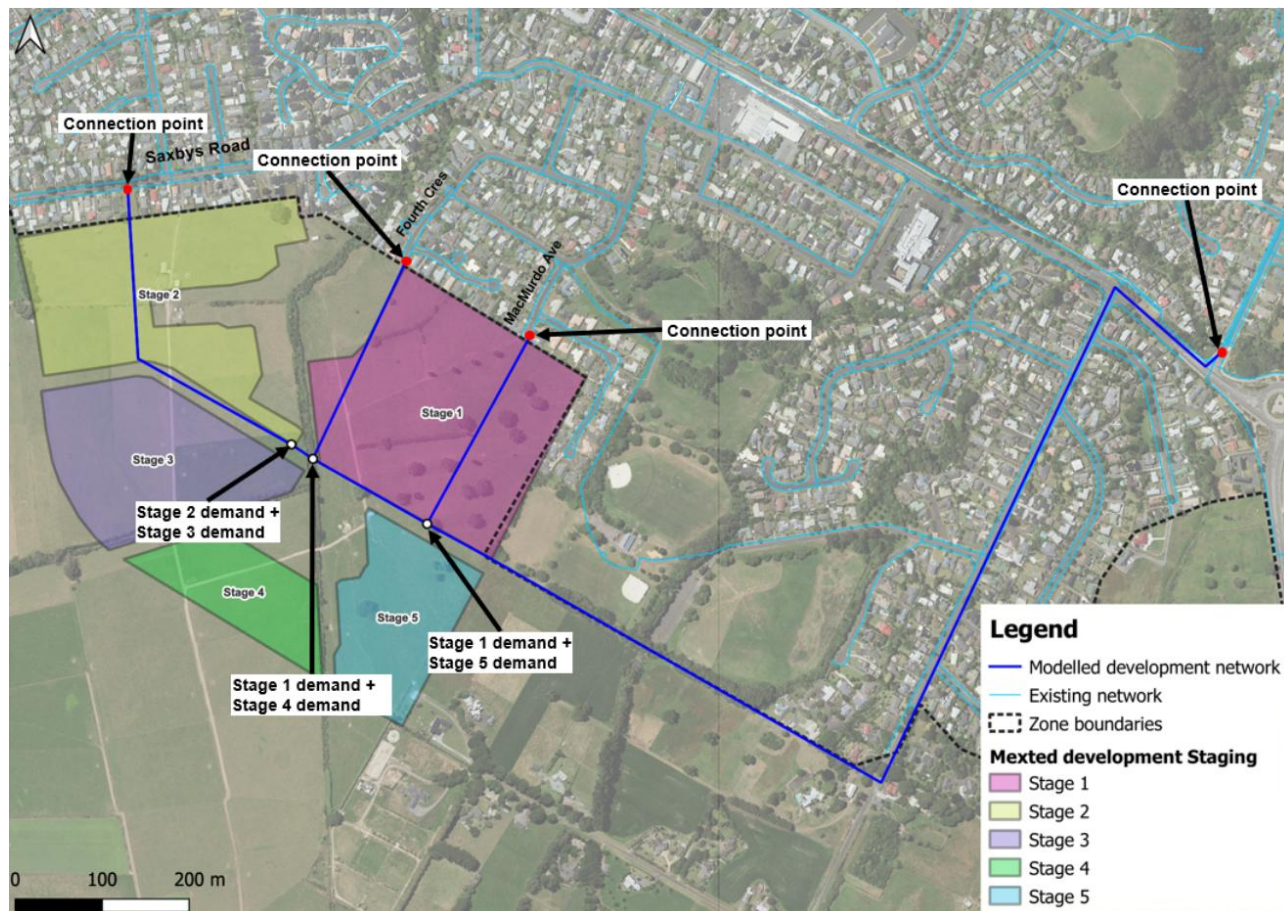


The Mexted Residential development internal reticulation was not included in the model, which is typical practice when development networks have not been through a formal engineering approval process first. The alignment shown in the figures is intended only to illustrate the system performance at the point furthest from the supply, where demand allocation was applied in the model. It served as an indicative location for assessing hydraulic behaviour rather than the final reticulation layout.

Table 2.2 below summarises the modelled scenarios and Figure 2.3 illustrates the location of the development per stage:

Table 2.2: Modelled scenarios

Scenarios	Horizon	Network
Scenario 1	2041 and 2061	Base network + Stage 1 connected in 2 locations (MacMurdo Avenue and Forth Crescent)
Scenario 2A	2041 and 2061	As above + Stage 2 – 1 connection point (Saxbys Road)
Scenario 2B	2041 and 2061	Base + Stage 2 – 1 connection point (Saxbys Road) - Stage 1 not included
Scenario 3	2041 and 2061	Base + Stage 1 to 5 (entire development) Connect to existing 750 mm Bulk Main – Intersection of Ohaupo Road/ Dixon Road Utilise Houchens Road as estimated alignment for a bulk connection Include the Stage 1 and 2 connections.

Figure 2.3: Model scenario demand per staging

2.1 Level of service

Each scenario was assessed against the system performance criteria listed in Table 2.3.

Table 2.3: System performance assessment criteria

Criteria	Threshold
WTP Capacity	Capacity $\geq$ PDD
Reservoir level	Must not drain within 3 PDD days
Storage	Replacement timing: Effective storage < 18 hours of 1.15*peak day demand
Pressure	Minimum pressure >20m Maximum pressure <80m
Head losses	- New pipe design: $\leq 5\text{m/km}$ for 50mm to 249mm diameter pipes $\leq 3\text{m/km}$ for 250mm to 599mm diameter pipes $\leq 2\text{m/km}$ for $\geq 600\text{mm}$ diameter pipes - Existing pipe replacement timing: 10m/km for 50mm to 249mm diameter pipes 5m/km for 250mm to 599mm diameter pipes 3m/km for $\geq 600\text{mm}$ diameter pipes
Fire fighting	Testing 25l/s (residential areas) and 50l/s (commercial and industrial areas,) with 10m residual pressure at the hydrant flowed an 1m residual pressure everywhere else in the network.

For the fireflow runs, the ability to supply flow at hydrants, without considering loss and restriction at hydrants, was assessed. A network residual pressure of 1 m at demand nodes is also considered in the runs. This allows the fireflow results to show available network fireflow capacity without causing pressure elsewhere in the network to reduce below 1 m, avoiding over-optimistic results.

3 Modelling results

3.1 Hamilton South storage capacity results

The Hamilton South reservoir currently provides an effective storage capacity of 18.2 ML. Table 3.1 and Table 3.2 show the Hamilton South Zone and Mexted Residential demands for the 2041 and 2061 horizons respectively. Because the storage replacement timing is 18 hours at 115% of the peak day demand, the tables report the cumulative demands against this threshold to determine compliance with Level of Service requirements.

Table 3.1: 2041 PDD reservoir storage capacity

Zone	24-hour demand (MLD)	18-hour demand *1.15 (MLD)	Spare capacity (18 hr)
HS – 2041 PDD	17.3	14.9	3.3
Stage 1	17.9	15.4	2.8
Stage 2A	18.3	15.8	2.4
Stage 2B	17.7	15.3	2.9
Stage 3	19.1	16.4	1.8

Table 3.2: 2061 PDD reservoir storage capacity

Zone	24-hour demand (MLD)	18-hour demand *1.15 (MLD)	Spare capacity (18 hr)
HS – 2061 PDD	19.8	17.1	1.1
Stage 1	20.4	17.6	0.6
Stage 2A	20.8	17.9	0.3
Stage 2B	20.2	17.5	0.7
Stage 3	21.6	18.6	-0.4

3.2 Pressure, head losses and firefighting performance results

Figures presenting the following performance metrics are provided in Appendix A.

- Hamilton South reservoir spare capacity
- Minimum pressure within the development, in the vicinity of the development and within the entire Hamilton South zone
- Head losses: local pipes failing the maximum headloss per km criteria listed in Table 2.3
- Firefighting capacity assessment (FW2 and FW3) for entire Hamilton South zone including the development.

Table 3.3 and Table 3.4 below provide a summary of hydraulic modelling outcomes for the 2041 and 2061 horizon respectively, identifying the specific development stages at which the Hamilton South zone and/or the Mexted Residential development fail to meet the prescribed system performance criteria. Performance was evaluated both across the entire Hamilton South zone and specifically within the Mexted Residential development area. However, existing level-of-service deficiencies can mask the true impact of the Mexted

Residential development on the network. To isolate the development's influence on the existing network, the analysis also focused on the section of the network directly affected by Mexted Residential, between the reservoir and the development, where deterioration in system performance is directly attributable to Mexted Residential.

Table 3.3: Modelling results summary – 2041 PDD horizon

System performance criteria	LoS threshold	2041 Baseline	Scenario 1	Scenario 2A	Scenario 2B	Scenario 3
Storage capacity	115% 18hr Demand < 18.2 ML	✓	✓	✓	✓	✓
Mexted development	Minimum pressure > 20 m	-	✓	✓	✓	✓
	FW2 achieved	-	✓	✓	✓	✓
Existing network (Entire Hamilton South)	Minimum pressure > 20 m	✗	✗	✗	✗	✗
	Head losses – see criteria above	✗	✗	✗	✗	✗
	FW2 achieved	✓	✓	✓	✓	✓
Existing network (Network directly affected by Mexted development)	Minimum pressure > 20 m	✓	✓	✓	✓	✓
	Head losses – see criteria above	✗	✗	✗	✗	✗
	FW2 achieved	✓	✓	✓	✓	✓

Table 3.4: Modelling results summary – 2061 PDD horizon

System performance criteria	LoS threshold	2061 Baseline	Scenario 1	Scenario 2A	Scenario 2B	Scenario 3
Storage capacity	115% 18hr Demand < 18.2 ML	✓	✓	✓	✓	✗
Mexted development	Minimum pressure > 20 m	-	✓	✓	✓	✓
	FW2 achieved	-	✓	✓	✓	✓
Existing network (Entire Hamilton South)	Minimum pressure > 20 m	✗	✗	✗	✗	✗
	Head losses – see criteria above	✗	✗	✗	✗	✗
	FW2 achieved	✓	✓	✓	✓	✓
Existing network (Network directly affected by Mexted development)	Minimum pressure > 20 m	✓	✓	✗	✓	✓
	Head losses – see criteria above	✗	✗	✗	✗	✗
	FW2 achieved	✓	✓	✓	✓	✓

4 Modelling limitations

The following consideration and limitations should be acknowledged when interpreting the modelling results, as they may influence system performance:

- **Reliance on Master Plan Assumptions:** The analysis is based on Master Plan models developed in 2023 using population projections from December 2022. Any deviation in growth patterns or demand forecasts could affect the validity of these results.
- **Planning-level assessment:** The modelling results are intended for planning and feasibility purposes only. They should not be used as final design specification without further detailed analysis and validation.

A. System Performance Maps