Before an Independent Hearings Panel

The Proposed Waikato District Plan (Stage 1)

IN THE MATTER OF the Resource Management Act 1991 (**RMA**)

IN THE MATTER OF hearing submissions and further submissions on the Proposed Waikato District Plan (Stage 1):
Topic 25 – Zone Extents

PRIMARY EVIDENCE OF RYAN JAMES PITKETHLEY ON BEHALF OF TATA VALLEY LIMITED

17 February 2021

BUDDLE FINDLAY

Barristers and Solicitors
Auckland
Solicitor Acting: **Vanessa Evitt / Mathew Gribben**
Email: vanessa.evitt@buddlefindlay.com / mathew.gribben@buddlefindlay.com
Tel 64-9-358 2555 PO Box 1433 DX CP24024 Auckland 1140

1. SUMMARY OF EVIDENCE

1.1 My full name is Ryan James Pitkethley. I am a Civil Engineer and Engineering Manager at CivilPlan Consultants Limited.

1.2 I am providing land development/infrastructure engineering evidence in relation to proposed rezoning sought by TaTa Valley Limited ("**TVL**")[1] of land at 42B Potter Road and 35 Trig Road, Pokeno ("the Site").

1.3 In conjunction with the evidence presented by Mr Leo Hills, I found that the Site can be serviced with an access road between the Site and Yashili Drive to be funded by the developer.

1.4 Stormwater management to address both quality and quantity is required at the time of development and has been based on low impact design as required by the Waikato Stormwater Management Guidelines, Waikato Regional Plan and Waikato District Council requirements. Based on current information I see no reason why those guidelines and requirements can not be met

1.5 There is a feasible stormwater design for development of the Site that will improve the quality of water discharges, compared to the existing discharges. For all contaminants there is a calculated reduction comparing pre-development to post-development with treatment, ranging from 25-82% of pre development loads. The conclusion is that the development improves the Waikato River water quality.

1.6 The proposed site improvements and flood management strategy include raising and improving the existing stopbank, installing culvert flood gates to protect the valley from inundation by the Waikato River, and installing a pump and weir system as part of the wetland, culvert and stopbank restorations.

1.7 Modelling results show a decrease in flooding extent on ite and no effect to either upstream or downstream properties along the Waikato River once these improvements are in place.

1.8 The Section 42A Report Hearing 25 Zone Extents prepared by Dr Mark Davey omits that Watercare have provided for the main infrastructure for water and wastewater to Tata Valley (“Tata-G”). My evidence explains that WDC have allowed for a ‘Tata Valley’ Growth Cell for water and wastewater.

[1] Submitter 574 and further submitter 1340.

1.9 Investigations and discussions with Counties Power and Chorus has confirmed that existing nearby telecommunication and power infrastructure can accommodate the proposed rezoning.

1.10 An existing Vector Gas IP20 ST 150mm main servicing the industrial area of Pokeno is located in Potter Road. There will be the option of local gas servicing coming off this main to service the development, although gas is not essential for the development to proceed.

1.11 Given the above summary and below detailed evidence, I conclude that there is no infrastructure engineering reason to not rezone the Site as part of the Proposed Waikato District Plan ("**PWDP**").

2. INTRODUCTION

2.1 My full name is Ryan James Pitkethley. I am a Civil Engineer and Engineering Manager at CivilPlan Consultants Limited.

2.2 I hold a BE (Civil, Hons) and since 2008 I have been a Chartered Professional Engineer (CPEng) and a Chartered Member of Engineering NZ (CMEngNZ). My work experience includes project managing and working on multi-disciplinary infrastructure and land development projects, working alongside client, local authority and contractor organisations. I have experience in the planning, design, co-ordination, and implementation of projects involving earthworks, erosion and sediment control, roading, three waters, and utilities infrastructure associated with land development.

2.3 I have been employed by CivilPlan Consultants Limited since February 2015. I hold the position of Engineering Manager at the office based in Manukau.

2.4 My previous experience includes the following relevant projects:

(a) Providing land development and infrastructure evidence, including preparation of a Stormwater Management Plan, to support the rezoning of approximately 50ha of Clarks Beach Special Housing Area from rural to urban and obtaining Stormwater Discharge Consents.

(b) Large scale residential land development known as Riverside Grove, Escotts Road, Tuakau. This involved design to gain resource consent and engineering plan approval and managing the implementation through to titles.

(c) Large scale residential development at Pokeno including the preparation of Stormwater Management Plans (forming the basis of Stormwater Discharge Consents) for various stormwater catchments in Pokeno.

(d) Providing land development and infrastructure services, including preparation of a Stormwater Management Plan, to support the rezoning of approximately 36ha of land known as the "Graham Block" from rural to urban and obtaining Stormwater Discharge Consents.

2.5 I have been involved in the rezoning proposal by TVL since March 2020 and have been working with associated companies on their other land holdings in Pokeno since December 2017. As a part of that involvement, I have undertaken infrastructure engineering designs (earthworks, erosion and sediment control, roading, three waters, and utilities infrastructure) to input into all the resource consent applications for works within the Tata Valley rezoning area. These are discussed in the evidence of Mr Scrafton.

2.6 As the Civil Engineer I have worked with various consultants such as urban designers, ecologists, planners, traffic engineers, geotechnical engineers, as well as Waikato District Council ("**WDC**"), Waikato Regional Council ("**WRC**"), and Watercare Services Limited ("**WSL**") teams. These council teams were specifically the WSL water and wastewater infrastructure planning team, the WRC environmental planning and consents teams, and the WDC infrastructure team. I last visited the Site on 11 November 2019.

Scope of evidence

2.7 My evidence describes the required utilities, three waters, roading and earthworks design and upgrades required to support the development and proposed rezoning sought by TVL[2]. It also explains the calculations and reporting of infrastructure constraints and availability completed by GHD on behalf of WDC as it specifically relates to the Site and the ability of it to be serviced.

2.8 Specifically my evidence addresses the following topics:

(a) Site context and characteristics;

(b) Existing infrastructure;

[2] Submitter 862 and further submitter 1291.

(c) Relevant parts of re-zoning proposal;

(d) Proposed earthworks;

(e) Infrastructure assessment methodology;

(f) Infrastructure required to service the Site; and

(g) Hazards.

2.9 My evidence relies on and should be read in conjunction with that of:

(a) Waikato District Council Report – "Pokeno Water Network Model Masterplan Update" by GHD, dated February 2020.

(b) GHD technical memo from Tony Millar to Richard Pullar with subject of "Pokeno W&WW Planning – Technical memo – Growth: Population and Flows", dated 16 October 2018.

(c) GHD technical memo from Tony Millar to Richard Pullar with subject of "Pokeno W&WW Planning – Technical memo – Population, Growth & Planning", dated 22 January 2019.

(d) The Engineering Report TR007-v1 ("ER") for Tata Valley Limited prepared by CivilPlan Consultants Limited, dated December 2018.

2.10 The calculations and reporting referred to in 2.9 reports have been shared with permission by Richard Pullar and Pearl McFall of WSL and are attached as appendices to this evidence.

2.11 These reports and calculations consider growth areas beyond the area notified in the Proposed Waikato District Plan as shown in the following Figure 1. WSL have been proactive in ensuring that they plan for growth not only in the notified land areas, but also in the areas covered by the extent of the PWDP submissions, which includes the subject Site.

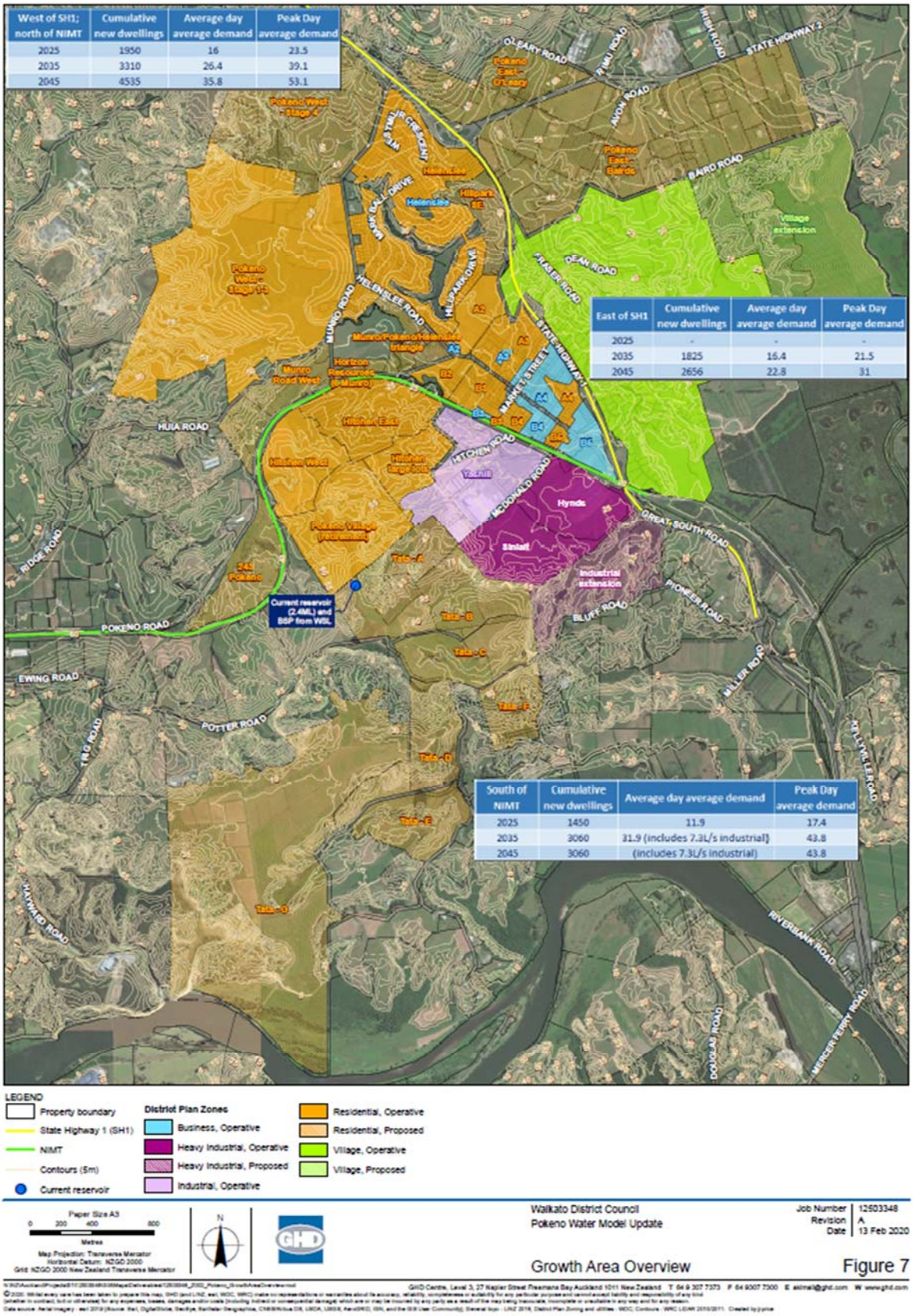


Figure 1 – Growth Area Extents – Site is noted as 'Tata-G' (from WDC Pokeno Water Network Model Masterplan Update Report, February 2020).

Code of Conduct

2.12 I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

3. SITE CONTEXT AND CHARACTERISTICS

3.1 The submission on the Proposed Waikato District Plan ("**PWDP**") proposed to rezone approximately 235 ha of land located at 42B Potter Road and 35 Trig Road in Pokeno.

3.2 The Site is zoned 'Rural' under the PWDP. Figure 2 shows the TaTa Valley Indicative Concept Plan. It shows the location of the Site, and how it shares its boundaries with rural zoned land.

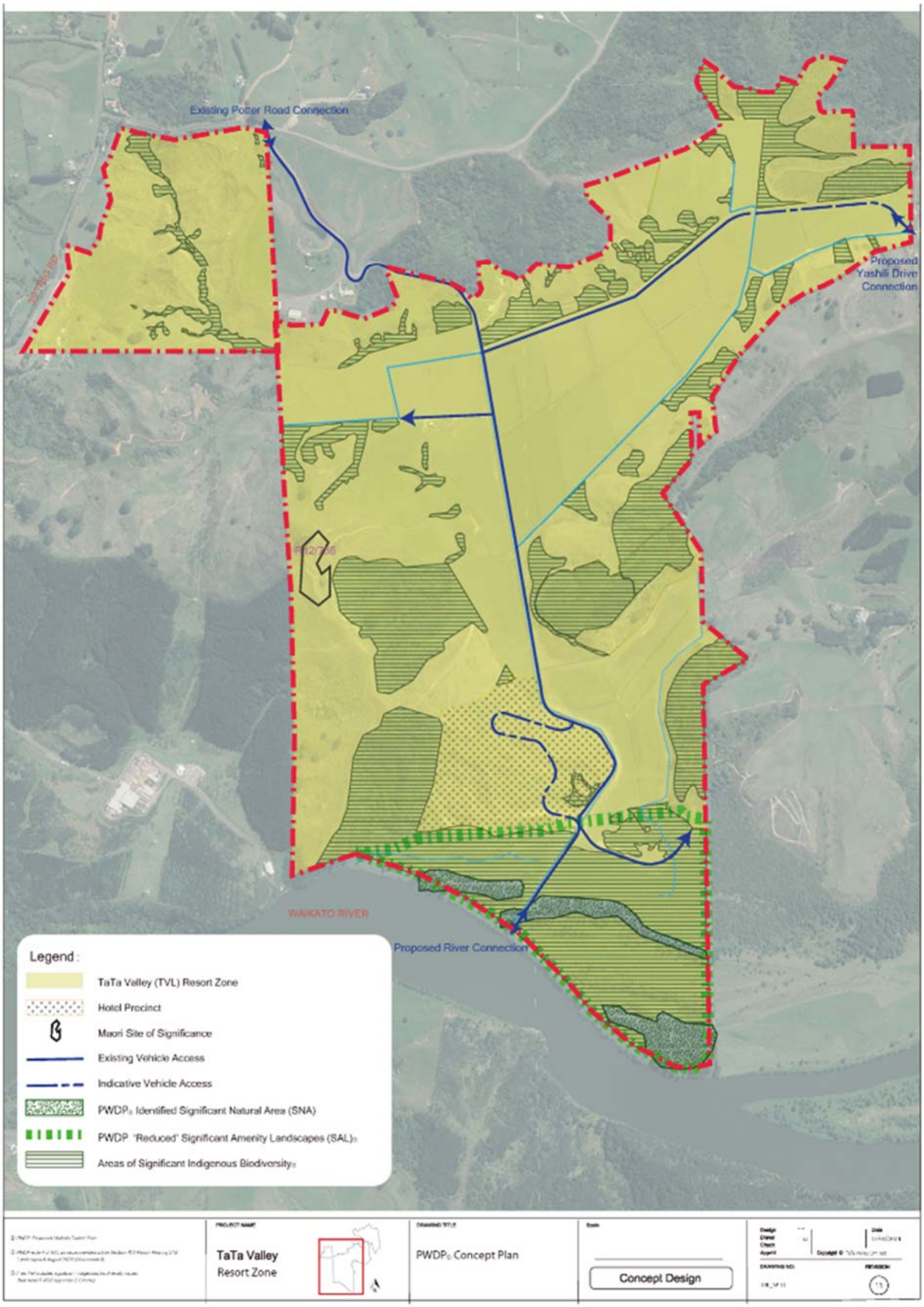


Figure 2 – Concept Plan

3.3 The Site consists of a flat and low-lying central valley discharging to the Waikato River to the south and bounded by steep slopes on all other sides. Large areas of native and exotic vegetation remain in several areas, and a number of open farm drains, streams and wetland areas run through the Site, as described by Mr Martin.

3.4 The Site is located immediately upstream of Watercare's Waikato River water intake. As this intake is one of the sources of water supply for the Auckland Region, careful design consideration has been taken for earthworks sediment and erosion control and contaminant load modelling comparisons pre vs post development.

3.5 The catchment ultimately drains to the Waikato River.

3.6 Potter Road is to the north, Trig Road to the west, and Bluff Road to the east. The southern boundary is the banks of the Waikato River.

To the east, Havelock Village (148 ha of land located at 5 Yashili Drive, 88, 242 and 278 Bluff Road) is owned by an associated development company to Tata Valley. It is proposed to provide private access (built to public standards) to the Site through this land. The resource consent application for this work is due to be lodged shortly with WRC and WDC. The Site is proposed to gain principal access from an extension to Yashili Drive and will connect to the subject Site at its north-eastern extent. Mr Leo Hills evidence explains more on this access.

3.7 As Havelock Village is owned by an associated development company to TVL, there are potential synergistic engineering solutions where a combined solution would have benefits and efficiencies for each site. These solutions specifically relate to utility supply, water supply and wastewater discharge. These could be implemented at resource consent stage in the event that the rezoning of both sites is approved. However, to ensure both developments can advance as separate projects, we have designed separate utility supply, water supply and wastewater solutions to ensure that they are not reliant on each other at this time. Apart from the private access explained above, my evidence covers the solutions that do not rely on development of the land for utility supply, water supply and wastewater at 5 Yashili Drive, 88, 242 and 278 Bluff Road.

3.8 Given the existing rural zoning of the Site there are water supply and wastewater capacity constraints, which I explain in more detail below.

4. EXISTING INFRASTRUCTURE

4.1 The existing infrastructure environment is typical for agricultural / rural zoned land.

(a) Surrounding roading is of a rural standard of unknown age and considered to be in an adequate standard for its current use.

(b) There is no public stormwater infrastructure. Existing field drains/ditches typically manage stormwater through Tata Valley prior to its discharge to the Waikato River.

(c) The valley is currently subject to inundation, particularly during winter, due to high tailwater levels in the Waikato River, backflow through the existing culverts, and overtopping of the existing stopbank during extreme events. The stopbank is located in the southern part of the valley and is proposed to be improved as explained below.

(d) For sites surrounding the Site, wastewater disposal is managed locally on-site using septic tanks for individual dwellings. The existing 'Hitchen 1' WWPS in Gateway Park Drive is the nearest pump station that ultimately discharges via the Buckland Road WSL interceptor to the Pukekohe WWTP via daisy chained pump stations in Pokeno and Tuakau. There is an existing 160 OD PE rising main in Whangarata Road which will be spare once Package 4 of the wastewater upgrade works are completed (explained in more detail below and is able to be used for this development.

(e) An existing 280 OD PE bulk supply watermain runs along Potter Road to the Hitchen Road reservoir located at the end of Hitchen Road, within and at the northwest corner of Lot 1 DP51064 (Havelock Village land). This supplies Pokeno township to the north (via Hitchen Road). The water supply to Tata Valley will come either from a new reservoir for Tata Valley serviced by connecting onto the bulk supply watermain in Potter Road, or from the Hitchen Road reservoir, with the existing reservoir supplemented with a second reservoir as explained below.

(f) Existing utility services (power & communications) are via overhead lines in Potter Road and Trig Road.

(g) An existing IP20 ST 150mm gas main (operated by Vector Gas) runs in Potter Road which currently only serves the industrial activities in Pokeno to the east.

5. RELEVANT PARTS OF REZONING PROPOSAL

5.1 The full details of TVL's rezoning proposal are outlined in TVL's submission and the primary evidence of Mr Chris Scrafton.

5.2 The relevant parts of the proposal for the purposes of my evidence are:

(a) Rezoning of 235 ha of land from Rural to Resort zone;

(b) Development of a resort hotel, spa and conference centre, and farming and commercial activities, and the required infrastructure to service these;

(c) New access from the Site's north-eastern boundary to Yashili Drive.

6. PROPOSED EARTHWORKS

6.1 While the rezoning itself does not propose earthworks over the Site, I anticipate bulk earthworks will be required to facilitate and implement any development on the Site.

6.2 As part of my role and involvement in the project both detailed and concept earthworks have been prepared for the Site to ensure that, from both a detailed and high level engineering perspective, the accesses into and throughout the Site (which supports the proposed Tata Valley Concept Plan) can be achieved.

6.3 I anticipate that recontouring of the Site will occur to achieve viable building platforms and achieve the required road and accessway gradients (as explained in detail in the evidence of Mr Hills).

6.4 I expect that these works will take some time (5 to 10) years to complete and will be staged to align with development stages.

6.5 Earthworks activities in the Waikato Region are guided by Waikato Regional Council's (WRC) Erosion & Sediment Control (**ESC**) Guidelines for Soil Disturbing Activities (TR0902 Version 1.0, January 2009) ("TR2009/02").

6.6 TR2009/02 provides a guideline for ESC by outlining principles of ESC and the sediment transfer process, providing a range of ESC practices which can be implemented in order to minimise adverse environmental effects of soil disturbing activities through the appropriate use and design of ESC techniques.

6.7 Stability of land during works and following completion of works is generally a matter which in my experience in land development is dealt with at the resource consent

stage, and during the implementation of the resource consent. The design submitted for resource consent is coordinated with and respects the constraints identified by Chris Edwards of Lander Geotechnical Limited. I also refer to the evidence of Mr Edwards outlining geotechnical constraints.

6.8 In my experience in working in the Waikato Region, including in the Waikato District, the potential effects of earthworks can be adequately dealt with and addressed through the District and Regional consenting processes as well as via the conditions of consent imposed on each. I have relied on the evidence of Mr Scrafton as to the appropriateness of the PWDP provisions to continue to achieve the same if not higher management of potential effects resulting from earthworks.

6.9 Overall, I am satisfied that the proposed TaTa Valley Concept Plan can be physically implemented on the Site and that the engineering constraints and effects can be adequately dealt with at consenting stage. I do not consider that further earthworks standards are necessary from an engineering perspective beyond those already outlined in the PWDP and contained in the Waikato Regional Plan.

7. INFRASTRUCTURE ASSESSMENT METHODOLOGY

7.1 An outline description of the methodology and processes I used to undertake the infrastructure assessments in Section 8 are listed below:

(a) Roading –designs for road widths and gradients coordinated with Mr Leo Hills based on Austroads design guidelines and Waikato Local Authority Shared Services Regional Infrastructure Technical Specifications (RITS) – Roading.

(b) Stormwater – designs for stormwater quality and quantity using WDC and industry accepted documents listed in paragraph 9.17. Modelling of Tata Valley flood plain, wetland, Waikato River and on-site devices using HEC HMS[3] and HEC RAS[4] software.

(c) Wastewater – calculations have been completed for staged wastewater flows generated by the development from 2025 – 2040 onwards based on design standards in the Waikato Local Authority Shared Services Regional Infrastructure Technical Specifications (RITS) – Wastewater. Numerous meetings and phone calls with Richard Pullar (WDC/WSL) starting in September 2018 until now to help assist with their forecasting.

(d) Water supply – calculations have been completed for staged wastewater flows generated by the development from 2025 – 2040 onwards based on design standards in the Waikato Local Authority Shared Services Regional Infrastructure Technical Specifications (RITS) – Water. Numerous meetings and phone calls with Pearl McFall (WDC/WSL) starting mid-2018 until now to help assist with their forecasting.

(e) Chorus – existing records searching and email correspondence with Chorus to confirm location of network in vicinity and provide confirmation of concept.

[3] The US Army Corps of Engineers "Hydrologic Engineering Center Hydrologic Modelling System" (HEC-HMS) is designed to simulate the complete hydrologic processes of dendritic watershed systems. The software includes many traditional hydrologic analysis procedures such as event infiltration, unit hydrographs, and hydrologic routing.

[4] The US Army Corps of Engineers "Hydrologic Engineering Center River Analysis System" (HEC-RAS) allows the user to perform one-dimensional steady flow, one and two-dimensional unsteady flow hydraulic calculations for a full network of natural and constructed open channels, rivers, and flood plains. HEC-RAS has the capability to perform inundation mapping of water surface profile results.

(f) Power – existing records searching, meetings and email correspondence with Counties Power to confirm location of network in vicinity and provide confirmation of concept.

(g) Gas – existing records searching, meetings and email correspondence with Vector to confirm location of network in vicinity.

7.2 A list of engagements I have completed with relevant stakeholders are summarised below:

(a) 8 March 2018 – Meeting with Lander Geotechnical to discuss Site characteristics and constraints.

(b) 27 September 2018 – Meeting with WDC (Richard Pullar) regarding infrastructure upgrade planning for water supply and wastewater.

(c) 11 October 2018 – Meeting with Lander Geotechnical to discuss initial designs for resource consent packages and geotechnical solutions for each.

(d) 16 October 2018 – Meeting with WRC to discuss 3 waters strategies.

(e) 30 October 2018 – Preapplication meeting with WDC planners, land development engineers, and development contributions coordinator. To discuss a proposed development of a hotel resort and associated activities within the rural zone of Tata Valley.

(f) 4 March 2019 – Meeting with Iwi (Lucy Rutherford, Edith Tuhimata, Karl Flavell) to discuss stormwater management strategy and wetland enhancement.

(g) 8 April 2019 – Meeting with WDC roading to discuss Hitchen Road Extension into the Havelock site.

(h) 12 April 2019 – Meeting with Counties Power networks team to discuss power supplies to the Site.

(i) 11 June 2019 – Meeting with WDC (Richard Pullar and Pearl McFall) regarding supplied calculations and staged flows from the Site, and update on infrastructure upgrade planning for water supply and wastewater.

(j) 2 September 2019 – Meeting with Iwi (Lucy Rutherford, Edith Tuhimata, Zac Rutherford) to discuss stormwater treatment strategy, wetland, swale and rain gardens operation and maintenance, and earthworks ESC management.

(k) 28 September 2019 – WDC meeting with Kevin Stokes and Iwi groups (Lucy Rutherford, Karl Flavell, Hero Potini)

(l) 28 September 2020 – 26 January 2021 – Various meetings and emails with Vector Gas (Jay Kesha) to arrive at a Memorandum of Understanding to complete gas relocation works.

(m) 16 February 2021 – Phone and email correspondence with Sven Harlos, Pukekohe Wastewater Treatment Plant (WWTP) upgrade Project Manager at Watercare. To understand the latest timing and progress of upgrades for the WWTP. Public information is shared here:

https://www.watercare.co.nz/About-us/Projects-around-Auckland/Pukekohe-Wastewater-Treatment-Plant-upgrades

https://www.watercare.co.nz/About-us/News-media/Pukekohe-Wastewater-Treatment-Plant-expansion-flie

8. REQUIRED INFRASTRUCTURE TO SERVICE THE SITE

8.1 The following is a summary of the necessary infrastructure elements required to service the Site. The development includes a 200-room resort hotel, spa and conference centre, and farming and commercial activities to showcase New Zealand agriculture activities to visitors.

Roading

8.2 Transport assessments have been undertaken by Commute Transportation Consultants about the capacity of the surrounding road networks and the road layout proposed to be utilised throughout the Site.

8.3 The findings of this assessment (as addressed by the evidence of Mr. Hills) has been used to guide the Concept Plan's road pattern, and any improvements works for the Site. The evidence of Mr Hills also addresses, the Precinct Plan's indicative roading network, road gradients and suitability of these against the Waikato Regional Infrastructure Technical Specification (RITS).

8.4 The proposed internal roads will all remain private and be located within the Site. It is proposed to provide private access to the Site from an extension to Yashili Drive and will connect to the subject Site at its north-eastern extent adjoining 242 Bluff Road. This access will be built to public standards so can be vested at a later stage if required.

8.5 The Concept Plan reflects key access connections tested and designed for the submitted resource consent applications.

8.6 The Concept Plan (as detailed in the evidence of Mr Scrafton) includes key access connections which can be achieved to accord with the RITS gradients from Yashili Drive. I expect that these will be subject to detailed design as part of the Engineering Plan Approval (EPA) process, as is usual practice for subdivision and engineering design approval processes.

8.7 As outlined in the evidence of Mr Hills the key access connections can be implemented without requiring other network improvements.

8.8 The access network envisaged by the Concept Plan for the Site would be implemented by the consent holder as part of future development phases and would be funded by the developer. No local authority funding is required to achieve the roading network or connections.

Stormwater

8.9 The Site falls outside of any approved WRC stormwater discharge consent area. In my experience with development and stormwater catchment planning in Pokeno stormwater discharge consent(s) are obtained from the WRC alongside subdivision and/or development-based land use consents.

8.10 The Site is bounded mostly by ridgelines, with some upstream rural catchments also falling into the central valley from the west and eastern sides. Stormwater flows to existing farm drains and streams within the Site and to the existing wetland and stopbank as shown on the figure below:

(a) The eastern upstream catchment drains to the existing Tata Valley wetland (as shown on Figure 3) from 242 Bluff Road and 316 Bluff Road (Lot 1 DP 167329).

(b) The western upstream catchment drains to the Tata Valley wetland from 35 Trig Road (the subject Site) and 89 Trig Road (Lot 3 DP 441406) via farm drains and streams.

(c) The wetland then discharges through an existing stopbank via culverts and a stream to the Waikato River.

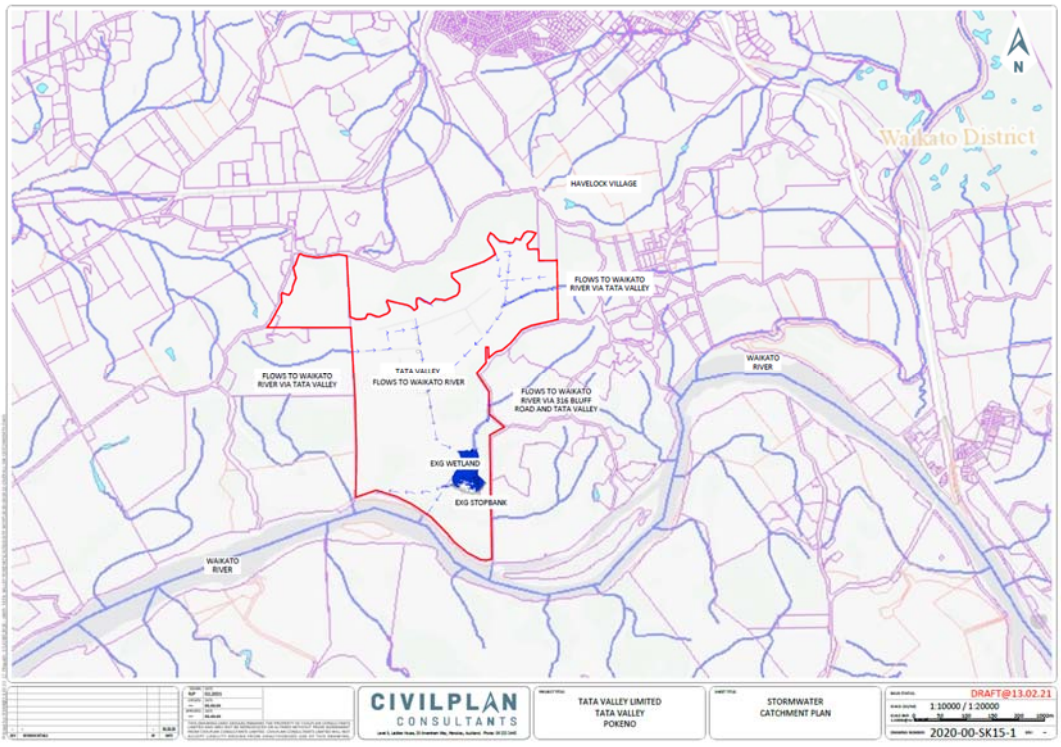


Figure 3 – Existing stormwater discharge locations.

8.11 It has been allowed for the upstream rural Site's (owned by third parties not related to the applicant) runoff to pass through the Site at pre development (rural) flow rates. The current flows include this third party land, and the design of the stop banks have also accounted for it.

8.12 I have assumed that the upstream Havelock Village Site has been developed in line with the PWDP Residential Zone standards for lot size and coverage, but assumed (in line with their proposals) that all of their proposed flows are attenuated at source and offline to streams with orifice controlled devices consistent with Council's stormwater guidance (basins/wetlands/rain gardens and/or tanks), so that the runoff is at no more than pre development (rural) rates. I note that the development of TaTa Valley is not dependent on the establishment of Havelock Village.

8.13 Stormwater management to address both quality and quantity is required at the time of development, and has been based on low impact design based as required by the Waikato Stormwater Management Guidelines and Waikato District Council requirements as outlined in current versions of the following documents:

(a) Waikato Regional Council TR2020/06– Waikato Stormwater Runoff Modelling Guideline.

(b) Waikato Regional Council TR2020/07 – Waikato Stormwater Management Guideline.

(c) Waikato Local Authority Shared Services Regional Infrastructure Technical Specifications (RITS) – Stormwater

8.14 The stormwater designs completed for the resource consent applications has tested the proposed zoning and Concept Plan and is outlined in the sections below. The design has many layers of at source treatment to ensure a 'better than industry standard' quality of water is released into the Waikato River. The design uses rainwater reuse tanks for buildings and incorporates a treatment train of forebays, rain gardens and treatment swales with extended detention volume (EDV) basins running along the main streams to allow for stream channel restoration and replanting of native bush. The streams would be protected by the provision of stormwater treatment and extended detention. Two forebays are also proposed at the head of the existing wetland, which is to be enhanced with native planting.

8.15 Stormwater from roofs, consistent with Council's stormwater guidance is to be managed by rain tanks providing non-potable reuse and extended detention.

8.16 Stormwater from paved areas will be managed by planted swales and rain gardens adjacent to these areas providing quality treatment and detention.

8.17 The existing on-line RC2 wetland would further enhance the quality of water discharged from the Site, over and above the separate treatment for each area. The streams would be protected by the provision of stormwater treatment and extended detention strategies.

8.18 The table below outlines the proposed stormwater management strategies for each design package.

Table 1: Stormwater Management Strategies

	Impervious Area	Treatment	Volume Control	Extended Detention
a	Hotel roof & RC1 south access road from RC2	Treatment swale	Non-potable reuse from roof areas	None – discharge directly to Waikato River via treatment swale
b	RC1 north access road from RC2.	Rain garden	Rain garden	Underdrain outlet control in rain garden
c	Site access from Yashili Drive (east access).	Rain garden Treatment swales	Rain garden	ED basins incorporated in the swale at discharge points
d	Roading in RC2, RC3, RC4A and "Site wide" packages and parking area in RC3	Treatment swales	None	ED basins incorporated in the swale at discharge points
e	Parking area in RC4A	Treatment swale	None	None – discharge directly to Waikato River via treatment swale
f	Roofs in RC3 area	Not required	Non-potable reuse	ED basins or tanks
g	RC3 "Production & Warehouse" area	Constructed Wetland	Non-potable reuse from roof	Outlet control in wetland

8.19 Geotechnical investigation (Insitu testing such as falling head percolation method) is required at EPA stage to determine how much retention by soakage can be provided. The clay soils which cover the steeper sides of the valley, and the high water table in the peat laden valley floor make this difficult. Infiltration soakage into the ground will need to be in accordance with geotechnical advice addressing slope stability. Usually infiltration would be discouraged for slope stability reasons on slopes showing signs of instability, or steeper than 1(v) in 4(h).

Contaminant Loads

8.20 The development includes 11Ha of impervious area (including roofs, roads, and paved areas). Stormwater management is detailed above and will likely consist primarily of treatment swales, re-use tanks and rain gardens. Additionally, the low-lying area behind the stopbank is to be reshaped and restored as a planted wetland.

8.21 The methodology recommended in TR2018/01 (now updated to TR2020/07) has been used to calculate contaminant loads for discharge to the Waikato River in the following cases:

(a) Pre-development

(b) Post-Development fully developed catchment, no treatment (i.e. including the separate residential subdivision in the upper catchment without treatment)

(c) Post-Development fully developed catchment, with treatment (i.e. including the separate residential subdivision in the upper catchment with treatment)

8.22 For all contaminants there is a calculated reduction comparing pre-development to post-development with treatment, the treated water having between 25-82% of pre development loads. The conclusion is that the development improves the Waikato River water quality.

Flood Protection from the Waikato River

8.23 The valley is currently subject to inundation, particularly during winter, due to high tailwater levels in the Waikato River, backflow through the existing culverts, and overtopping of the existing stopbank during extreme events.

8.24 WRC has provided a Flood Hazard Report for the Site, dated 25 August 2017. The report states that the flood level in the Waikato River adjacent to the Site is predicted to peak at between 4.85m and 5.32m during a river/tidal flood event with a 1% Annual Exceedance Probability (AEP). The maximum historical water level is estimated to have been between 5.6 m and 5.16m, during the 1958 storm event.

8.25 The level of the existing stopbank varies from RL4.3 to RL5.25. As part of the proposed development the stopbank would be raised to approximately RL 5.7. The final level is subject to confirmation in conjunction with Waikato Regional Council (WRC) and the river modelling they are currently updating.

8.26 In addition to raising the existing stopbank to RL 5.7m, it is proposed to install culvert flood gates to protect the valley from inundation by the Waikato River in the 1% AEP river/tidal flood event.

Wetland Restoration and Pump System

8.27 The low-lying area inside the stopbank will be reshaped and restored as a planted wetland system, with an area of deeper open water opposite the amphitheatre formed in RC1.

8.28 To improve the health of the wetland ecosystem and increase the volume of flood storage that is available when river levels are high, an outlet pump system will be installed to maintain normal wetland levels (between RL 3.2 and RL 3.5).

8.29 A weir will be installed upstream of the outlet to maintain normal wetland levels when the river levels are low.

8.30 Details of the weir and pump system are subject to further design, however the stormwater flood modelling is based on a nominal pump flow rate of 300l/s. The stormwater model (detailed below) indicates that with a tailwater level of RL 5m this flow rate will ensure the wetland levels exceed RL 3.5m for no more than 4 days in the 50% AEP (2 year) storm event.

Fish Passage

8.31 Detailed design will be provided for fish passage in streams and structures, with details such as mussel spat ropes in culverts, wetland flood gates with slow closing flap gates, and fish friendly pump systems with grates and Archimedes screw type systems.

Flood Modelling

8.32 A 2D HEC RAS[5] model of flow in the river has been developed based on information provided by WRC. This included Waikato River stage data from Mercer and Tuakau and 23 river cross sections between the Mercer and Tuakau bridges, a distance of 11.6km. The modelled water surface elevation outside the stopbank in the 1998 100 year event is approximately RL 5.0 m. As a part of the lodged resource consent calculations, sensitivity checks were completed to test those conclusions. The model is yet to be finalised and accepted by WRC.

[5] The US Army Corps of Engineers "Hydrologic Engineering Center River Analysis System" (HEC-RAS) allows the user to perform one-dimensional steady flow, one and two-dimensional unsteady flow hydraulic calculations for a full network of natural and constructed open channels, rivers, and flood plains. HEC-RAS has the capability to perform inundation mapping of water surface profile results.

8.33 A continuous simulation of the proposed wetland has also been run, based on daily runoff volumes calculated from historic rainfall data from the Onewhero and Pukekohe rainfall gauges and river levels estimated from the Mercer and Tuakau stage data.

8.34 In the predevelopment case, a total of 429 days above the proposed “normal” wetland level of RL 3.5m, with a maximum of 63 consecutive days above this level.

8.35 In the postdevelopment case, a total of 38 days with a wetland level above RL 3.5, with a maximum of 4 days above this level.

8.36 These results support the conclusion that the proposed stormwater strategy and flood management system will reduce flood risk in the valley. The comparison is shown in Figures 4 (pre) and 5 (post).

8.37 Roads in the valley floor are set at a minimum level of RL4.5m, which is above the maximum flood level in the 1% AEP storm event (RL4.36m).

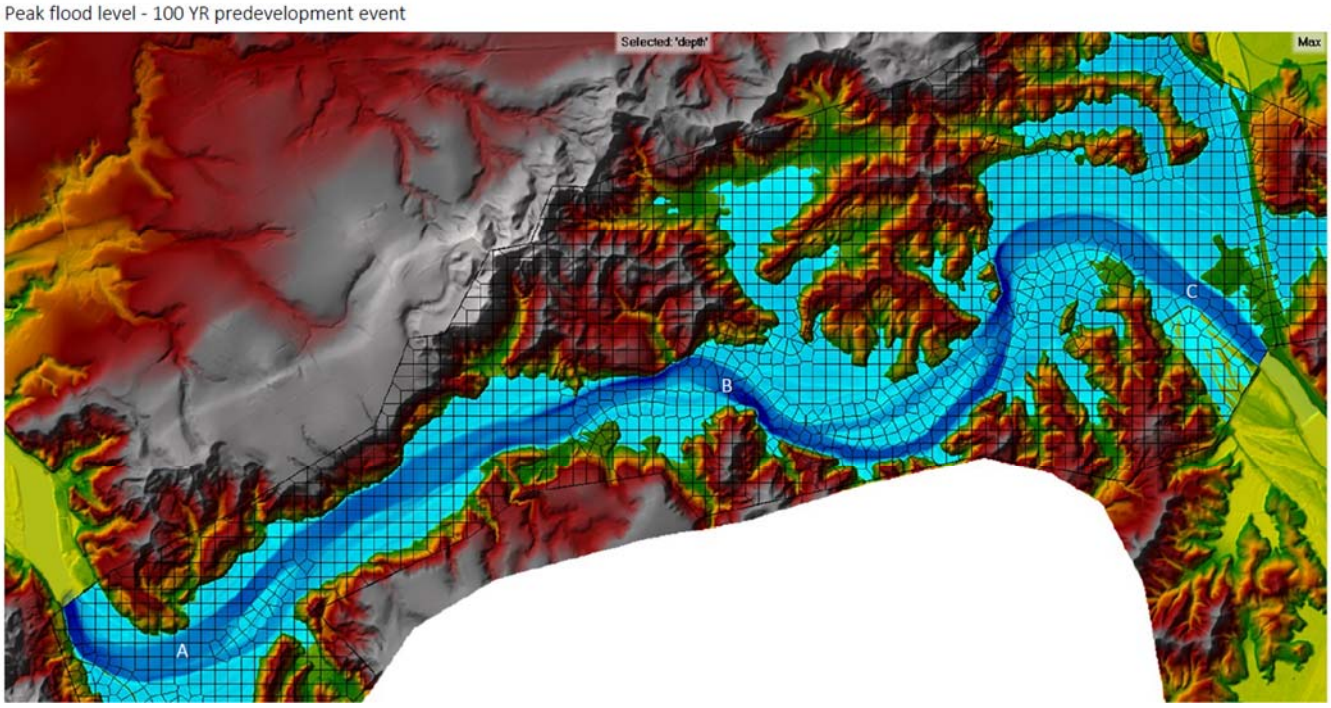


Figure 4 – Peak flood extents – 100 yr pre development – valley floor inundated to RL5.00m.

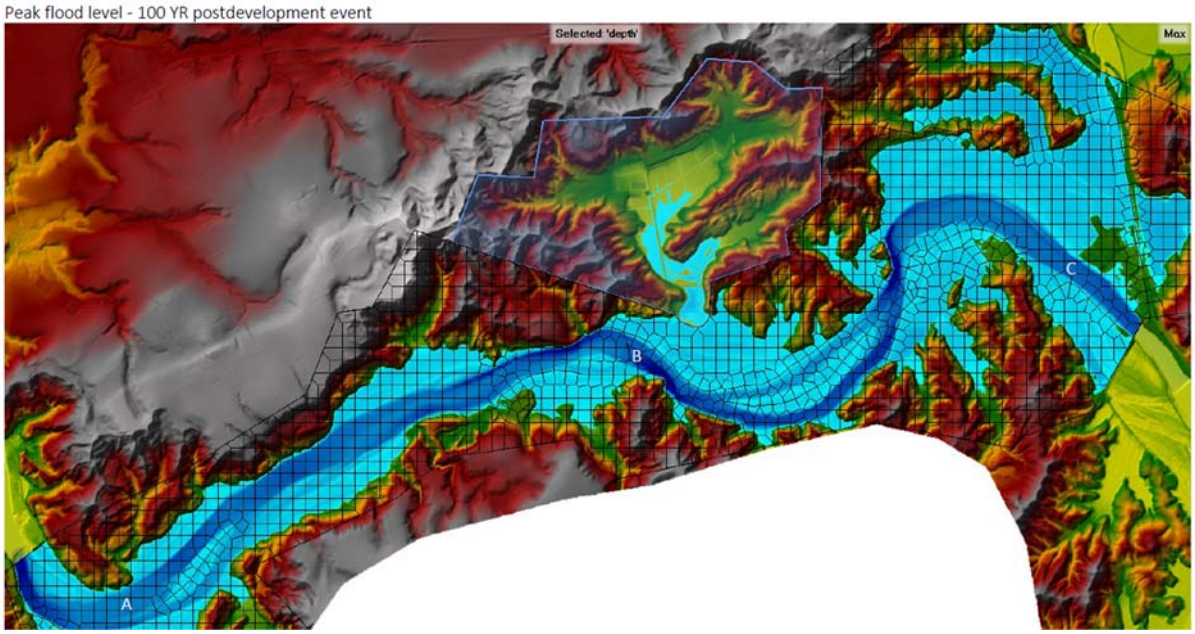


Figure 5 – Peak flood extents – 100 yr post development – valley floor inundated to RL4.36m

Upstream & Downstream Effects

8.38 WRC has advised that the nearest stopbanks are downstream at Murray Road (private stopbank); and upstream at Mercer West (WRC stopbank), i.e. approximately 4.4km upstream, and 4.8km downstream of the Site. Refer to Figure 6.

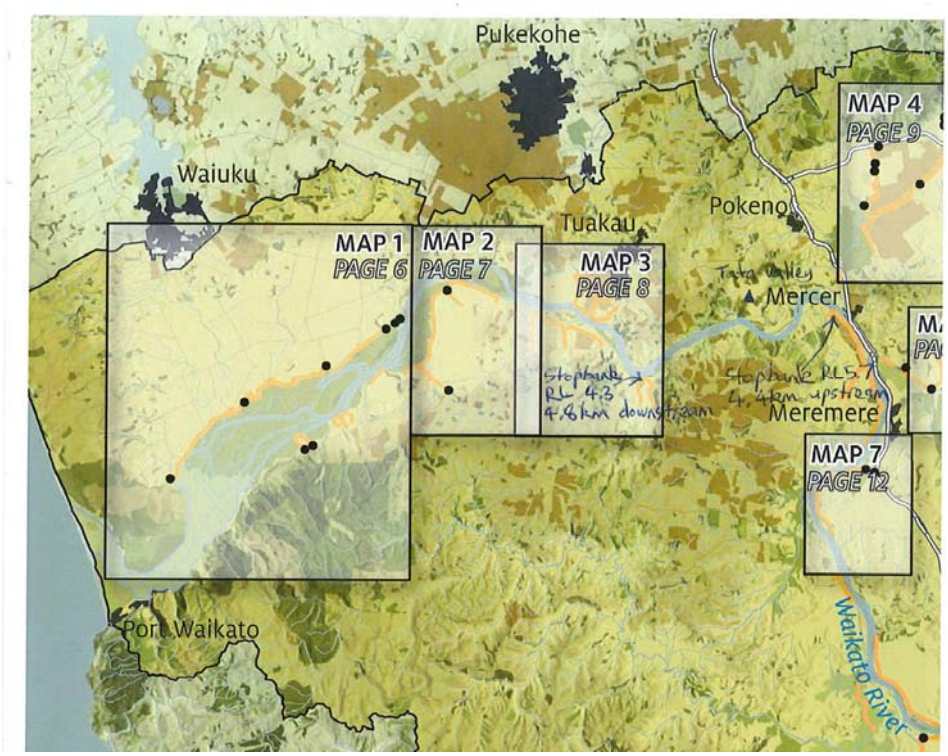


Figure 6 – Stopbank Locations upstream and downstream of Site.

8.39 WRC has advised that both stopbanks protect against the 10 year ARI event. Based on the 2010/2011 lidar the respective crest levels of these stopbanks are RL5.7m and RL4.3m.

8.40 The flood levels at these locations would be approximately 400-500mm above and below the flood level at the Site. The 2D hydraulic model shows the development will not change existing flood levels in the river, including at these locations.

8.41 Due to the considerable distance from the Site and the negligible impact the Site has on flows in the river, it can be concluded that the development will not affect these assets or flood levels at these locations.

8.42 Given the above evidence I am confident that suitable solutions are proposed as a part of the resource consent applications and they support the proposed zoning of the land.

Wastewater

8.43 As identified earlier in my evidence there is no public wastewater servicing for the Site at the present time.

8.44 As part of my role I have been consulting with WDC engineering team members and subsequently Watercare regarding the potential capacity and relevant upgrades needed to provide Tata Valley with a publicly reticulated wastewater system. I have reviewed the reports and memos outlined in section 2.8 of my evidence as relevant to the potential for servicing of Tata Valley.

8.45 Appendix 5 to the Section 42A Report Hearing 25 Zone Extents prepared by Dr Mark Davey confirms that Watercare have provided for the main infrastructure for wastewater to the proposed adjacent Havelock Village, as shown in Figure 7 below. But it omits confirmation that Tata Valley ("Tata-G") is also accounted for (as explained in the WDC background reports).

Town	Growth Cell	Waikato 2070 /District Plan	Timing	Water Supply	Wastewater	Stormwater
	Pokeno East	Waikato 2070	2023-2050	Bulk water main and network to supply Pokeno East have been allowed for.	Currently unserviced. Watercare to undertake investigations.	
	Havelock Village	Waikato 2070	2023-2030	Watercare have provided for the main infrastructure, however developers to undertake extension.	Watercare have provided for the main infrastructure, however developers to undertake extension.	
	Town Centre	Waikato 2070	2023-2030	Water supply network available	Wastewater network available.	Stormwater is a significant issue. Watercare to undertake investigations.
	Pokeno East Commercial	Waikato 2070	2030-2050	Water supply infrastructure allowed for	Watercare to undertake investigations.	

Figure 7 – Excerpt of Appendix 5 to the Section 42A Report Hearing 25 Zone Extents.

8.46 The two GHD technical memos from Tony Millar to Richard Pullar with subjects of "Pokeno W&WW Planning – Technical memo – Growth: Population and Flows", and "Population, Growth & Planning "dated 16 October 2018 and 22 January 2019 respectively explains the current network configuration in Pokeno, Tuakau and Pukekohe, and reports on required upgrades to the infrastructure that will cater for all future wastewater demands from Pokeno, which includes the proposed TVL development. The wastewater demand information from TVL was calculated and shared with WDC in September 2019 (see Appendix 13 iv)) and discussed in subsequent meetings (refer to paragraphs 7.2 (b) and 7.2 (i)). The technical memos assume staged development from the Site starting in 2022 until the year 2034. Tata

Valley is referred to in the report as “Tata – G”, and the populations (or population equivalents[6]) have been extracted from Table 2 and shown below:

Table 2: Summary of Pokeno Population Projections (additional information to split Tata-A-F from Tata-G, extract from Table 2 of “Pokeno W&WW Planning – Technical memo – Growth: Population and Flows” by GHD, dated 16 October 2018)

Sub catchment	2018 Population	2022 Population	2026 Population	2030 Population	2034 Population
Tata-A to F	0	0	560	1960	2800
Tata-G	0	1016	2814	4014	4112
Tata Valley (total)	**0**	**1016**	**3374**	**5974**	**6912**

8.47 Staged demands from the Site are shown below:

Table 3: Tata Valley (Tata-G) Wastewater Peak Wet Weather Flows (l/s)

	2018	2022	2026	2030	2034
Dry Retail Only	0	9	12	18	23
Wet Retail (livestock and milking)	0	20	22	28	33

8.48 The existing ‘Hitchen 1’ WWPS in Gateway Park Drive is the nearest pump station that ultimately discharges via the Buckland Road WSL interceptor to the Pukekohe WWTP via daisy chained pump stations in Pokeno and Tuakau.

8.49 As shown in Figure 8 the Site has been considered by WDC to be in the Hitchen Road catchment and they have assumed that the Site will be serviced with a pump station on the Tata Valley Site to lift flows to the high part of Tata-A catchment. The flows would then discharge by gravity to the existing Hitchen Road WWPS, ‘Hitchen 1’, via Yashili Drive and Gateway Park Drive. This would be supplemented by a new ‘Hitchen 2’ WWPS once catchment wide flows require it. This rising main and gravity pipe alignment could be located in the berm of the proposed private access between the Site and Yashili Drive.

[6] To avoid any confusion I can confirm that no dwellings are proposed at TaTa Valley. Instead the water and wastewater calculations have used population equivalents to assess demand from the Site.

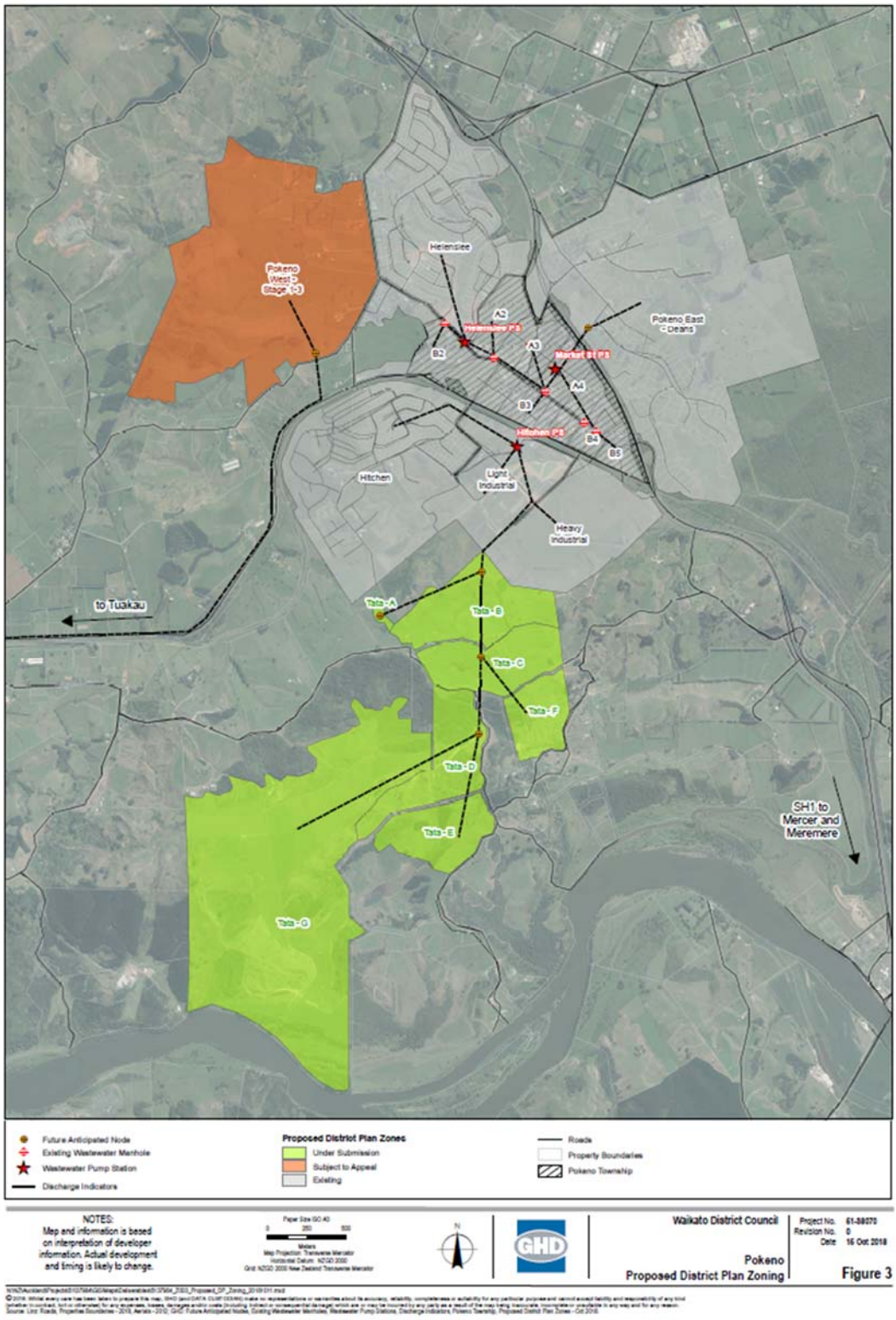


Figure 8 – Wastewater catchments considered in WDC's upgrade requirements.

8.50 Although this is a possible option and the Tata-G flows have been allowed for in WDC's modelling and expected upgrades, I also present another possible solution to separate the Tata Valley Development from the Havelock Village development. This has also been discussed with WDC (Richard Pullar) as a feasible option.

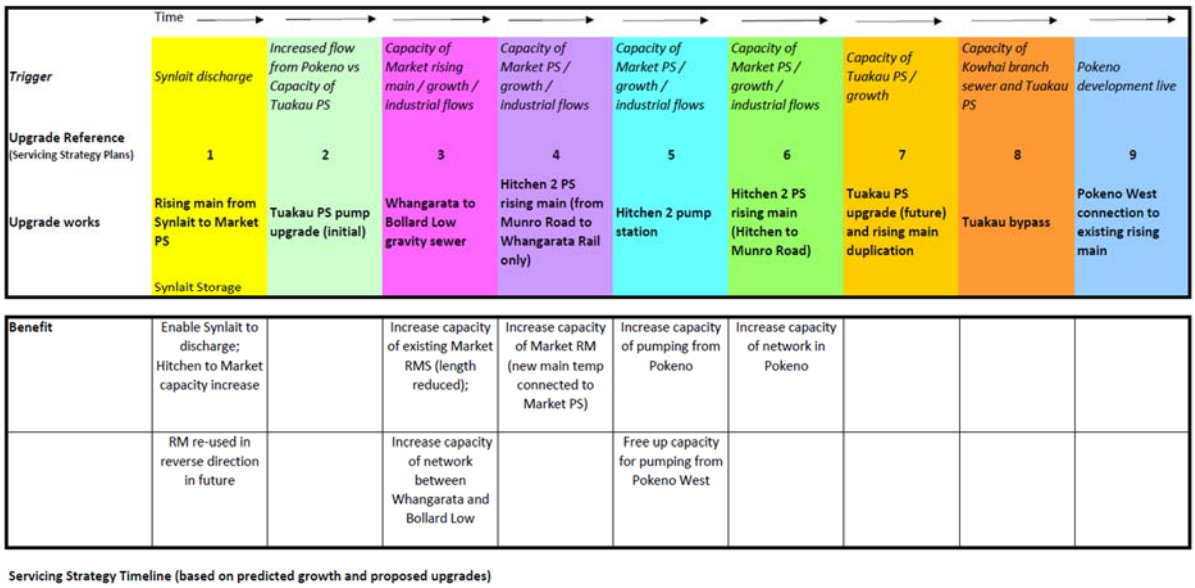
8.51 A wastewater vacuum (for internal flows) and pump station would be constructed in the central part of the Site, servicing the entire development. The pump station could also be increased in size to service the future Havelock Village residential subdivision to the east (as an option).

8.52 A new 225OD PE rising main approximately 2900m long would run along the 42B Potter Road access and Potter Road, to the intersection with Ewing/Whangarata Road, where it would connect to the existing 160PE rising main coming from Pokeno. This will be spare once WDC's network upgrade Package 4 (see Figure 9) of the wastewater upgrade works are completed, and is able to be used for this development. This rising main discharges to the manhole at the top of Bollard Road in Tuakau.

8.53 The 160PE rising main has a limiting flow rate of 27 l/s (PWWF), so based on the staged demands in Table 4, this may need to be upgraded with a rising main installed side by side, between the years 2026-2030 (if wet retail is put into system).

8.54 This solution would also assist with alleviating flows needing to be managed in the Pokeno WWPS and networks.

8.55 The existing network infrastructure and planned upgrades are explained in the tech memos and 9 packages of works are to be built across the network as catchment flows increase, at a high level estimated cost of $6.2 million. This is summarised in the table below, extracted from the memo.



Time →									
Trigger	*Synlait discharge*	*Increased flow from Pokeno vs Capacity of Tuakau PS*	*Capacity of Market rising main / growth / industrial flows*	*Capacity of Market PS / growth / industrial flows*	*Capacity of Market PS / growth / industrial flows*	*Capacity of Market PS / growth / industrial flows*	*Capacity of Tuakau PS / growth*	*Capacity of Kowhai branch sewer and Tuakau PS*	*Pokeno development live*
Upgrade Reference (Servicing Strategy Plans)	1	2	3	4	5	6	7	8	9
Upgrade works	**Rising main from Synlait to Market PS** Synlait Storage	**Tuakau PS pump upgrade (initial)**	**Whangarata to Bollard Low gravity sewer**	**Hitchen 2 PS rising main (from Munro Road to Whangarata Rail only)**	**Hitchen 2 pump station**	**Hitchen 2 PS rising main (Hitchen to Munro Road)**	**Tuakau PS upgrade (future) and rising main duplication**	**Tuakau bypass**	**Pokeno West connection to existing rising main**
Benefit	Enable Synlait to discharge; Hitchen to Market capacity increase		Increase capacity of existing Market RMS (length reduced);	Increase capacity of Market RM (new main temp connected to Market PS)	Increase capacity of pumping from Pokeno	Increase capacity of network in Pokeno			
	RM re-used in reverse direction in future		Increase capacity of network between Whangarata and Bollard Low		Free up capacity for pumping from Pokeno West				

Servicing Strategy Timeline (based on predicted growth and proposed upgrades)

Figure 9 – Pokeno wastewater network upgrade packages

8.56 Watercare has confirmed that the upgrade works have been put forward to be included into upcoming Long Term Plan budgeting which is to be finalised mid-2021.

8.57 Trunk network upgrades by WDC will be staged to allow for incremental development through Pokeno, and development contributions will need to be paid on connection to support the upgrades. Extensions from the Site to these trunk networks will be completed by the developer.

8.58 Industrial flows proposed for Pokeno (existing and future milk processing factories) currently dominate WW flows and will also dominate flows in the future. Figure 5 in the 22 January tech memo projects that the year 2039 industrial ADWF flows will be approximately 170l/s, 240% more than residential ADWF flows of 70l/s. These dominant flows are a driver for upgrading of the Pukekohe WWTP.

8.59 Watercare provides water and wastewater treatment services to WDC to allow servicing of Pokeno. The arrangement is a contractual agreement between Watercare and WDC which has existed since 2014. This sets out the volume and quality of the wastewater that can be treated by Watercare from WDC's network.

8.60 The Pukekohe WWTP currently services Pokeno, Patamahoe, Pukekohe (including Paerata), and Tuakau, and is currently being upgraded with advanced membrane bioreactor (MBR+UV treatment) capacities to cater for the projected population growth for these areas.

8.61 The WWTP is currently treating at its limit of 25,000 people equivalent ("PE" – this is the technical term for number of people and industrial demand converted into people) (approximately 8,300 dwellings).

8.62 Stage 1 of the upgrade is currently being commissioned and will be able to provide treatment for up to 30,000 PE by June 2021 (approximately 10,000 dwellings).

8.63 Stage 2 of the upgrade will be completed and commissioned by July 2022 and will be able to provide treatment for up to 60,000 PE (approximately 20,000 dwellings).

8.64 With 2-3 years notice and funding secured, there is ability for the WWTP to be further upgraded to treat flows up to 80,000 PE (approximately 26,000 dwellings).

8.65 Discussions with Watercare have confirmed that Watercare's current and future upgrade plan for the Pukekohe WWTP as explained above allows for residential growth expected by WDC in Pokeno.

8.66 As detailed EPA designs are developed, liaison with WDC and WSL will be required in order to update them on final population numbers (or population equivalent numbers in respect of TaTa Valley) and design flows and to understand the status of the upgrades explained above. In my experience with land development this is not unusual, and ensures that development aligns with the pace rate of infrastructure.

8.67 Extensions and upgrades to service the Tata Valley Site from major infrastructure will be carried out by the developer.

8.68 Furthermore, Watercare charge development (and developers on a per lot/Household Unit equivalent basis) an “infrastructure Growth Charge” which is a levy attributed to recovering the cost of growth-related infrastructure.

8.69 I am of the opinion that there is sufficient provision for the growth proposed by TVL to be accommodated into existing and planned infrastructure and that there are suitable mechanisms to ensure that the funding of that infrastructure can be achieved to align with the pace of development.

Water Supply

8.70 As identified earlier in my evidence there is no public waster servicing for the Site at the present time.

8.71 As part of my role I have been consulting with WDC engineering team members and subsequently Watercare regarding the potential capacity and relevant upgrades needed to provide Tata Valley with a publicly reticulated water supply system. I have reviewed the reports and memos outlined in section 2.8 of my evidence as relevant to the potential for servicing of Tata Valley.

8.72 I discussed above Appendix 5 to the Section 42A Report Hearing 25 Zone Extents prepared by Dr Mark Davey which also confirms that Watercare have provided for the main infrastructure for water supply to Havelock Village, but omits (as explained in the WDC reports) confirmation that Tata Valley ("Tata-G") is also accounted for.

8.73 The Waikato District Council Report – "Pokeno Water Network Model Masterplan Update" by GHD, dated February 2020, has modelled and reported on required upgraded infrastructure that caters for all future water demands from Pokeno, including the proposed Tata Valley rezoning. The water demand information from Tata Valley was calculated and shared with WDC in September 2019 (see Appendix 13 iv)) and discussed in subsequent meetings (refer to paragraphs 7.2 (b) and 7.2 (i)). The Council modelling assumes staged development from the Site starting in 2025 until the year 2045, which is consistent with the likely build out time proposed by the developer. (refer to Figure 7 and Table 1 of the report). Tata Valley is referred to in the report as "Tata – G", and the cumulative new dwellings have been extracted from Table 1 and shown below.

Table 4: Summary of Timing and Scale of Future Growth (extract from Table 1 of "Pokeno Water Network Model Masterplan Update" by GHD, dated February 2020)

Future Growth Area	2019 cumulative new dwellings	2025 cumulative new dwellings	2035 cumulative new dwellings	2045 cumulative new dwellings
Tata - G	0	491	1412	1412

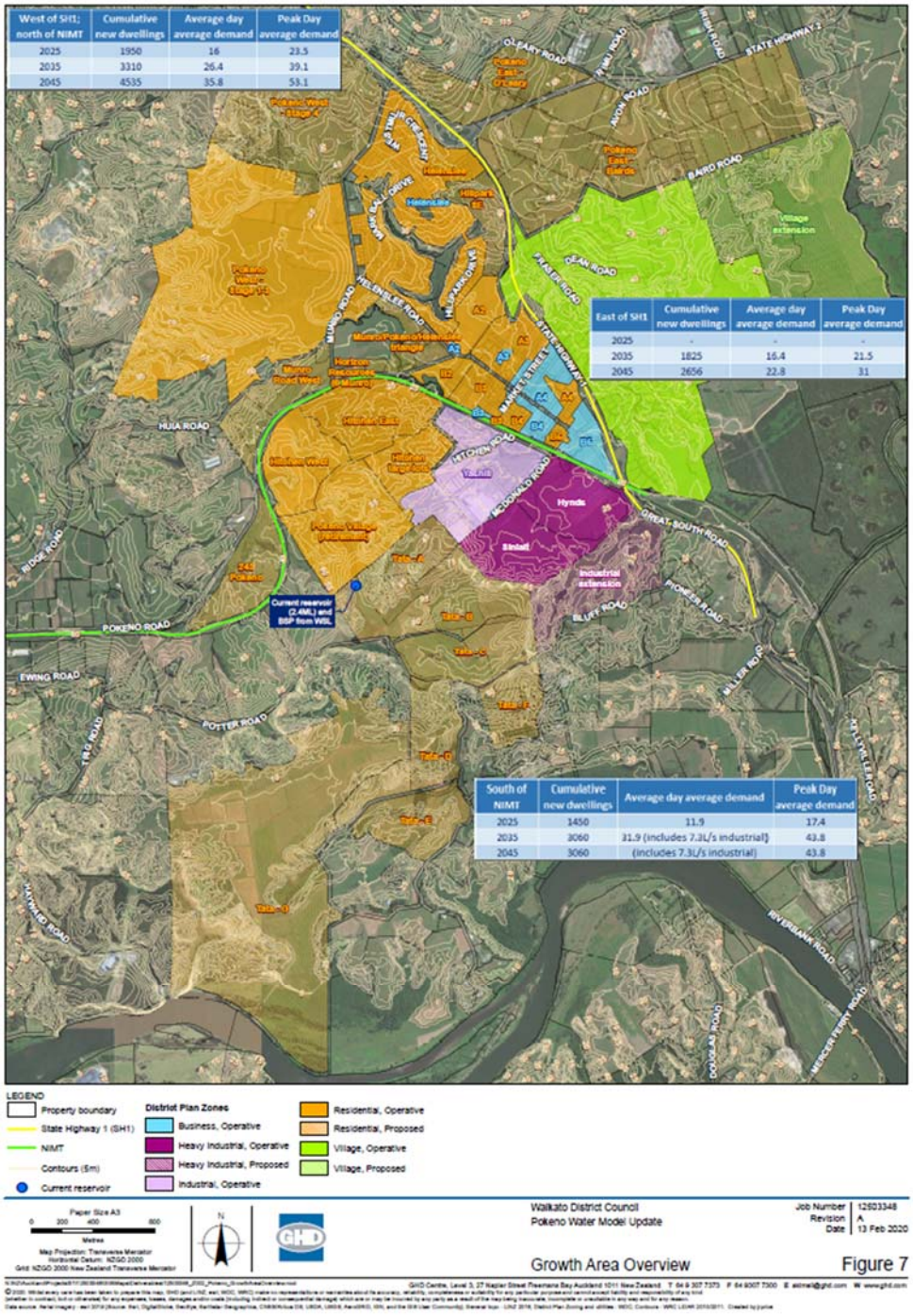


Figure 10 – Water supply catchments considered in WDC's upgrade requirements.

8.74 As with the wastewater reports, the water supply reports use dwelling equivalents to assess demand. I can confirm there are no dwellings to be provided at TaTa Valley.

8.75 There are two feasible servicing solutions for Tata Valley which are both commented on in the WDC report. The first solution relies on providing a connection from the Hitchen Road Reservoir located in Havelock land (maintained and owned by WDC) and installing a main through Havelock land to the Site, which could possibly be located in

the proposed Yashili Drive access berm. Paragraphs 8.76 – 8.79 explain this first option.

8.76 Trunk network upgrades by WDC will be staged to allow for incremental development in conjunction with WDC, and development contributions will need to be paid on connection to support the upgrades.

8.77 Required upgrades for the future modelled growth of Pokeno involve the installation of a second 3.6ML reservoir to support the existing 2.4ML reservoir (located at approximately 96m RL), approximately in the year 2035. Depending on the speed of development in the catchment, this may or may not be required for the Tata Valley Site to be developed. The current reservoir parcel has adequate space for the second reservoir. Council has applied to Watercare Services Limited (WSL) for a flow from the Pokeno Bulk Supply Point ("BSP") of 3500m^3/d in 2038 to service the total growth in Pokeno. Watercare has confirmed that the upgrade works have been put forward to be included into upcoming Long Term Plan budgeting which is to be finalised mid-2021.

8.78 For development in high elevations of the Site (between 70-120m RL), a new connection onto the WSL 280 OD PE bulk supply watermain, upstream of the BSP and prior to the Hitchen Road reservoir will need to be constructed (with approval from Watercare Services Limited – yet to be discussed). As the WSL BSP is at a higher HGL of 140m RL this will have sufficient pressure to service the high Site elevations. If this is not preferred a new booster pump station will be required to be built after connection to the Hitchen Road reservoirs, to be discussed with WDC. This will ensure that the higher areas of the Site are used efficiently.

8.79 For development in low elevations of the Site (<70m RL), the area will have adequate supply but will require pressure reduction as a part of the network, which can be coordinated with WDC and their design requirements.

8.80 The second feasible solution separates the Tata Valley Development from the Havelock Village development. It is a variant of the solution described in 8.78, explained below.

8.81 The current design for which resource consent has been applied for, is for Tata Valley to be serviced off its own private reservoir tanks with a 24hr low flow take off from the existing 280 OD PE bulk supply main in Potter Road (owned by WSL). These storage tanks will be located in private land at the Potter road connection location, to provide adequate firefighting storage.

8.82 For either of the design options, infrastructure layouts within Tata Valley then will be privately owned and maintained, and will be in accordance with the RITS for water supply and firefighting requirements in accordance with SNZ PAS 4509:2008. Potable water will be piped along the Site roads, from the reservoirs off Potter Road. The private water supply will only service activities within the Site.

8.83 The proposed buildings will have rainwater reuse tanks for non-potable supply as outlined in the stormwater strategy above.

8.84 At the time of detailed design and EPA application, liaison with WDC and WSL will be required in order to update them on final design flows and to understand the status of the upgrades explained above. In my experience with land development this is not unusual and ensures that development aligns with the pace rate of infrastructure.

8.85 Extensions and upgrades to service the Site from major infrastructure will be carried out by the developer.

8.86 Furthermore, Watercare charge development (and developers on a per lot/Household Unit equivalent basis) an “Infrastructure Growth Charge” which is a levy attributed to recovering the cost of growth-related infrastructure.

8.87 I am of the opinion that there is sufficient provision for the growth proposed by TVL to be accommodated into existing and planned water supply infrastructure and that there are suitable mechanisms to ensure that the funding of that water supply infrastructure can be achieved to align with the pace of development.

Utilities

8.88 Based on the investigations and discussions with Chorus, existing telecommunication infrastructure can accommodate the proposal. Existing telephone exchanges are at Pokeno and Tuakau, and servicing is in Potter Road and Trig Road. Exact connection locations have not been confirmed, but they have been described as local to the development.

8.89 Based on the investigations and discussions with Counties Power, existing power infrastructure can accommodate the proposal. An existing overhead high voltage line (Whangarata feeder) travels along Potter Road. Although this line cannot be directly connected to, additional infrastructure will enable power supply. Exact connection locations to service the development have not been confirmed, but servicing can be made from this existing infrastructure.

8.90 There is an existing Vector Gas IP20 ST 150mm main in Ewing Road and Potter Road. Ongoing discussions are being held with Vector Gas and there is no impediment to the proposal. There will be the option of local gas servicing coming off this main to service the development, although gas is not essential for the development to proceed.

9. HAZARDS

Flooding

9.1 Paragraphs 8.27 to 8.42 explain the proposed Site improvements and flood management strategy to be adopted.

9.2 These include raising and improving the existing stopbank, installing culvert flood gates to protect the valley from inundation by the Waikato River, and installing a pump and weir system as part of the wetland, culvert and stopbank restorations.

9.3 The modelling results shows a decrease in flooding extent on Site and no effect to either upstream or downstream properties along the Waikato River.

9.4 This supports the conclusion that the proposed stormwater and flood management strategy will reduce flood risk at the Site.

Geotechnical

9.5 Geotechnical ground conditions and specific future foundation design can be addressed with each specific development stage.

9.6 Mr Edward's evidence relating to Geotechnical matters states that there is no geotechnical reason why the Site cannot be rezoned and developed as proposed by TVL.

9.7 Liquefaction hazards have also been addressed by Mr Edwards.

10. COMMENTS ON COUNCIL SECTION 42A FRAMEWORK REPORT

10.1 I have discussed above in the Wastewater and Water Supply sections how Appendix 5 to the Section 42A Report Hearing 25 Zone Extents omits confirmation that Tata Valley ("Tata-G") is accounted for within the WDC infrastructure planning. For the reasons outlined above I am confident that TaTa Valley can be adequately serviced by bulk infrastructure and that the developer is to undertake extensions of this infrastructure to their Site. This is in my experience typical practice for standard land development projects.

10.2 Extensions and upgrades to service the Site from major infrastructure will be carried out by the developer. This agrees with the current Development Contributions Policy explained in paragraphs 289 and 290 of the Section 42A Report.

10.3 Paragraphs 291-294 notes that privately owned wastewater systems often fail due to the disproportionately high cost of maintenance per household and therefore the subsequent lack of maintenance completed by body corporates. Although private systems could be used, the proposed development of the Site would also benefit from publicly owned infrastructure, located in publicly vested roads or in easements that grants Council access, so that maintenance can be completed by Council.

11. CONCLUSION

11.1 Based on the Waikato District Council Water Report, GHD technical memos for water and wastewater, and my evidence, I consider that the full extent of development enabled by plan change can be appropriately supported by the existing and upgraded infrastructure (as I have detailed above), to maintain appropriate levels of serviceability to the proposed development through utilities provision, three waters, roading alignments and grades, and the earthworks required to facilitate these.

11.2 Accordingly, I conclude that there is no infrastructure engineering reason to preclude acceptance of the plan change.

Ryan James Pitkethley
17 February 2021

12. APPENDICES

i) Waikato District Council Report – “Pokeno Water Network Model Masterplan Update” by GHD, dated February 2020.

ii) GHD technical memo from Tony Millar to Richard Pullar with subject of “Pokeno W&WW Planning – Technical memo – Growth: Population and Flows”, dated 16 October 2018.

iii) GHD technical memo from Tony Millar to Richard Pullar with subject of “Pokeno W&WW Planning – Technical memo – Population, Growth & Planning”, dated 22 January 2019.

iv) CivilPlan Staged Water and Wastewater Demand Calculations, dated 16 September 2019.

APPENDIX

i) Waikato District Council Report – “Pokeno Water Network Model Masterplan Update” by GHD, dated February 2020.

Waikato District Council

Pokeno Water Network Model Masterplan Update

February 2020

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Background

To support the rapid forecasted growth in the area, Waikato District Council (WDC) is updating the Pokeno water supply model and reassessing an earlier masterplan. WDC had a calibrated hydraulic water model and masterplan prepared for Pokeno in 2015. However, due to the model software (H2OMap) being no longer being supported, and the significant growth in Pokeno occurring at a greater rate than anticipated, WDC engaged GHD to update the Pokeno water supply model.

Steps in this overall update include the conversion and update of model into InfoWorks WS Pro, field-testing (pressure and flow monitoring) and targeted recalibration, and required network upgrade improvements necessary to support the revised growth forecast. Works completed prior to this report include the targeted model conversion and update, as well as the field-testing.

1.2 Purpose of this report

This report has been prepared to outline the revised masterplan for Pokeno.

1.3 Scope and limitations

This report has been prepared by GHD for Waikato District Council and may only be used and relied on by Waikato District Council for the purpose agreed between GHD and the Waikato District Council as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Waikato District Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Waikato District Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has prepared the high level estimates set out in section 6 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.

The Cost Estimate has been prepared for the purpose of assessing the scale of upgrades and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the [works/project] can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

1.4 Assumptions

The model recalibration process described in this report builds upon a previous calibration carried out in 2015 by WSP Opus. It has been assumed that while some modifications will be required to accommodate the changing network and demands, the earlier calibration was generally appropriate. It is on this basis that a targeted recalibration was been undertaken – largely focussed on confirming pressures within the zone and only some hydrant flow testing undertaken. It is assumed that in accordance with good industry practice, a full recalibration will be undertaken by WDC within the next 3-5 years or where as the model is considered no longer a good representation of the network performance.

2. Background

Since 2015, the operation of the Pokeno water supply has changed with a new bulk supply point (BSP) from Watercare (WSL) as well commissioning a new reservoir, to support supply from the BSP on the southwestern side of town, rather than from the northeast (where the previous bore supply and reservoirs were located).

In addition to network changes, Pokeno has recently experienced significant residential and industrial growth. Compounding this, the total forecast growth as well as the rate of growth has increased beyond earlier estimates. A number of studies have been completed previously for WDC, to develop an understanding of how growth might impact on infrastructure requirements going forward. A summary of recent studies is provided in the following sections.

2.1 2015 Masterplan (Opus 2015)

Opus prepared the Pokeno Water Supply Masterplan in July 2015. Growth and flows expected for Pokeno in 2015 were identified as per the extract provided in Figure 1 below.

Scenario	Demand volume m^3/day	Instantaneous peak demand l/s
Calibration day (19/02/2015)	330	8.80
Current peak day	390	10.55
2026 peak day	1570	35.84
2046 peak day	1876	46.54

Figure 1 Forecast demands 2015 masterplan

The 2015 masterplan was prepared while the network was still operated from the springs source on the north-east side of town - the BSP and the Hitchen Reservoir were not in service. The model calibration was carried out with the network configuration at the time but masterplanning process considered the new BSP and Hitchen Reservoir in service.

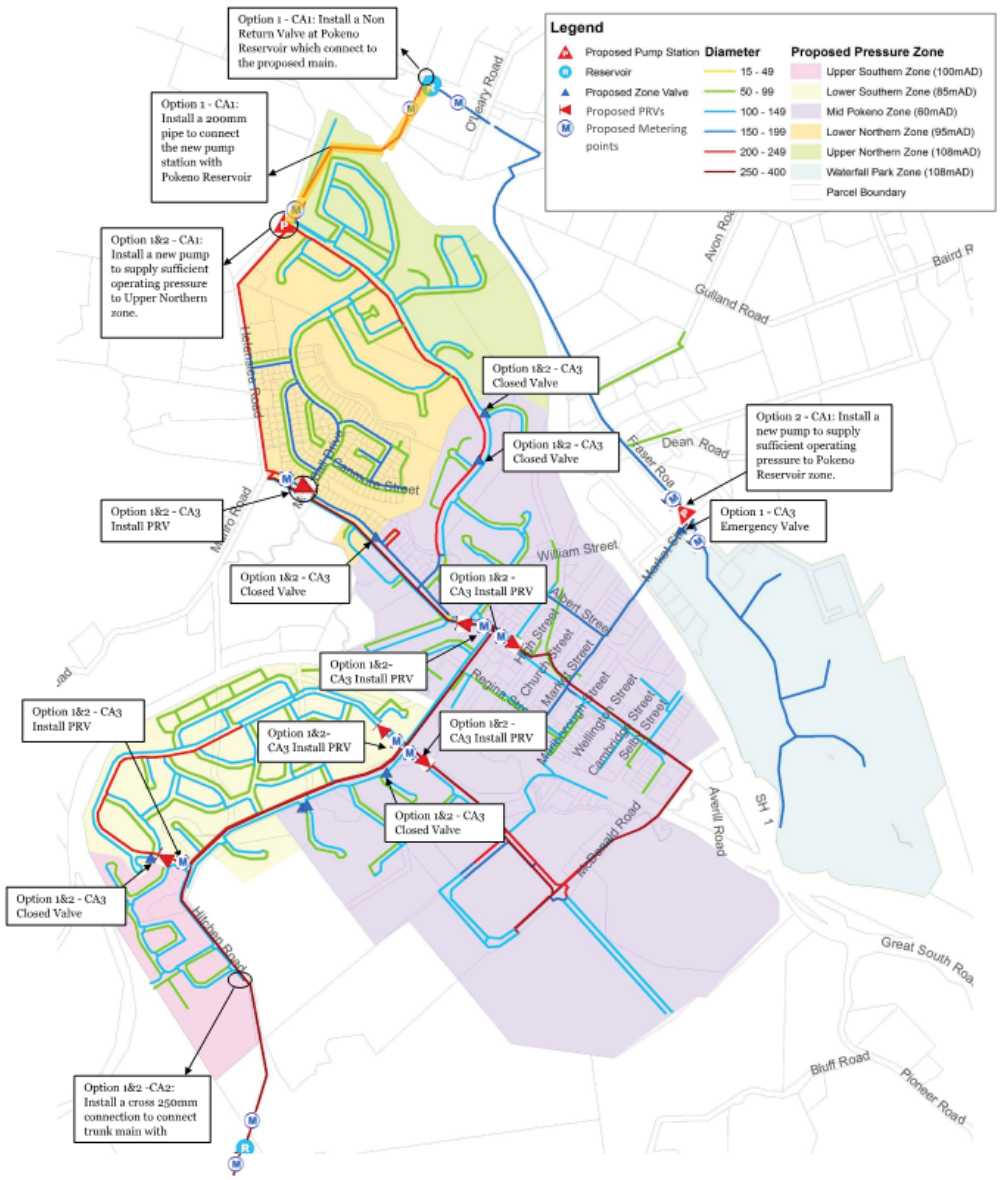


Figure 2 Opus 2015 Pokeno Masterplan - proposed upgrades

The masterplanning identified:

- Two new pump stations (PS) would be required to support development on the northwest and northeast side of town (based on recommended option 2 from the report). One PS was identified at the intersection of Market Street and McGill Road, the other would be located at the northern extent of Helenslee and would boost to support future development and high elevation areas to the north. It does assume that the existing (at that time) 'Pokeno Reservoir' is in service (500 m^3). The Pokeno Reservoir is a combination of smaller reservoirs on the eastern side of town – these reservoirs are no longer in use and (at the time of writing this 2019 update) the site is no longer available.
- Development of separate pressure zones was recommended (7 in total)

2.2 Waikato Water Modelling Strategy (GHD May 2018)

A water modelling strategy was developed by GHD in 2018/2019. Stage 1 of the strategy was completed in May 2018 with the following key points in relation to Pokeno:

- Industrial growth is significant and will include wet-processes. There is an existing private bore that is meeting some of the current industrial demand.
- No formal fireflow requirements have been identified.
- Areas currently on a restricted/trickle-feed supply may be requesting an on-demand supply in future.

2.3 Pokeno Water and Wastewater Planning – Technical Memo, water supply (GHD July 2018)

This memo was prepared as an initial assessment of issues and options that could be considered in subsequent modelling activities. The key points identified from the memo are:

- A second reservoir site has been planned for the Hitchen Road site – it is understood that the initial sizing (completed by Beca in approximately 2014) is 3.6ML to support the existing 2.4ML reservoir.
- Pressure boosting is expected to be required to meet minimum pressures for some of the new growth off Helenslee Road towards the motorway and above 75 m in elevation. The highest current house FFL is 82 m and is experiencing low pressure. We understand there have been complaints from approximately 7 houses in the higher elevation areas of the existing Helenslee area
- Pokeno West growth considered a possible new connection under the NIMT rail corridor to connect to the Hitchen Block. The memo suggested consideration of a new reservoir site as part of the servicing strategy for the final stages (Stage 3 and Stage 4) of Pokeno West – potentially adjacent to the northbound on-ramp to the Southern Motorway. Supply to this reservoir would be from a new booster pump operating on a constant basis over 20 hrs per day, outside of peak demand periods. Fire flow capacity would be provided by the reservoir.
- Pokeno East could also be supported with a new reservoir and filled on a similar basis with a new booster pump station (located adjacent to the existing Market Road wastewater PS), and pumping on a continuous basis 20 hrs per day. This would provide storage on the eastern side of the Southern Motorway. Indicative reservoir sizes are 1.5-2.4 ML by 2030.
- The Tata development may also require a new reservoir, with reservoir and supply to the reservoir kept as public, but with private reticulation to the development area.
- As Pokeno is currently supplied by a single connection from the WSL Pokeno BSP, the report identified a security of supply issue. A possible solution would be a new BSP, potentially off the bulk supply to Tuakau. Other options include the provision of additional storage.
- Possible pressure zones were also identified in the GHD 2014 report at the time of installation of the Watercare BSP. There were been some attempts to initiate the recommended pressure zones (e.g. the industrial area with a supply pressure of 80 m HGL.
- The technical memo noted that Council have applied to WSL for a flow from the Pokeno BSP of 3500m^3/d in 2038.

- The DFH group have developed a high yielding bore that is located on the Yashili site. They currently sell industrial grade water to the adjacent industrial sites. The water is of generally good quality but may not meet the A grade supply standard. There is a current treatment plant located adjacent to the bore. It is understood that this supply may be high in silica.

The memo also included the design report for the bulk main from the Pokeno BSP to the Hitchen reservoir and into Pokeno township. Figure 4 is an extract showing the design flows for the bulk main (noting that diurnal peak demand is understood to be peak day peak hour)

Criteria	Design Flow	Comment
Average Peak Daily Demand	3,515 m^3/day 40.9 L/s	Demand for Pokeno peak residential and non-residential demand for 2042, based from the WDC projected water supply demands.
Diurnal Peak Demand	102.3 L/s	Using a peaking factor of 2.5 from the HCDM.
Average Peak Daily Demand plus Fire	90.9 L/s	Using a 50 L/s criterion for fire from the Hamilton City Council Code of Practice.

Figure 3 Design flows - extract from the Pokeno Bulk Watermain Detailed Design Report (October 2014)

2.4 Population and growth forecast (GHD October 2018)

GHD have been involved with population projections since 2014, to provide council with a basis for forecasting growth and associated infrastructure timing. In 2018, a review was undertaken that updated earlier growth projections considering census data, the outcomes of a University of Waikato growth study, developer staging plans, 224C release dates and GHD's understanding of anticipated build rates. The outcome from the 2018 update is summarised in the extract below (Figure 4). Please note that updated growth figures used for this system performance assessment are provided in Section 4 of this report (and extends to the 2045 timeframe).

Sub-catchment	2018	2022	2026	2030	2034
Pokeno Township	**53**	**567**	**1216**	**1558**	**1558**
Helenslee Block	1972	2041	2041	2041	2041
Hitchen Block	384	1736	2449	2449	2449
Tata Valley	0	1016	3374	5974	6912
Pokeno West	0	398	2743	3843	3843
Pokeno East	0	0	0	1829	4301
Mercer & Meremere	0	0	900	1700	2800
Connected Population (at 2.65 p per HHU)	**2048**	**5756**	**12722**	**19392**	**23902**
Total Predicted HHU	**909**	**2172**	**4801**	**7318**	**9020**

Figure 4 Population forecast, July 2018

It should be noted that the numbers in the figure above includes Mercer and Meremere and the population projections have assumed 2.65 people per dwelling. If Mercer and Meremere are excluded then the predicted 2034 population (at 2.65 people per dwelling) is in the order of 16,483 people, an increase of approximately 11,000 people from 2018.

The 2018 analysis also identified the following items with regard to industrial growth in Pokeno:

- Yashili. Stage 1 is complete and has been operational since 2015. This is one of the wet industries. An adjacent site remains undeveloped however this is planned to be in production by 2022.
- Synlait. Stage 1 is due to commence production by May 2019. Based on early discussions, this could ramp up every year and be at full production by 2023 although GHD expect production increase to be at a slower rate.
- Winstone Nutritional Dairy Factory has secured land although the operational start date is yet to be confirmed.

Water demand for the industrial sites was not detailed in this document.

3. Model calibration outcomes

A targeted calibration was undertaken, with the aim of updating network connectivity, base demands and confirming network pressures. A detailed flow assessment was not included in the scope for the calibration. Calibration day selected was Thursday 31 January 2019, with a total daily demand of 1038 m^3. The model is structured to commence at the Hitchen Road reservoir – the supply from WSL and the BSP was not included in the model calibration.

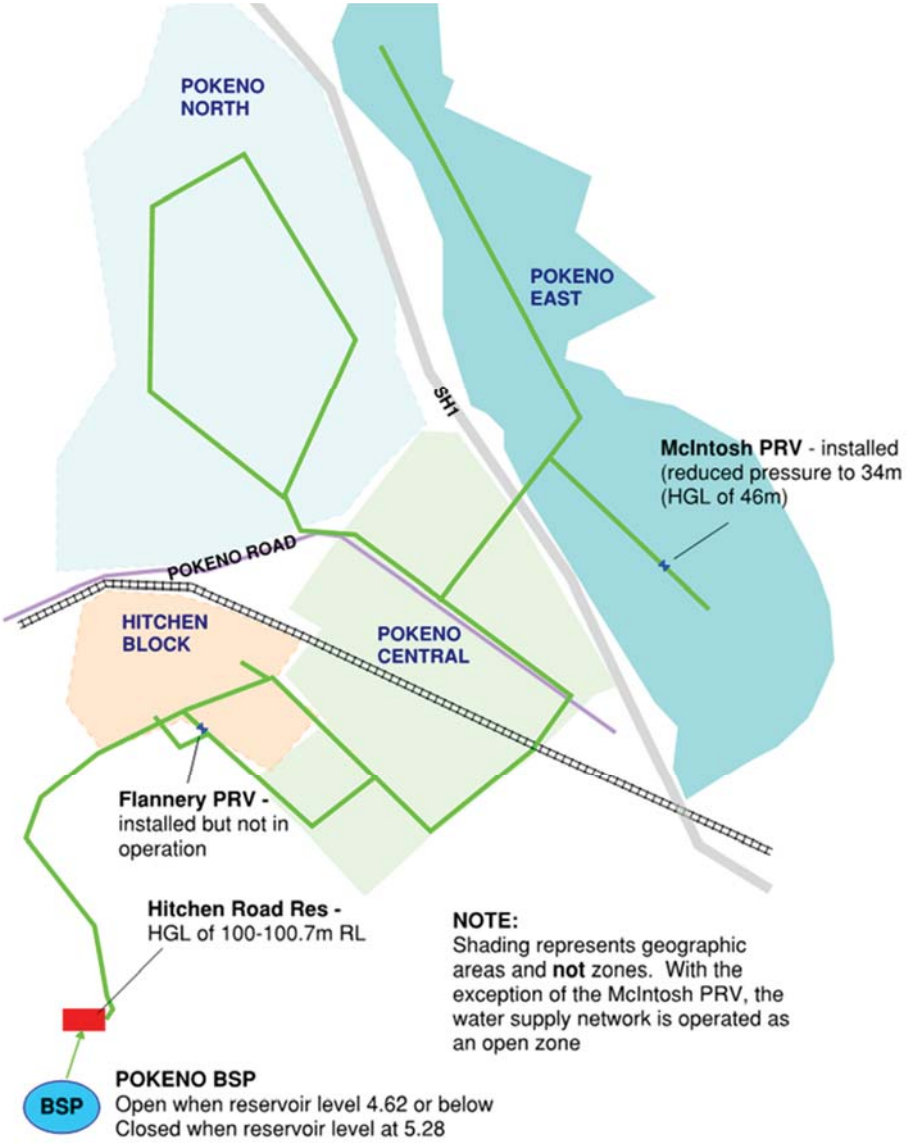


Figure 5 Pokeno – calibration day network schematic

Overall, a good calibration was achieved at 20 of the 23 logged pressure sites with 3 sites requiring further investigation.

The anomaly investigation carried out by GHD and WDC confirmed missing connectivity to the bulk main at Market Road and highlighted that there was a large customer demand that commenced at the start of the field testing. As a result, a large metered customer (LMC) demand point was created for the Hynds factory and base demands reallocated to account for this redistribution. The WDC field investigations also identified a number of partially closed valves that were replicated in the calibrated model.

Some anomalous results were identified that were not resolved as a consequence of some additional field investigations undertaken by WDC. The anomalies remain within the masterplanning model (see next section for further discussion of working model set up).

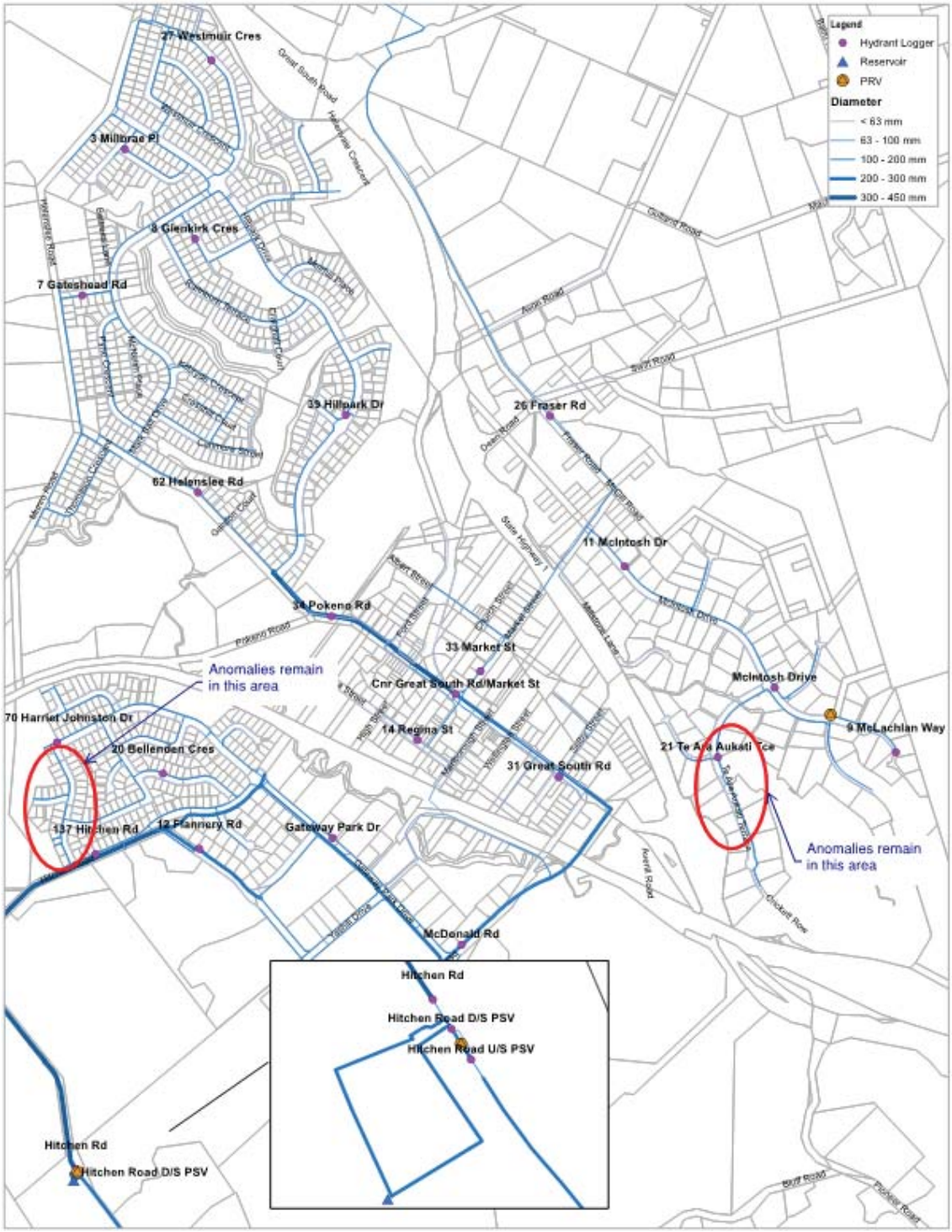


Figure 6 Location of model anomalies

The fire flow results within the calibration were not conclusive and field testing results indicate that measured fire flow is greater than the modelled fire flow capacity. Modelled fire flow capacity may be conservative. This may be a consequence of the hydrant flow tests not being run sufficiently long enough during the field testing to generate the same scale of headloss, or it may be reflecting greater connectivity in the network than currently modelled. Any deficiencies identified in the fire flow analysis carried out in the masterplanning will need to be considered carefully and may need to be revised when the model is next fully calibrated. This may also impact on PRV settings for creation of future pressure zones

4. Model development

4.1 Working model

The scope of this model update was to develop a peak day network model. Review of the data provided indicated that flows in Pokeno have been steadily increasing over time – calibration day was the highest demand at the time of developing the working model scenario so base demands from the calibration model were carried over and then specific areas of 2019 growth applied (refer Table 1). The following changes were made to develop the current peak day model:

- The residential demand pattern was smoothed from that used during calibration and controls on the reservoir were also released - reservoir levels vary naturally depending on network demand.
- Valves that were noted to be partially closed during the site investigations by WDC were opened for the working model.
- Committed works and new pipes since calibration for Pokeno were included in the model. The key pipe change to note is the Hitchen Road extension where the bulk main is extended and, as agreed with Council, has been assumed to connect into the bulk main on Pokeno Road, close to the intersection with Helenslee Road.

4.2 Development of growth scenarios

The following scenarios have been considered:

- 2019 current peak day. This includes committed projects and developments that are expected to be connected in the near future (as mentioned in the previous section).
- 2025 short-term, peak day
- 2035 medium-term, peak day
- 2045 medium/long-term

Growth areas are shown on the following page and summarised in Table 1. These areas and references were based upon development numbers used in earlier GHD work (refer Section 2.4) but updated to accommodate recent planning and development updates by WDC. As with all growth planning, this represents a snapshot of current expectations but this may change over time depending on market pressures and commercial/development drivers.

As mentioned earlier, Pokeno is expecting significant growth. The bulk of the forecast growth is larger infill blocks within the current developed areas (i.e. areas A2-B5 shown in Figure 7) or in newer greenfield areas. No general infill has been used in this model at this time (although there is some specific infill areas within the Helenslee area that have been included). It is expected that individual lot subdivision will be relatively small across Pokeno in comparison to the overall growth in larger blocks of land.

As the future growth models are created based on peak days (and not average day) then a peak day factor of 1.5 has been applied to average day demand from residential growth areas to establish the base node demand. This is consistent with Watercare guidelines for large populations (greater than 10,000 people) and is appropriate for sizing of large trunk infrastructure. An example of how this is applied is shown below:

- Average day, average demand is 250 L/person/day.
- Peak day, average demand will be 250*1.5 = 375 L/person/day – this is the basis for the residential growth base demands placed in the masterplan model scenarios.
- Peak day, peak demand is calculated in the model based on the diurnal profile.

In addition, population per dwelling has been set at 3 persons per dwelling for new growth areas. This is slightly higher than the 2.65 used in previous work (refer Section 2.4) but is consistent with Watercare standards.

The growth has also been categorised by the geographic area of town:

- E = area to the east of SH1
- S = area south of the North Island Main Trunk railway line (NIMT)
- NW = area between SH1 and NIMT

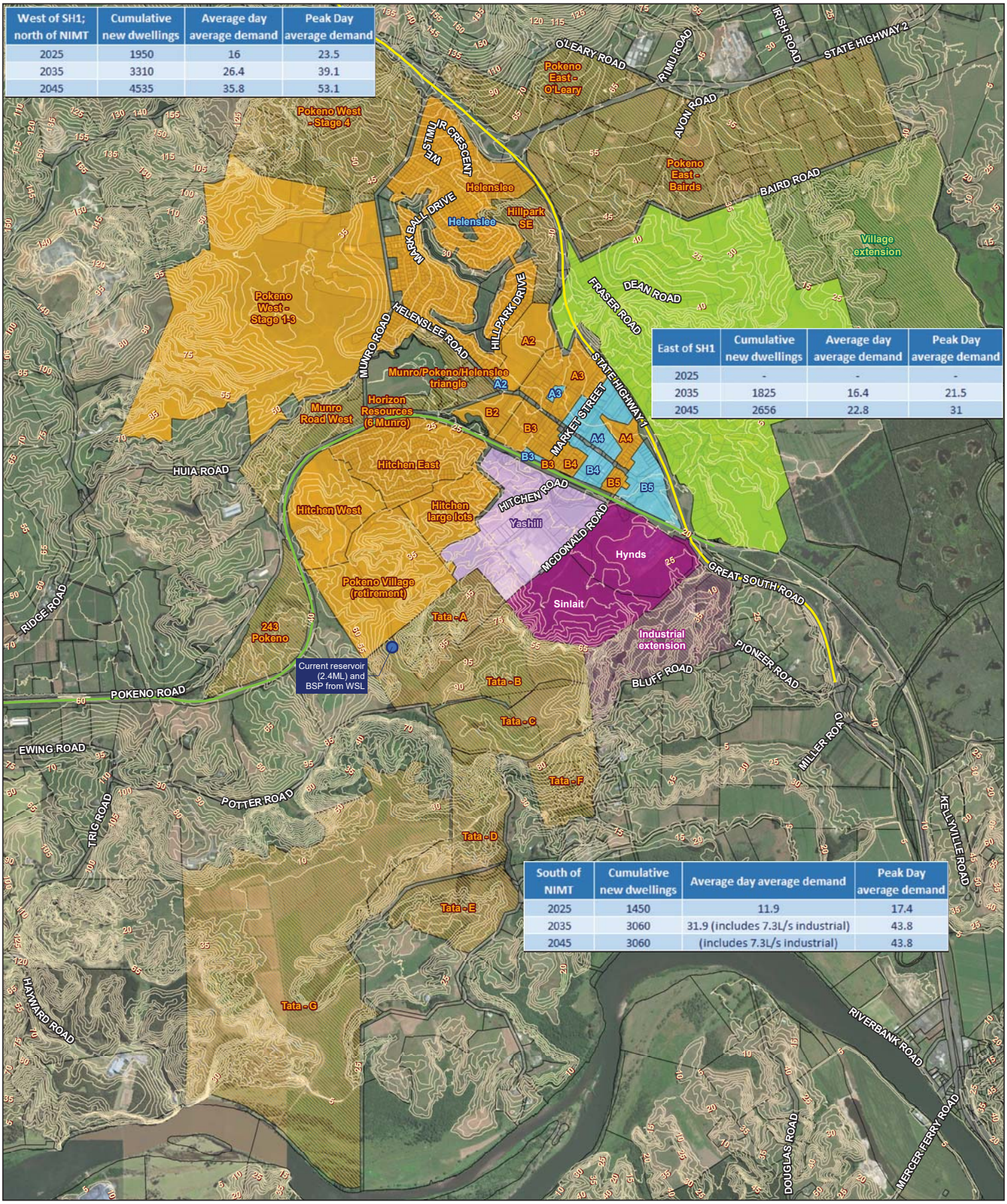
This is summarised in Tables 2, 3 and 4. It is worth noting the timing and relative distribution of the growth, as this influences prioritisation of works to support growth.

Tata refers to the “Tata Valley and Havelock Village development”, located to the south west of Pokeno.

West of SH1; north of NIMT	Cumulative new dwellings	Average day average demand	Peak Day average demand
2025	1950	16	23.5
2035	3310	26.4	39.1
2045	4535	35.8	53.1

East of SH1	Cumulative new dwellings	Average day average demand	Peak Day average demand
2025	-	-	-
2035	1825	16.4	21.5
2045	2656	22.8	31

South of NIMT	Cumulative new dwellings	Average day average demand	Peak Day average demand
2025	1450	11.9	17.4
2035	3060	31.9 (includes 7.3L/s industrial)	43.8
2045	3060	(includes 7.3L/s industrial)	43.8



LEGEND

- Property boundary
- State Highway 1 (SH1)
- NIMT
- Contours (5m)
- Current reservoir

District Plan Zones

- Business, Operative
- Heavy Industrial, Operative
- Heavy Industrial, Proposed
- Industrial, Operative
- Residential, Operative
- Residential, Proposed
- Village, Operative
- Village, Proposed

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

Waikato District Council
Pokeno Water Model Update

Job Number 12503348
Revision A
Date 13 Feb 2020

Growth Area Overview

Figure 7

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\12503348_Z002_Pokeno_GrowthAreaOverview.mxd

GHD Centre, Level 3, 27 Napier Street Freemans Bay Auckland 1011 New Zealand T 64 9 307 7373 F 64 9307 7300 E akmail@ghd.com W www.ghd.com

Data source: Aerial imagery - esri 2019 (Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - LINZ 2018; District Plan Zoning and utilities - WDC; Contours - WRC LiDAR 2010/2011. Created by:jrprice

Table 1 Summary of timing and scale of future growth

Future growth areas	Growth sector	2019			2025			2035			2045		
		cumulative new dwelling	average day average demand (L/s)	peak day, average demand (L/s)	cumulative new dwelling	average day average demand (L/s)	peak day, average demand (L/s)	cumulative new dwelling	average day average demand (L/s)	peak day, average demand (L/s)	cumulative new dwelling	average day average demand (L/s)	peak day, average demand (L/s)
Helenslee	NW	767	5.86	5.94	770	5.88	8.82	770	5.88	8.82	770	5.88	8.82
A2	NW	30	0.23	0.34	102	0.78	1.17	102	0.78	1.17	102	0.78	1.17
A3	NW	0	0.00	0.00	50	0.38	0.57	50	0.38	0.57	50	0.38	0.57
A4	NW	0	0.00	0.00	0	0.46	0.46	0	0.46	0.46	0	0.46	0.46
Munro/Pokeno/Helenslee triangle	NW	5	0.04	0.05	15	0.11	0.17	50	0.38	0.57	134	1.02	1.54
B3	NW	20	0.15	0.05	20	0.15	0.23	119	0.91	1.36	119	0.91	1.36
B5	NW	0	0.00	0.00	0	0.42	0.42	0	0.42	0.42	0	0.42	0.42
B4	NW	0	0.00	0.00	0	0.20	0.20	0	0.20	0.20	0	0.20	0.20
Pokeno Village (retirement)	S	0	0.00	0.00	98	0.75	1.12	98	0.75	1.12	98	0.75	1.12
Pokeno East - Deans	E	0	0.00	0.00	0	0.00	0.00	500	3.82	3.82	500	3.82	3.82
Pokeno West - Stage 1-3	NW	0	0.00	0.00	550	4.20	6.30	900	6.88	10.31	1150	8.78	13.18
A4	NW	0	0.00	0.00	22	0.17	0.25	102	0.78	1.17	102	0.78	1.17
B3	NW	0	0.00	0.00	0	0.03	0.03	0	0.03	0.03	0	0.03	0.03
Pokeno East - Bairds	E	0	0.00	0.00	0	0.00	0.00	1243	9.50	14.24	1375	10.50	15.76
Pokeno West - Stage 4	NW	0	0.00	0.00	0	0.00	0.00	400	3.06	4.58	800	6.11	9.17
Pokeno East - O'Leary	E	0	0.00	0.00	0	0.00	0.00	80	0.61	0.92	781	5.97	8.95
Tata - A	S	0	0.00	0.00	27	0.21	0.31	27	0.21	0.31	27	0.21	0.31
Tata - B	S	0	0.00	0.00	310	2.37	3.55	310	2.37	3.55	310	2.37	3.55
Tata - C	S	0	0.00	0.00	147	1.12	1.68	294	2.25	3.37	294	2.25	3.37
Tata - D	S	0	0.00	0.00	0	0.00	0.00	123	0.94	1.41	123	0.94	1.41
Tata - E	S	0	0.00	0.00	0	0.00	0.00	147	1.12	1.68	147	1.12	1.68

Future growth areas	Growth sector	2019			2025			2035			2045		
Tata - F	S	0	0.00	0.00	25	0.19	0.29	294	2.25	3.37	294	2.25	3.37
Tata - G	S	0	0.00	0.00	491	3.75	5.63	1412	10.79	16.18	1412	10.79	16.18
Helenslee	NW	0	0.00	0.00	0	0.01	0.01	0	0.01	0.01	0	0.01	0.01
Pokeno Heights	NW	40	0.31	0.45	40	0.31	0.46	40	0.31	0.46	40	0.31	0.46
Hitchen East	S	297	2.27	3.40	297	2.27	3.40	297	2.27	3.40	297	2.27	3.40
Hitchen large lots	S	0	0.00	0.00	0	0.00	0.00	0	0.41	0.61	0	0.41	0.61
Hitchen West	S	3	0.02	0.03	55	0.42	0.63	55	0.42	0.63	55	0.42	0.63
Hynds	S	0	0.79	0.79	0	0.79	0.79	0	0.79	0.79	0	0.79	0.79
Industrial extension	S	0	0.00	0.00	0	0.00	0.00	0	7.33	7.33	0	7.33	7.33
A3	NW	0	0.00	0.00	0	0.03	0.03	0	0.03	0.03	0	0.03	0.03
Munro Road West	NW	0	0.00	0.00	0	0.00	0.00	130	0.99	1.49	410	3.13	4.70
B2	NW	134	1.02	1.54	134	1.02	1.54	149	1.14	1.71	149	1.14	1.71
243 Pokeno	NW	0	0.00	0.00	50	0.38	0.57	100	0.76	1.15	200	1.53	2.29
Horizon Resources (6 Munro)	NW	0	0.00	0.00	32	0.24	0.37	32	0.24	0.37	32	0.24	0.37
B4	NW	0	0.00	0.00	34	0.26	0.39	34	0.26	0.39	34	0.26	0.39
B5	NW	0	0.00	0.00	30	0.23	0.34	32	0.24	0.37	32	0.24	0.37
Village extension	E	0	0.00	0.00	0	0.00	0.00	0	2.50	2.50	0	2.50	2.50
Hillpark SE	NW	5	0.04	0.06	100	0.76	1.15	300	2.29	3.44	410	3.13	4.70

Table 2 East of SH1

Scenario	Cumulative new dwellings	Average day average demand L/s	Peak Day average demand L/s
2025	-	-	-
2035	1825	16.4 (~1420 m^3/d)	21.5
2045	2656	22.8 (~1970 m^3/d)	31.0

Table 3 Between SH1 and NIMT

Scenario	Cumulative new dwellings	Average day average demand L/s	Peak Day average demand L/s
2025	1950	16.0 (~1387 m^3/d)	23.5
2035	3310	26.4 (~2285 m^3/d)	39.1
2045	4535	35.8 (~3092 m^3/d)	53.1

Table 4 South of NIMT

Scenario	Cumulative new dwellings	Average day average demand L/s	Peak Day average demand L/s
2025	1450	11.9 (~1025 m^3/d)	17.4
2035	3060	31.9 including 7.3L/s industrial (~2755 m^3/d)	43.8
2045	3060	31.9 including 7.3L/s industrial (~2755 m^3/d)	43.8

The above tables show that development to the east of SH1 is expected to occur slower and with lower flows that the other areas. Growth numbers to the south are heavily influenced by the timing and scale of the Tata development areas and the industrial land. While some of the Tata development land is expected to be relatively straightforward to build upon, other areas (closer to the current reservoir and existing reticulation) are expected to be more difficult to develop and this will impact on actual timing of growth. Growth between SH1 and the NIMT is most likely in the short-medium term. It is understood that resource consent has recently been granted for part of the Tata development although details of this are not known and it is unclear whether they have contacted WSL in regard to the supply of water to their development.

It is worth noting that the BSP and storage for Pokeno are both located in the southwest. The current network has reservoir storage of 2400 m^3 – additional storage will need to be considered in conjunction with future growth. In terms of general connectivity, there are currently two pipes in service to convey flow across the NIMT and there is only a 150mm providing flow to the east of SH1.

4.2.1 Industrial

There is a future industrial expansion area that has been identified east of the current industrial area. The contours in this area are steep and it is likely that significant earthworks would be likely to support large-format industrial development in that area. The timing of the industrial development has not been confirmed so has been placed into the 2045 scenario with a demand of 7.3 L/s peak day average demand, assuming 0.2 L/s/Ha based on Watercare guidelines.

5. System performance – no upgrades

5.1 Level of service criteria

The following LoS criteria have been considered

- Pressures between 25 and 80 m
- Velocities not greater than 2 m/s
- FW2 fire capacity (25 L/s from two hydrants)

5.2 Current system performance

Overall, the current system is operating well, with typically good network capacity and available. Refer to Appendix A for system performance figures with no upgrades. The current key issues are:

- Low pressures in 2019 to the north of Helenslee area (refer Figure 8). This is a high elevation area in the network with elevations in the order of 65-90m compared with the majority of current development located between 25-55 . Headloss and velocities are not excessive in the area.
- High pressures in 2019 on the eastern extent of McIntosh Drive and in part of Te Ara Aukati Terrace. These are in a low-lying network spur, outside of the current PRV in that area.

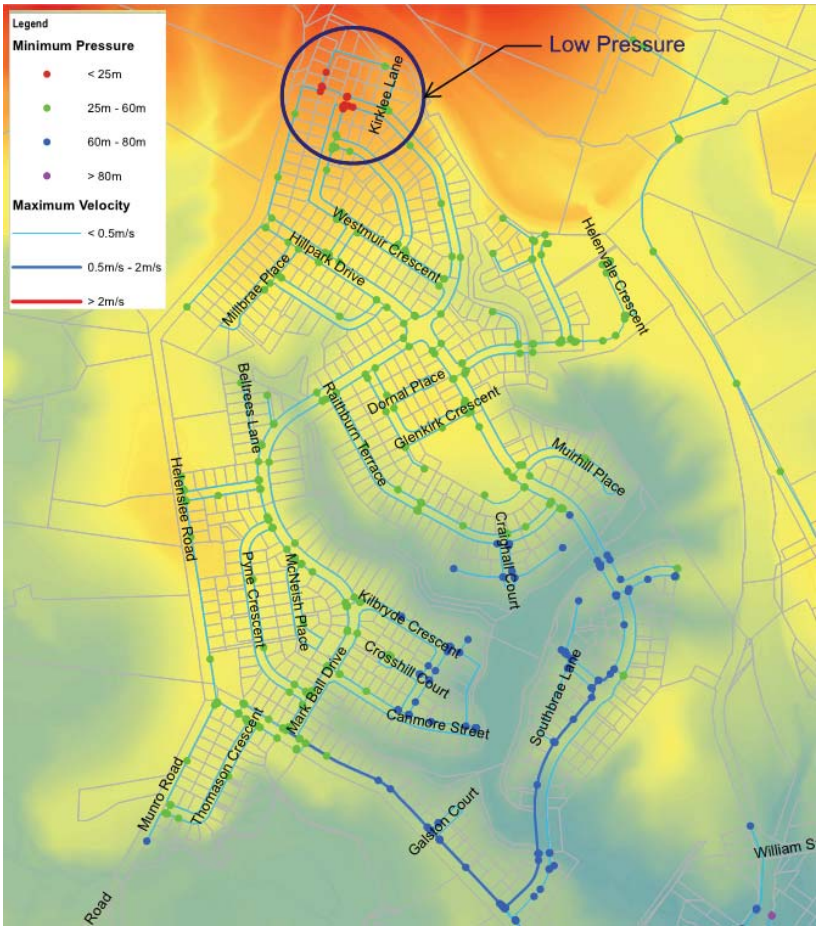


Figure 8 2019 low pressure at north Helenslee area

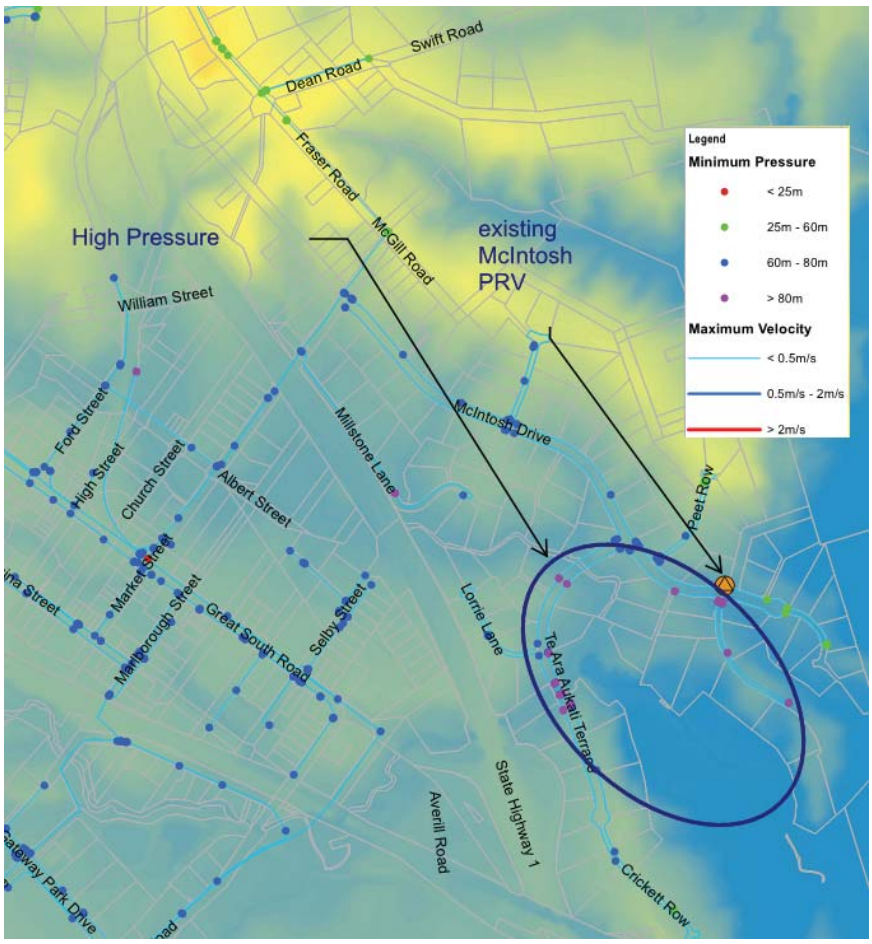


Figure 9 2019 localised high pressure area south of McIntosh PRV

Fire flow capacity of FW2 has been considered by applying 25L/s across nodes within the network (as the original model did not distinguish hydrants within the node dataset). Fire flow compliance at 25L/s from a single hydrant is marginal for some areas, particularly to the north (note that there are no hydrants installed around Kirklee Lane) and to the east (Te Ara Aukati Terrace and McIntosh Drive). While some improvement could be achieved in the results by considering two hydrants running at 12.5 L.s, as the calibrated model predicts less fire flow capacity than what was measured during field testing then further investigation into fire flow capacity is required before implementing network changes to improve fire flow capacity.

There is currently a lack of monitoring data to provide WDC with information on industrial demands – particularly instantaneous demands. While the industrial area does have access to the Dines/Fulton Hogan bore (subject to private agreements), there have been high demands placed on the network to accommodate immediate requirements from industrial customers that will impact on WDC's ability to manage pressures and flows. For example, it is considered likely that Hynds have placed high instantaneous demands on the network as part of their initial batching system requirements. We also understand that Hynds' long terms plans are to extract water from the DFH bore on McDonald Road. Synlait placed a high demand on the network when they filled their 2500 m^3 on site reservoir. It is understood that there is no agreement or guidance on how much the industrial users can take as an instantaneous demand from the WDC network (which causes unnecessary stress on the network). Similarly, it is not known how these industrial customers manage fire requirements.

5.3 Future System Performance

Without upgrades and with future growth areas applied to the existing model then the area of low pressure around Helenslee Road increases and extends further south due to increased headlosses within the network. The results from 2025 growth with no upgrades are shown in Figure 10 on the following page. Network pressures drop due to increased headlosses from increased flow through the network and as more growth is applied then the situation deteriorates.

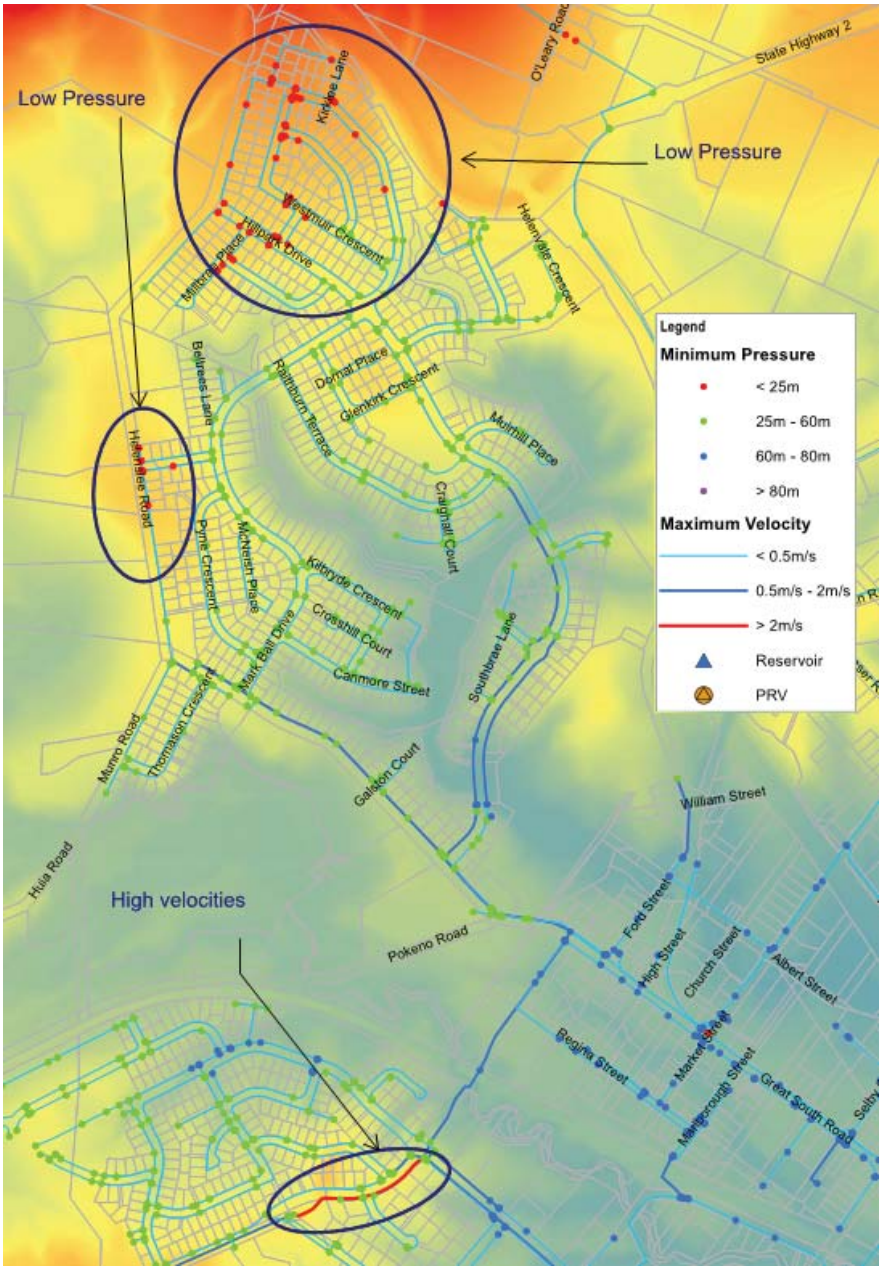


Figure 10 2025 low pressure and high velocity

The high velocity area shown above is a section where the pipe diameter reduces from DN355 PE pipe to a 250 mm PVC pipe. It is also impacted by the current connectivity of the Flannery PRV which is effectively limiting the ability for flow to travel east along Flannery Road from Hitchen Road, and results in more flow continuing through the 250 mm dia PVC pipe

As network demands increase (2035 and beyond) it becomes difficult to maintain the reservoir levels in the existing reservoir and velocities and headlosses through the existing network increase – resulting in network-wide level of service issues.

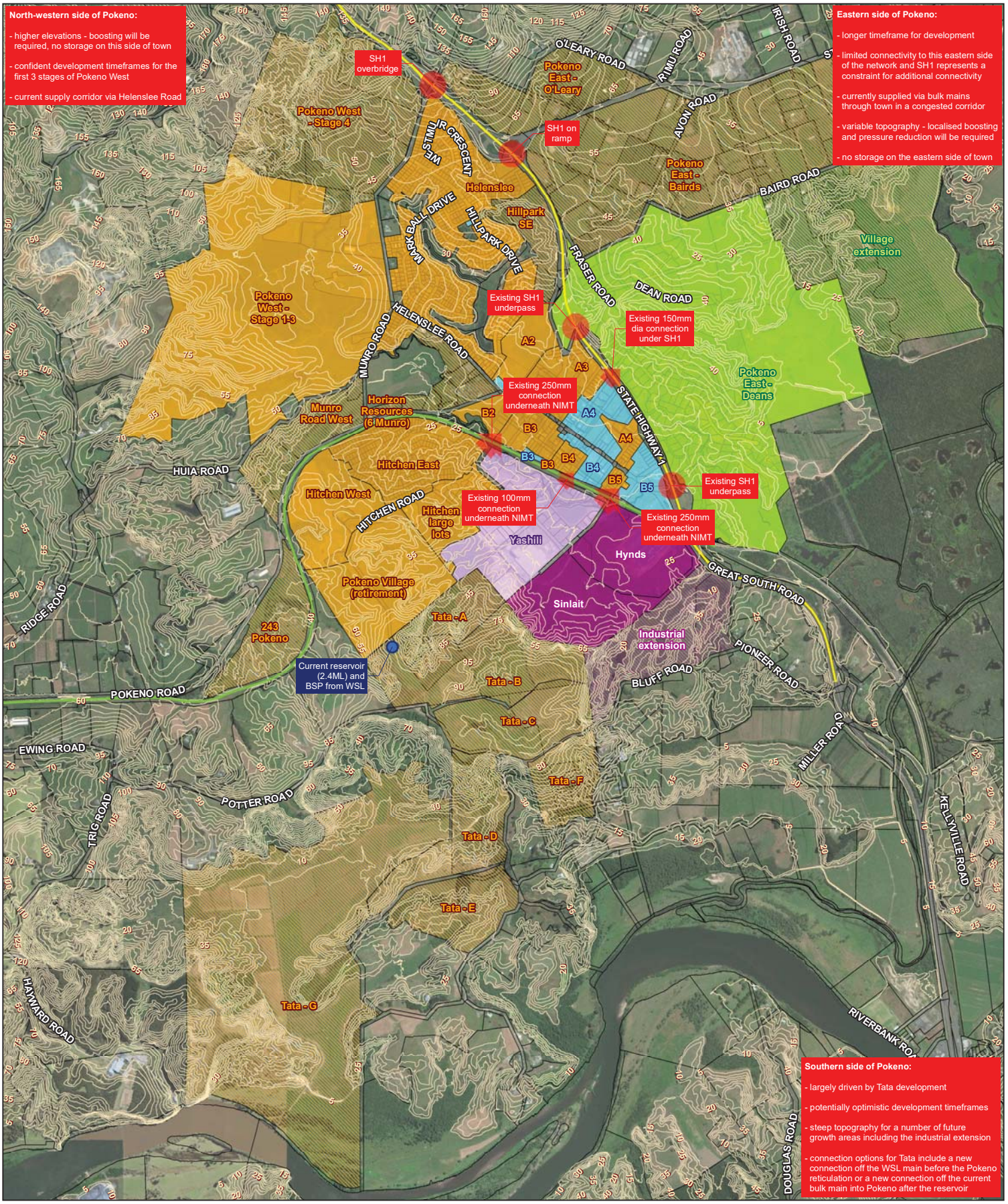
5.4 Summary of areas for network improvement

Overall, the current Pokeno system is working well with the key issues relating to low pressures in a (high elevation) area to the north and issues with the current PRVs – the Flannery PRV is not in service and the McIntosh PRV zone may need to be extended. In future, key mains capacity will need to be provided as growth progresses. Refer to Figure 11 on the following page.

Considering the findings of the model calibration, ongoing communications with WDC with regard to current industrial demands, review of the modelling and background reporting, the following key areas have been noted for improving the Pokeno water system:

- Low pressures to the north of town - to be considered in conjunction with future growth.
- Flow meters to be installed with all PRVs.
- High pressures in areas outside of the McIntosh PRV.
- Issues with the Flannery Road PRV to be resolved and Hitchen 80 m HGL zone to be established
- No fire flow classification for Pokeno and some further investigations required into fire flow capacity within the network to improve the match between modelled capacity and observed fire capacity. This impacts on how pressure reduction can be applied for the town centre as well as the industrial zones where a higher fire flow classification may be required.
- Opportunities for some pressure reduction through the centre of town – 60 m HGL zone to be considered.
- Supply of the industrial area with a *minimum* of 60 m pressure (80 m HGL) – this impacts how pressure reduction is applied.
- No control or monitoring of instantaneous demands from industrial customers – this impacts how pressure reduction is applied.
- Limited crossings at present with regard to key infrastructure corridors (ie SH1 and NIMT).
- New trunk infrastructure will need to be provided to accommodate future growth including consideration of pump stations and additional reservoir storage.

As a general comment, provision of key water mains need to be considered in conjunction with provision of sewer mains also, to manage disruption to locals and also to achieve some efficiencies in construction.



LEGEND

- Property boundary
- State Highway 1 (SH1)
- NIMT
- Contours (5m)
- Current reservoir

District Plan Zones

- Business, Operative
- Heavy Industrial, Operative
- Heavy Industrial, Proposed
- Industrial, Operative
- Residential, Operative
- Residential, Proposed
- Village, Operative
- Village, Proposed

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

Waikato District Council
Pokeno Water Model Update

Job Number 12503348
Revision A
Date 13 Feb 2020

Growth Issues

Figure 11

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\12503348_Z003_Pokeno_GrowthIssues.mxd

Data source: Aerial imagery - esri 2019 (Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - LINZ 2018; District Plan Zoning and utilities - WDC; Contours - WRC LiDAR 2010/2011. Created by:jrprice

GHD Centre, Level 3, 27 Napier Street Freemans Bay Auckland 1011 New Zealand T 64 9 307 7373 F 64 9307 7300 E aklmail@ghd.com W www.ghd.com

6. System performance with upgrades

The overall approach for the future network improvements is to allow for development of **'trunk' mains within Pokeno at full pressure**, with specific connections to the local network and PRVs to develop reduced pressure zones. As development planning and earthworks progress over time, pressure zone boundaries and settings may need to be adjusted to match finished contours, road layouts and proposed staging.

6.1 Current (2019) network improvements

The proposed improvements for 2019 are largely around resolving some of the existing PRV issues and setting up future PRVs to support future pressure reduction in the central zone (expected in 2025).

Table 5 Proposed improvements to current network

Upgrade name and objective	Description of works and key components	Order of cost for physical works*	Construction / implementation considerations	Other considerations
Flannery PRV/Hitchen reduced zone – 80 mHGL • To place the existing PRV into service • To create the Hitchen 80 mHGL zone	Engineering assessment of current PRV physical arrangement will need to be completed as it is understood to be deep compared to current ground levels. This assessment to consider ability to safely maintain and operate/adjust the PRV in this location. An alternative location or modifications may be required. Valve 23958, 15429, and 23456 to be closed to form the zone. The connection on Hitchen Road will need to be completed.	Not costed	Separate investigation required. The anomaly at Peter Borne Drive should also be investigated further before progressing physical works. Confirmation of ground levels will be beneficial for confirming PRV setting – likely to be somewhere between 80-85m HGL. Logging within zone to be carried out to confirm PRV setting. Logger to be placed at Peter Bourne Drive and at Gibboney Place. Final valves and settings to be confirmed once PRV assessment completed.	Modelled fire flow capacity to be reviewed in conjunction with additional hydrant testing completed to confirm capacity.
	A flow meter to be provided with the PRV to allow for future logging of flows into the pressure reduced zone.	$10K		
Central reduced pressure zone • To reduce the pressure through town	This will require new PRVs and flow meters to be established 2 PRVs at Market Road intersection	$70K	The following items to be considered prior to reducing pressures in the centre of town: • Fire flow targets/objectives for the commercial centre of town. • Ability to supply the eastern side of town	PRVs may not need to be implemented immediately but flow meters would be beneficial to install now. With the pressure management proposed, it would be good to benchmark current performance in regards to non-revenue water. This will allow for future assessment of benefits including pipe breaks (savings). While flowmeters can be buried considering WSL guidelines, their location will also need to take into account the future chamber location and size requirements for the PRVs as well as safe on-going maintenance and access requirements.
McIntosh Drive PRV • To extend the pressure reduced zone to reduce high pressures	Move the current PRV location to a new location at 3/4 McIntosh Drive. A flow meter to be provided with the PRV to allow for future logging of flows into the reduced zone.	$30K	Anomaly at Te Ara Aukati Drive to be investigated before progressing physical works. This option needs to be considered in conjunction with central zone pressure reduction as McIntosh Drive is supplied via a local reticulation from the central zone.	PRV and chamber as per WSL guidelines. Modelled fire flow capacity to be reviewed in conjunction with additional hydrant testing completed to confirm capacity.

Upgrade name and objective	Description of works and key components	Order of cost for physical works*	Construction / implementation considerations	Other considerations
Flow monitoring	A programme of pressure and flow logging of industrial customers is recommended. Pressure can be logged at hydrants on the local reticulation – for example opposite 45 McDonald Road or from 44 McDonald Road. The objective will be to get a better picture of current instantaneous demands. Logging of the flow leaving the Hitchen Road reservoir should also be undertaken for the same timeframe and timesteps (note that this will require a smaller timeframe than the reservoir flowmeter is currently recording).	Not costed		Further discussions to be held with industrial customers to provide a better understanding of their operational requirements and how this might impact the local reticulation.
	A flow meter on the 150 mm dia pipe on Market Road is recommended to monitor demands on the eastern side of town. It is proposed that this be carried out in advance of pressure reduction in the central part of town as this improve understanding of flows to the village.	10K	The location ideally will be on the eastern side of SH1, potentially immediately south of Millstone Road.	

*Please note that extra allowances will need to be added for projects including investigations and design, services and geotech, consenting costs, traffic management, contractors margins etc. The costs identified above should not be used for setting project budgets.

Refer to Appendix B for future system performance after upgrades have been applied.

6.2 2025 network improvements – Peak day 3765m³/d

6.2.1 Proposed upgrades

The main objectives of these improvements are to:

- Strengthen northern end of bulk main 'spine' through town towards Helenslee to support growth in the north-west, particularly Pokeno West growth
- Local boosting of the northern end of Helenslee
- Provide for a new connection underneath NIMT to support short-term growth around Pokeno / Munro Road
- Provide for options for servicing Tata developments

Refer to Appendix B for system performance with proposed upgrades.

Table 6 Proposed improvements for 2025 growth

Upgrade name and objective	Description of works and key components	Order of cost for physical works*	Construction / implementation considerations	Other considerations/triggers
Helenslee Extension • To support growth forecast in Pokeno West Stages 1-3 in 2025	Extension of current main along Helenslee Road. Helenslee Road Extension – from intersections with Pokeno Road to Munro ~670 m of 250 mm dia capacity Proposed 250 mm capacity main to allow for a valved cross-connection at the intersection of Helenslee and Munro Road, and connections to the west of Helenslee Road for future connectivity of Pokeno West.	$500-800K	Costs will depend on construction methodology and whether works can be installed as part of broader development works.	Pokeno West Stages 1-3
Helenslee Booster PS- Stage 1 • To boost pressure in the current northern extent of Helenslee	Small booster PS to boost pressures as required to the northern area of Helenslee. Once Stage 4 Pokeno West is developed then a new reservoir further uphill will be required. Need to investigate the location further - there is currently no reserve land that would be suitable so land would be best obtained and managed as part of the development of Pokeno Stage 1-3 with the booster ultimately providing pressure to Stage 4 of Pokeno West as well as to the adjacent northern portion of Helenslee	$500K	To be considered in conjunction with the Helenslee Extension main. The further north the PS is placed, the greater the risk of suction-side pressure issues in future. Will need to consider power and comms to the site. Consider staging of the booster capacity over time. Site selected should have sufficient space to allow for expansion and access and maintenance requirements as well. This booster could be considered in conjunction with early delivery of storage identified for 2035 (option B for the Helenslee Extension as shown on Figure 13) but it is considered that boosting on demand should be sufficient at this time unless there is a significant procurement or consenting advantage with early delivery of the reservoir.	Current issue, impacted by Stage 1-3 growth For the proposed PS, land/easements will need to be provided, consents for the new structure, and noise and visual impacts will need to be addressed. This PS could be modified to provide pumping to higher elevation areas of Stage 1-3, depending on development extent at upper elevations. Consultation will be required. Consenting will need to consider full build out.
NIMT Crossing • To support growth forecast if 243 Pokeno Road goes ahead by 2025 • To support a future trunk corridor along Munro Road	New crossing underneath NIMT from Hitchen West/Pokeno Village. A full 300mm capacity section needs to be provided underneath the NIMT to accommodate possible future connectivity. As development in the area progresses (ie Munro West) then construction of the full Munro pipe should be considered (currently in 2035).	$140K	The main options for this area relate to whether an interim servicing connection be provided from Hitchen West or whether a new long-term connection be provided along the western boundary of Pokeno Village. Either option will require a connection to be provided underneath the NIMT with the ultimate solution requiring a connection off the bulk main on Hitchen Road. An interim connection will allow for more rapid delivery of infrastructure to the development at 243 Pokeno Road but may limit opportunities to recover costs in future for building the ultimate section of pipe along the western side. Horizontal directional drilling is typically NOT supported by KiwiRail as a construction methodology – it is likely that construction would need to consider pipe thrusting and this will require a reasonable length for set up that may influence crossing location.	Will depend on timing for the development of 243 Pokeno Road Crossing would be assessed as defined by KiwiRail guidelines. Sleeving of any crossing is likely to be required along with detailed geotechnical investigations red either side of the crossing, along with interpretive reports. Significant lead time for investigations consultation and consenting should be allowed for in planning. Some discussion should be had with WSL with regard to general requirements for a future second BSP. If a BSP has to connect into a reservoir then a second crossing underneath the NIMT may need to be considered and could be planned for at the same time.

Upgrade name and objective	Description of works and key components	Order of cost for physical works*	Construction / implementation considerations	Other considerations/triggers
			Sewer connections required underneath the NIMT should also be considered at the same time with planning for watermains.	
Tata Valley and Havelock Village Development - High Elevation • To support growth forecast for the Tata development areas	In the short-term, a high level of growth is forecast for Tata. There is a mixture of high elevation areas adjacent to the reservoir and lower-lying land further to the south west. A new connection upstream of the BSP (which has a higher HGL~140m) is proposed. Any new connection from the WSL main up gradient of the existing BSP will need to be negotiated with WSL. As the Pokeno model starts at the BSP then an assessment of the impact on the WSL main has not been carried out. It has been assumed that 970 m of 250 mm dia capacity dia pipe will be used with a connection from the current bulk main into Pokeno	$0.8-1.2M (trunk pipework only)	The site gradients for Tata A and B may influence the timing and development yields for these areas.	Tata A, B, C
Tata Valley and Havelock Village Development - Low Elevation • To support growth forecast for the Tata development areas	The low elevation areas will need to be pressure reduced – an indicative HGL of 70-80 m can be considered, although this will depend on how far the development will extend up the valley sides. As the Pokeno model starts at the BSP then an assessment of the impact on the WSL main has not been carried out.	$1.7-2.6M	Construction and implementation will depend on developer timeframes. There is some capacity that could be used from the existing network if a short-term connection is required in advance of any new connection to the WSL line.	Tata D-G

Refer to Appendix B for future system performance after upgrades have been applied. *Please note that extra allowances will need to be added for projects including investigations and design, services and geotech, consenting costs, traffic management, contractors margins etc. These costs should not be used for setting project budgets.

6.3 2035 network improvements – Peak day 6955 m³/d

By 2035, there is significant growth forecast to be either completed or underway – this mid-scenario considers the bulk for forecastf Pokeno growth. As a result, the focus needs to be on managing peak flows through the current bulk infrastructure, providing additional bulk connectivity and targeting upgrades to tie into development areas. In particular, the main objectives of these improvements are to:

- Provide for a dual feed to the north/northeast via the Munro pipeline on the north-west side of town, with potential cross-connectivity provided to Helenslee main as well as connectivity to the east across SH1.
- Provide for increased connectivity through the industrial area to the existing reservoirs (in conjunction with delivery of future wastewater in a similar corridor). This also supports potential connectivity to the eastern side of the network – with additional pipe capacity managing loads on the existing infrastructure.
- Provide for additional reservoir storage – both at the current reservoir site (where there is an existing platform) and to the north.

Table 7 Proposed improvements for 2035 growth

Upgrade name and objective	Description of works and key components	Order of cost for physical works*	Construction / implementation considerations	Other considerations/triggers
Helenslee Extension • To support growth forecast in Pokeno West Stage 4 in 2025	Continued extension of main along Helenslee Road to the north from intersections with Munro Road to the northern end of Hillspark Drive ~950 m of 250 mm dia capacity Proposed 250 mm capacity main to allow for a valved cross-connection at the intersection of Helenslee and Munro Road, and connections to the west of Helenslee Road for future connectivity of Pokeno West. Helenslee Road Extension – Pokeno to Hillspark North:	$0.8M-1.1M	Costs will depend on construction methodology and whether works can be installed as part of broader development works.	Pokeno West Stages 1-3
Northern Reservoir • To buffer peak demands on existing infrastructure • To distribute storage within Pokeno	A new reservoir to supply Pokeno West Stage 4 and the extended northern Helenslee zone (~120mHGL). The final location (and resulting HGL) will need to be confirmed once a suitable site has been identified.	$3 M	The reservoir needs to be supplied from the new Helenslee Booster. Possible locations for the reservoir are located near NZTA land at the northern extent of Pokeno West Stage 4. Investigation of possible sites and geotechnical requirements will need to be investigated early.	Consenting/designation of land. Consultation with landowners and interactions with NZTA land will need to be scoped out early. Will need to consider long-term operational access and any easements that may need to be obtained
Helenslee Booster PS – Stage 2 • To fill Northern reservoir based on level control.	Expansion and reconfiguration of the Stage 1 PS to allow for pumping up to the new Northern Reservoir.	$800K		
Munro Main • Cross-connectivity to Helenslee Main if required • Largely dedicated supply to the east • Location should support a new future BSP on the northwestern side of the NIMT (2045)	New 300 mm dia capacity main -~2800 m from reservoir to the intersection with Helenslee Road	$2.2-3.4M	Valves to be provided to allow for cross-connectivity with the Helenslee Main if required for operational purposes in future. The cross connection will not be used under normal operation.	
McDonald Extension Main • To provide dual connectivity to industrial land and to the north-west	This main will follow the corridor of proposed wastewater infrastructure. ~1380 m of 250 mm dia capacity pipe	$1.1-1.7M	This project assumes that there is a combined corridor available - this is important as the corridor does go across private land and negotiations with landowners will be required.	This main can also support some supply to local Tata growth.

Upgrade name and objective	Description of works and key components	Order of cost for physical works*	Construction / implementation considerations	Other considerations/triggers
			If the industrial land extension does not progress as rapidly as forecast then the timing of this main could be deferred. Without the industrial land extension however, the main will still have some benefit in providing improved supply to the north western side of town	
Hitchen Road Reservoir Stage 2 • Additional storage required alongside new growth	New 3.6 MLD reservoir located at the existing site.	$3 Million Assumes less groundworks and pipework than for a new site	Any new reservoir should allow for cross connectivity between the reservoirs and sufficient pipework and valving to allow reservoirs to be taken off line individually. A flow meter on the outlet from the new reservoir should be included as part of the works. Water age also need to be managed such that the residual level of chlorine is maintained at acceptable levels.	
Helenslee Northern Crossing - Option A for Eastern Supply • A dedicated main to pass over/under SH1 to provide a dual supply to the eastern side of the network	This option was proposed in the original masterplan and has benefits in that the main is located through the proposed on-demand residential area of Pokeno East and provides opportunities for cross-connections to the Northern reservoir as well as the Helenslee Main extension. ~1540m of 250 mm main between intersection with Munro Road to east of SH1 ~2300 m of 250 mm dia capacity main from east of SH1 to Baird Road	$7.95M	The crossing location would require the existing bridge to be used so bridge structural capacity would need to be reviewed. If this is not viable then the pipe would need to be directed underneath SH1 noting that there are a number of lanes to negotiate in the area due to the merging of SH1, SH2 and the low speed lanes.	The feasibility of these options will need to be considered further. The general scale of cost is expected to be similar and the proposed upgrade will be largely driven by the timing and proposed scale of development to the east. From a modelling perspective, either pipe option can supply to the eastern side. The modelling has confirmed the feasibility of supply but has left the final options open. As an interim option, there is the possibility of boosting the existing main along Market Road, if necessary, to suppose any localised development that may be occurring – refer Eastern Booster option discussed below. This may be a more feasible option to manage demands in the interim. Early consultation with NZTA will be required.
Helenslee Eastern Crossing - Option B for Eastern Supply • A dedicated main to pass over SH1 to provide a dual supply to the eastern side of the network	This option considers a crossing utilising the existing underpass below SH1 ~1240 m of 250 mm dia capacity main from the intersection with Munro Road to east of SH1 ~2750 m of 250 mm dia main to north of SH2	$8.20M	This crossing location will require drilling or similar underneath the current underpass location. Structural assessment will be required to confirm pipe location with regard to underpass abutments. This option will require crossing through land that is already developed so there will be additional interactions with existing services and the public. The final alignment is unlikely to go along Helenslee Road but may be aligned close to it.	
Eastern Booster PS • Required if a second connection across SH1 is not possible	Location to be confirmed – either Market Road (west of SH1) or east of SH1. There are pros and cons with each option: Market Road location - better access to power and comm's as it would be located adjacent to an existing wastewater PS and the site is expected to have sufficient space to accommodate a water PS. This location is also likely to have better suction side pressure. However, there could be some additional risk with pumping the 150 mm dia main (an assessment could need to be made on material strength of existing	$1.5M	The location of the PS will be dictated by an engineering assessment for both sites rather than hydraulics. This PS will be boosting pressure through the existing 150 mm main to the village zone which is on a restricted supply –as such, the peak flows are somewhat suppressed and the impact on the existing bulk mains through town is expected to be manageable, particularly if additional bulk main connectivity is provided.	This PS may not be required for the 2035 scenario, if another connection underneath SH1 can be provided. If a new site is selected then it will require consenting and consultation. The location of the booster PS will influence the location of PRVs and pressure reduction through town.

Upgrade name and objective	Description of works and key components	Order of cost for physical works*	Construction / implementation considerations	Other considerations/triggers
	main). Would also be boosting pressures to then locally reduce for part of the network on the eastern side (Te Awa Aukati and McIntosh Drive). The Market Road site will require some rezoning to isolate the 150 mm main – the Albert Street connection would need to be closed. The flood risk at the Market Road site would need to be assessed as this might impact on the viability of this site. (refer Figure 12 below) Eastern location – new power and comms would be required. New site would need to be procured.		If WDC decide to transition this part of the network to an on-demand network then peak flows will be higher. If additional bulk main connectivity and capacity is *not* available then some form of storage may need to be considered on the eastern side of the network (not modelled) to allow pumped flows through the existing network to be smoothed out, or allow for a connection to the village zone from the on-demand supply via Pokeno East - Bairds and Deans. In the short to medium term, it is recommended that the village areas remain on a restricted supply.	

*Please note that extra allowances will need to be added for projects including investigations and design, services and geotech, consenting costs, traffic management, contractors margins etc. These costs should not be used for setting project budgets.

Figure 12 Possible PS locations for the Eastern Booster (if required)

Refer to Appendix B for future system performance after upgrades have been applied.

6.4 2045 network improvements – peak day 11,300m³/d

By 2045, there is still significant growth occurring in all areas. The main issue is that the capacity of the WSL bulk main supplying Pokeno could be at capacity, reservoirs may struggle to maintain water levels on peak days and an alternative supply will be required. If a new supply is to be provided then there would be benefits in a separated corridor from the existing route but any new BSP supply is likely to still be from the western side of Pokeno. There is the possibility to connecting any new supply into the Munro Raid main.

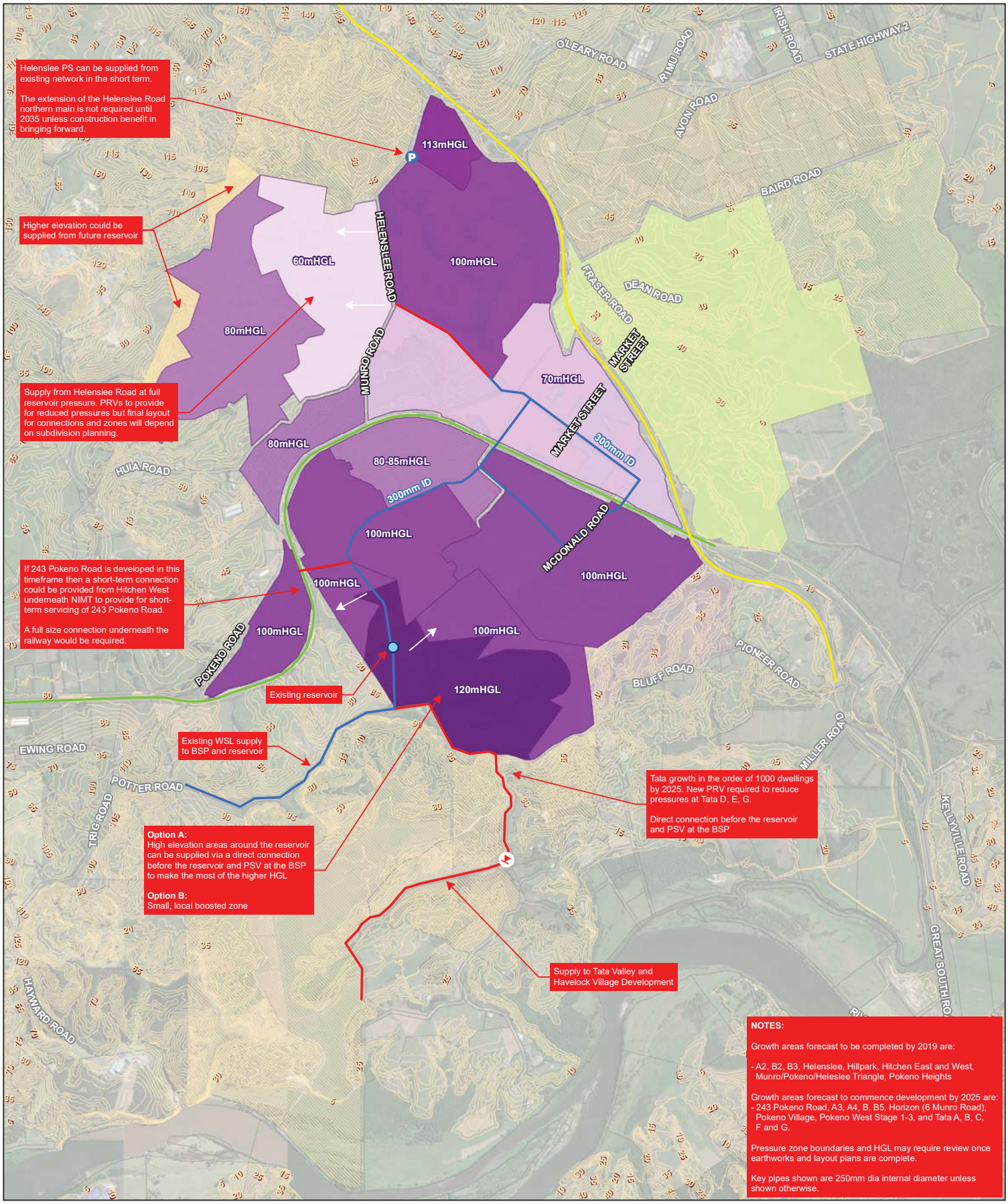
An alternative to a new supply pipeline and BSP would be to boost pump the existing WSL main during peak demand periods – this could be located on Ewing Road. This would need to be discussed further with WSL. This option will address the potential long-term risk in terms of supply pressure to the reservoirs and can be accommodated with the scope of the upgrades already proposed. A new PS on the existing WSL line will not provide additional resilience to Pokeno but this may be less of an issue if sufficient reservoir storage can be provided.

Current BSPs in the area (Tuakau, Pokeno, Pukekohe) discharge water into local reservoirs rather than providing a direct connection into the local reticulation via a PRV. It is understood that this has been a preference in the past, particularly where reservoirs are available. Direct connections are possible however, so discussion will be required with WSL to better define their requirements in future.

If a connection to a reservoir is required then a second crossing underneath the NIMT may be required. If a reservoir connection is not required, then a connection into the Munro main would be possible.

6.5 Implementation Plan

The figures on the following page summarise how upgrades to manage growth could be staged over time.



LEGEND

- Upgrade pipe
- Existing pipe
- Upgrade PRV
- Existing pump
- Current reservoir
- State Highway 1 (SH1)
- NIMT (North Island Main Trunk)
- Contours (5m)
- Property boundary

Catchment

- 120mHGL
- 113mHGL
- 100mHGL
- 80-85mHGL
- 80mHGL
- 70mHGL
- 60mHGL

District Plan Zones

- Business, Operative
- Heavy Industrial, Operative
- Heavy Industrial, Proposed
- Industrial, Operative
- Residential, Operative
- Residential, Proposed
- Village, Operative
- Village, Proposed

Paper Size A3
0 200 400 800
Metres
Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

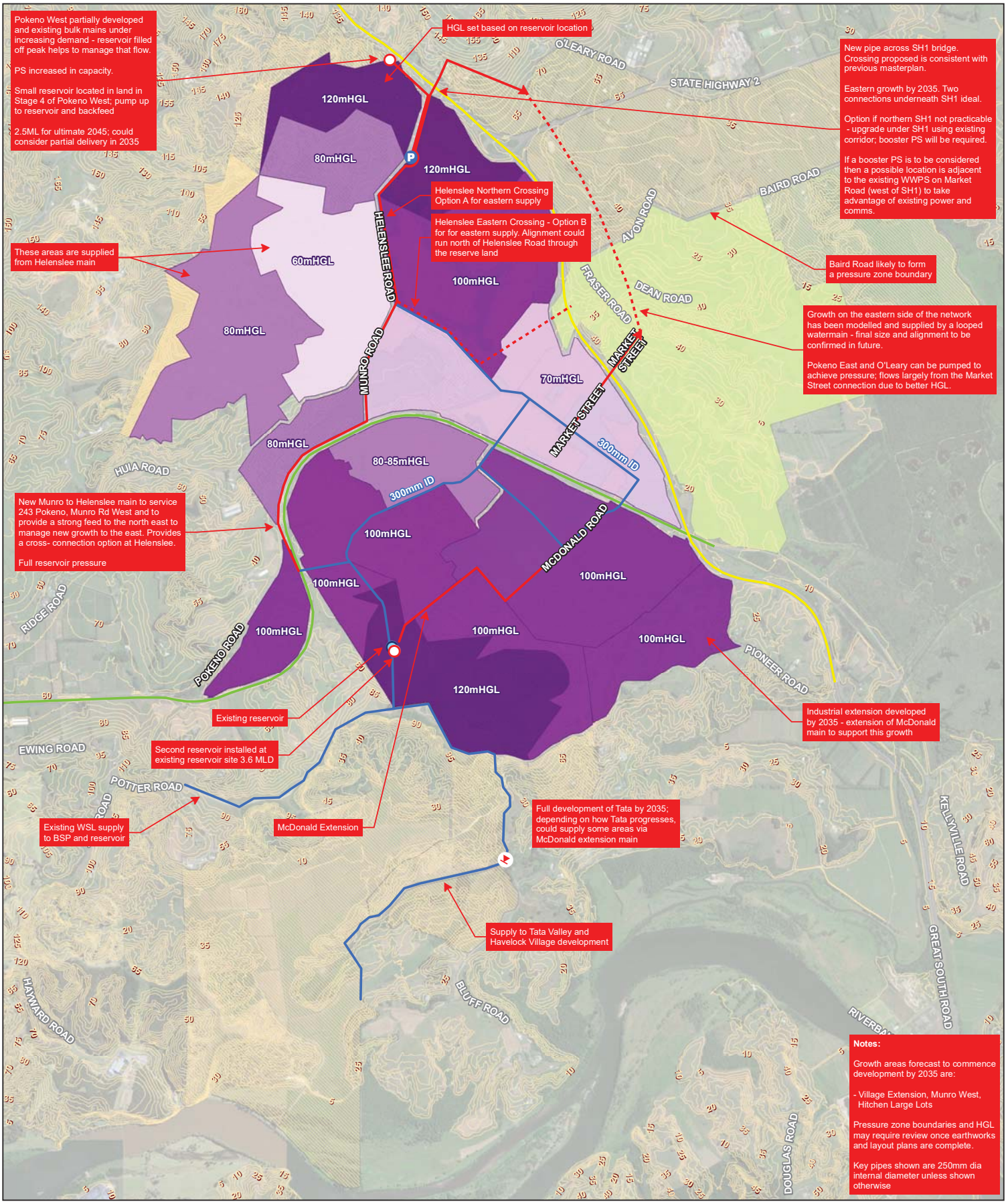
Waikato District Council
Pokeno Water Model Update

Job Number 12503348
Revision A
Date 13 Feb 2020

Upgrades 2025

Figure 13

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\12503348_Z004_Pokeno_Upgrades2025.mxd
GHD Centre, Level 3, 27 Napier Street Freemans Bay Auckland 1011 New Zealand T 64 9 307 7373 F 64 9307 7300 E akmail@ghd.com W www.ghd.com



LEGEND

- Upgrade pipe
- Upgrade pipe (Option B)
- Existing pipe
- Additional reservoir
- Upgrade PRV
- Current reservoir
- State Highway 1 (SH1)
- NIMT (North Island Main Trunk)
- Contours (5m)

Catchment

- 120mHGL
- 100mHGL
- 80-85mHGL
- 80mHGL
- 70mHGL
- 60mHGL

District Plan Zones

- Business, Operative
- Heavy Industrial, Operative
- Heavy Industrial, Proposed
- Industrial, Operative
- Residential, Operative
- Residential, Proposed
- Village, Operative
- Village, Proposed

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

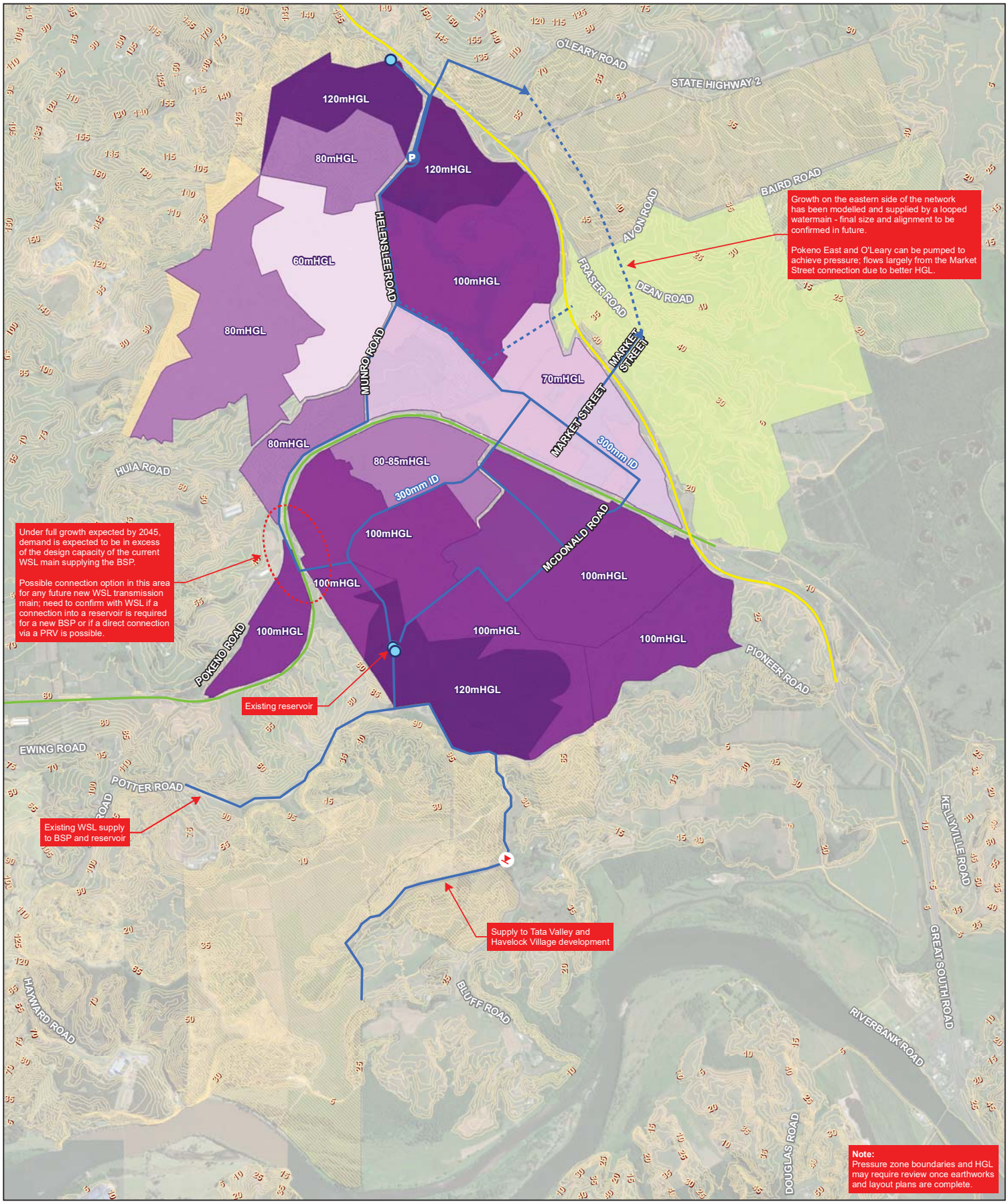
Waikato District Council
Pokeno Water Model Update

Job Number 12503348
Revision A
Date 13 Feb 2020

Upgrades 2035

Figure 14

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\12503348_Z005_Pokeno_Upgrades2035.mxd
GHD Centre, Level 3, 27 Napier Street Freemans Bay Auckland 1011 New Zealand T 64 9 307 7373 F 64 9307 7300 E akmail@ghd.com W www.ghd.com



LEGEND

- Existing pipe
- Existing pipe (2035 Option B)
- Reservoir
- Upgrade PRV
- State Highway 1 (SH1)
- NIMT (North Island Main Trunk)
- Contours (5m)

Catchment

- 120mHGL
- 100mHGL
- 80-85mHGL
- 80mHGL
- 70mHGL
- 60mHGL

District Plan Zones

- Business, Operative
- Heavy Industrial, Operative
- Heavy Industrial, Proposed
- Industrial, Operative
- Residential, Operative
- Residential, Proposed
- Village, Operative
- Village, Proposed

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Waikato District Council
Pokeno Water Model Update

Job Number 12503348
Revision A
Date 13 Feb 2020

Upgrades 2045

Figure 15

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\12503348_Z006_Pokeno_Upgrades2045.mxd

GHD Centre, Level 3, 27 Napier Street Freemans Bay Auckland 1011 New Zealand T 64 9 307 7373 F 64 9307 7300 E aklmail@ghd.com W www.ghd.com

Data source: Aerial imagery - esri 2019 (Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - LINZ 2018; District Plan Zoning and utilities - WDC; Contours - WRC LiDAR 2010/2011. Created by:jrprice

7. Discussion

Upgrades required for Pokeno largely relate to the provision of additional trunk capacity for growth. However, as growth timeframes can change, a staged approach to upgrades is proposed and the general approach has been to provide for future flexibility in managing flows through the network. Some areas are largely independent of the current Pokeno infrastructure and the provision of their infrastructure can be managed to suit. For example, with the Tata development areas it is understood that this development is considering provision of their own reservoir storage and separate BSP from the Watercare main, before the Pokeno BSP.

The main item that will need further investigation before a final solution is progressed is the supply to eastern areas of Pokeno. The crossings underneath (or over) SH1 will require a corridor and engineering assessment to be completed to identify the preferred route and associated infrastructure on the eastern side of town. At this time, the northern route to the eastern side of SH1 has been progressed in the modelling as this is consistent with earlier masterplanning and is expected to be more conservative in terms of cost. It also provides opportunities for (emergency) cross connections to the Helenslee Booster PS, is located closer to the on-demand residential growth from the O'Leary and Bairds developments and has advantages in avoiding some of the currently built up area in the Helenslee area. The central route should also be investigated, however, as it is expected to have a shorter overall pipe length and (as it uses an underpass crossing rather than a bridge and would support an easier crossing of SH1. From a hydraulic perspective, either route is considered viable.

In addition, the operation of the eastern supply will need to be considered further. The current 150 mm dia main underneath SH1 will not have capacity for peak flows to the eastern side of town expected by 2035/2045 depending on development uptake on the eastern side of town. The 150 mm dia main can continue to be used if the eastern side of town (Deans and the Village Extension) remains on a restricted supply and peak flows are buffered through individual storage. If, however, the current and future village areas are placed onto an 'on-demand supply' then a second (or upgraded) supply will be required to accommodate the peak flow requirements. Additional storage to the east is not proposed at this time (with two points of supply from the western side of town considered), but this could be investigated further if a suitable site presents itself, or if an additional supply across SH1 cannot be implemented.

As a general comment, the growth timeframes may be optimistic for some areas considering the steep topography. This is particularly applicable for the industrial extension area and some of the upper areas of the Tata development – either significant earthworks will be required or yield may be reduced. This will need to be monitored going forward.

Provision of wastewater services will need to be considered in conjunction with water supply - this will be particularly critical when considering crossing trunk infrastructure such as SH1 or the NIMT.

Long term, if growth progresses to the scale anticipated then the main supplying the Pokeno BSP is unlikely to have sufficient capacity. The provision of infrastructure along Munro Road provides the opportunity for a future cross connection from any new BSP from the western side of Pokeno. Whether WSL has the long-term capacity to support additional flow to Pokeno something that will need to be discussed further with WSL. At minimum, WDC will need to demonstrate efficient use of their current water resources and may need to be able to provide further information on their groundwater resources in the area and the viability (or otherwise) of utilising them in the long-term. As mentioned earlier, the growth identified may be optimistic for some areas so the ability to track and measure flows compared to growth assumptions will be beneficial.

8. Conclusions and recommendations

8.1 Conclusions

The current Pokeno system is operating well with only a few areas of improvement to manage current pressures. There is further investigation required into fire flow requirements and industrial demands on the network to inform WDC planning going forward.

In future, however, the level of forecast growth in the area is significant and additional trunk infrastructure will need to be delivered as development occurs. Supply to the east of SH1 will need to be reviewed carefully and final infrastructure alignments will depend on feasibility studies around crossing SH1. Flow and pressure monitoring will be beneficial within the network to benchmark capacity over time.

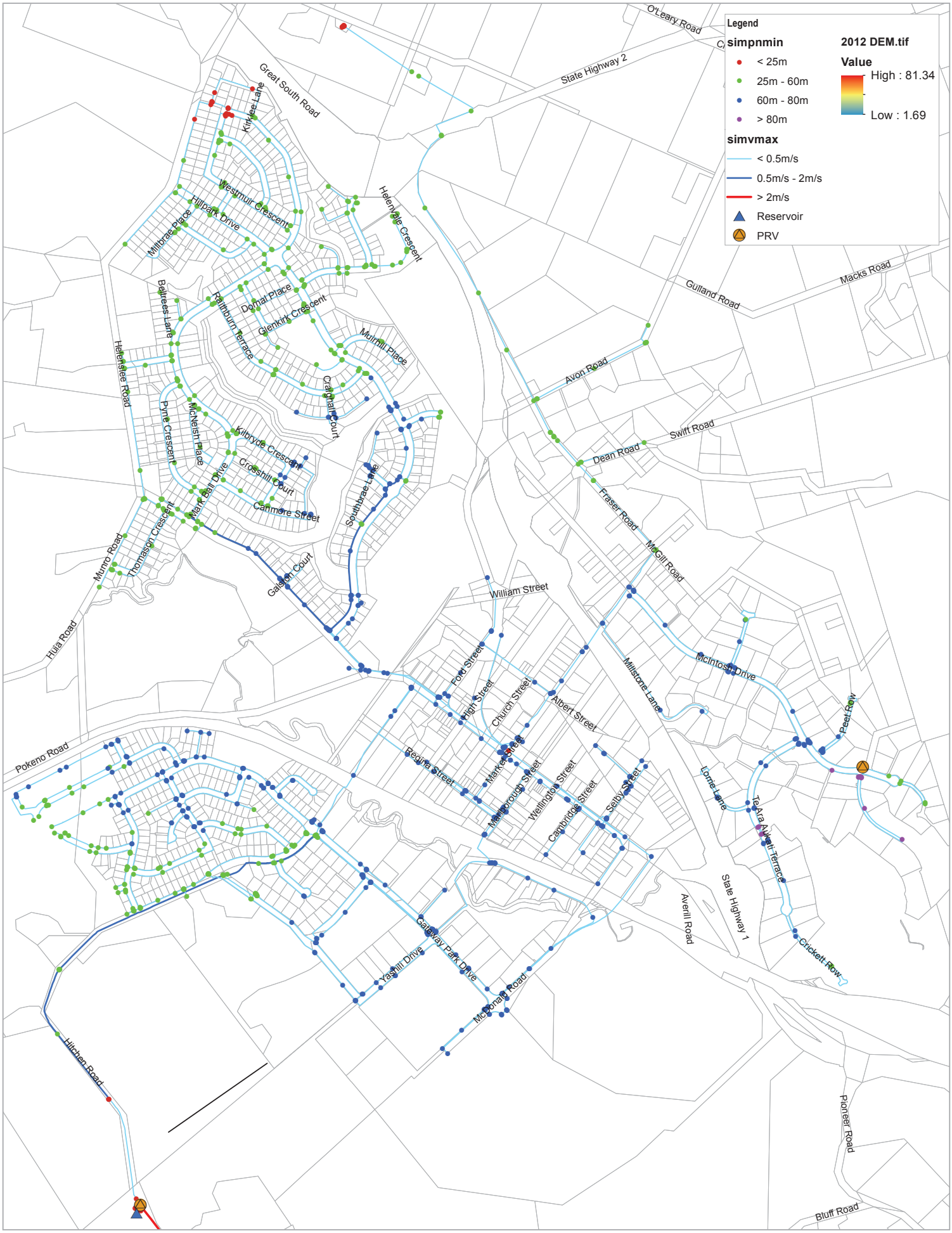
8.2 Recommendations

The following items are recommended in the short-term:

- Items in Table 5 be progressed.
- Corridor assessments be carried out where future crossings of SH1 and NIMT may be required, to scope out the best alignments going forward.
- Site assessment and concept for proposed eastern PS to confirm possible location if interim servicing is required.

Appendices

Appendix A – System Performance No Upgrades



Paper Size ISO A3

0 0.065 0.13 0.195 0.26

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

WAIKATO DISTRICT COUNCIL
DEVELOPMENT OF WATER MODELLING STRATEGY

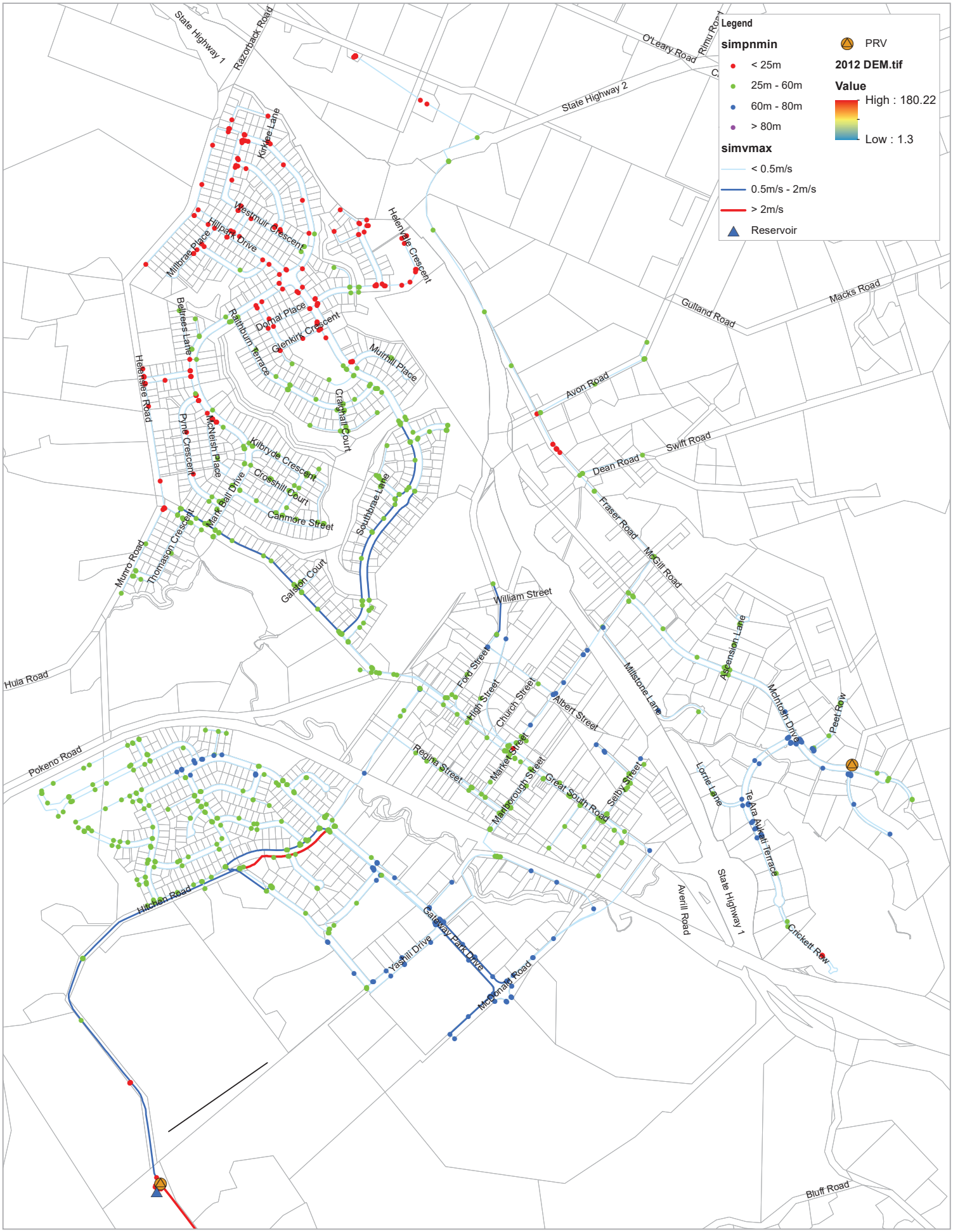
POKENO FIELD TESTING LOCATIONS

Project No. 12503348
Revision No. B
Date 31/08/2018

FIGURE 1

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\System Performance Maps\125033488_G001_Rev1_2019 Peak Day SP.mxd
Print date: 10 Jul 2019 - 17:10

Data source: . Created by: chaegoda



Paper Size ISO A3

0 0.07 0.14 0.21 0.28

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

WAIKATO DISTRICT COUNCIL
DEVELOPMENT OF WATER MODELLING STRATEGY

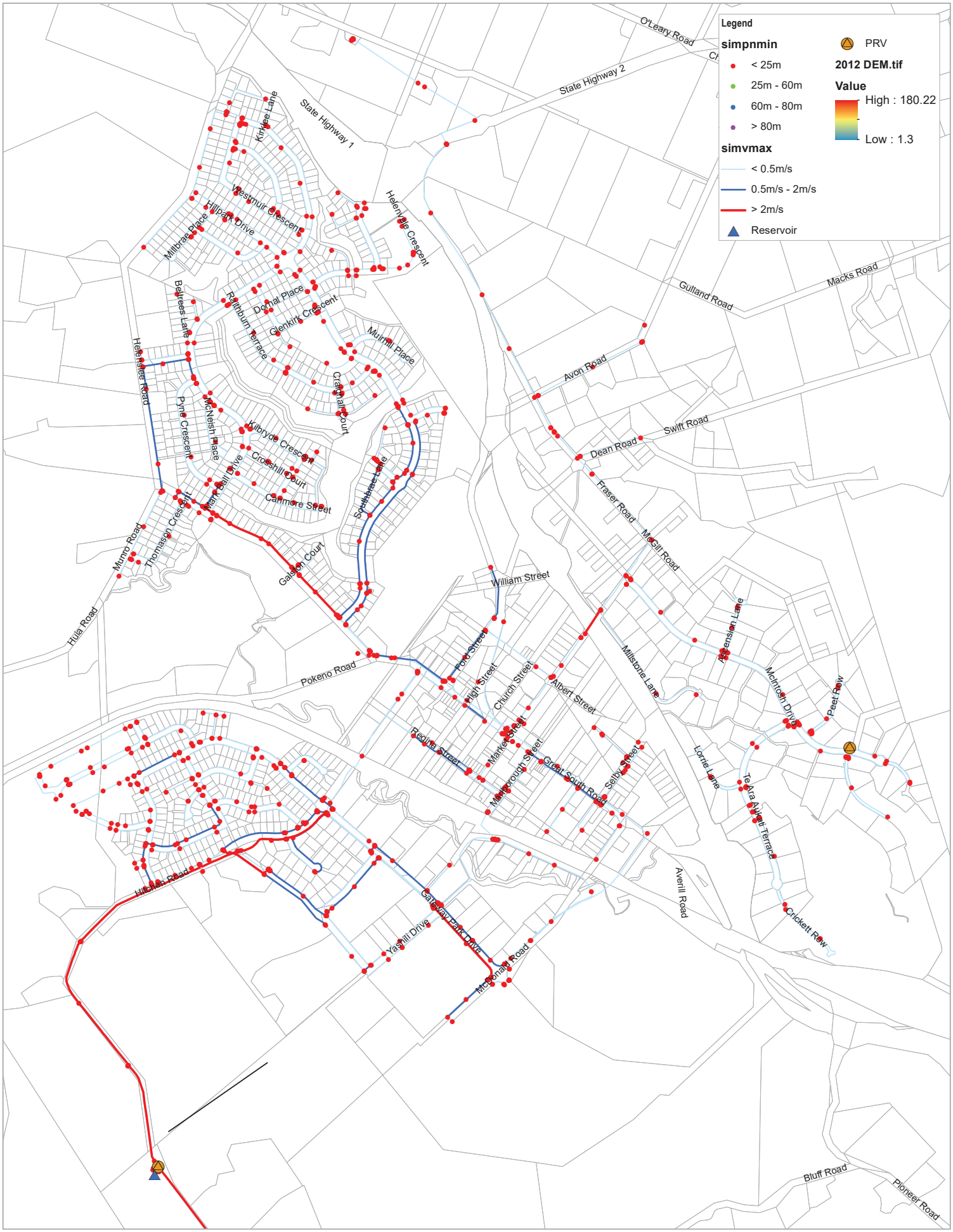
POKENO FIELD TESTING LOCATIONS

Project No. 12503348
Revision No. B
Date 31/08/2018

FIGURE 1

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\System Performance Maps\12503348_G001_Rev1_2025 Peak Day SP.mxd
Print date: 11 Jul 2019 - 16:53

Data source: . Created by: jprice



Paper Size ISO A3

0 0.07 0.14 0.21 0.28

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

WAIKATO DISTRICT COUNCIL
DEVELOPMENT OF WATER MODELLING STRATEGY

POKENO FIELD TESTING LOCATIONS

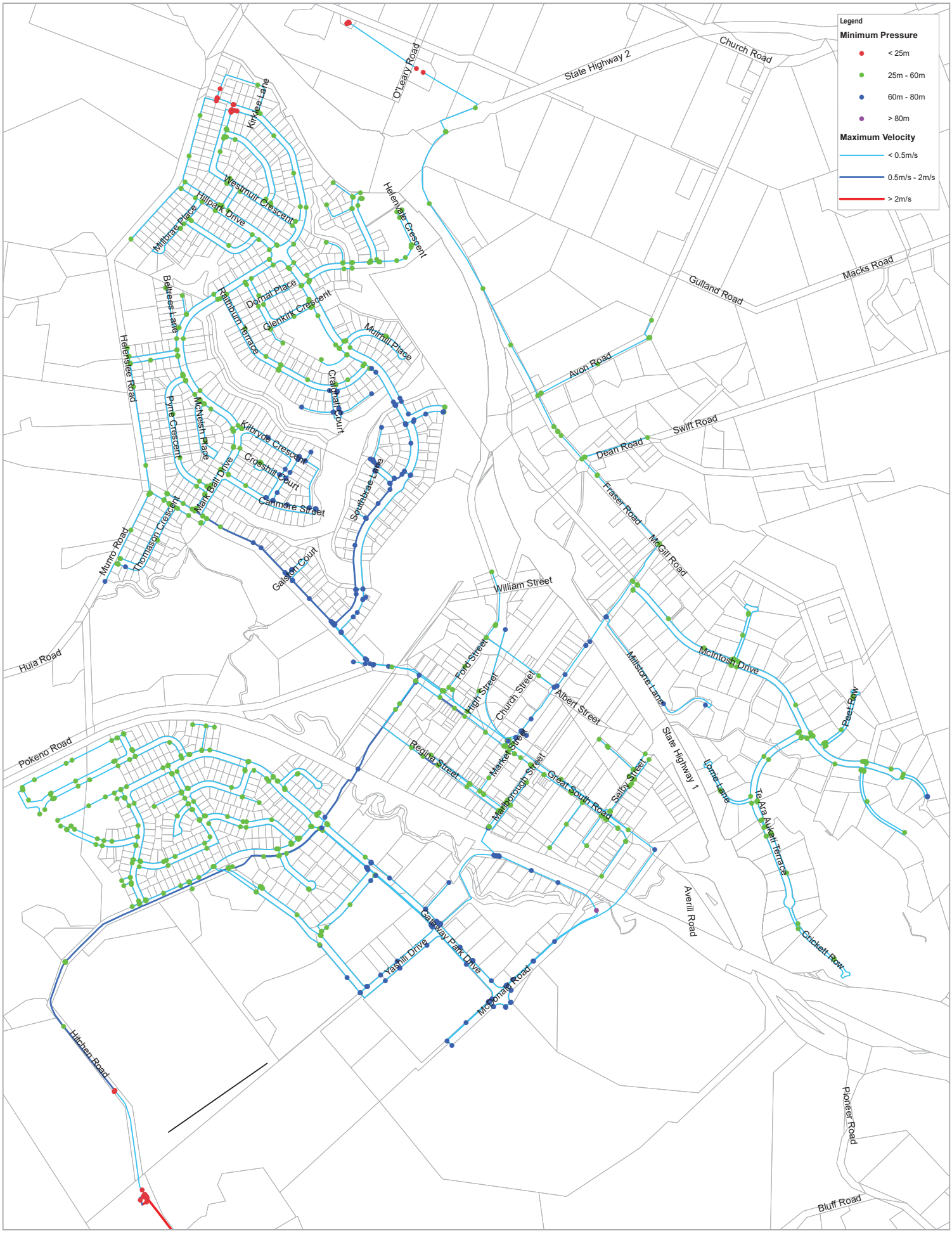
Project No. 12503348
Revision No. B
Date 31/08/2018

FIGURE 1

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\System Performance Maps\12503348_G001_Rev1_2035 Peak Day SP.mxd
Print date: 11 Jul 2019 - 16:56

Data source: . Created by: jprice

Appendix B – System Performance With Upgrades



Paper Size ISO A3

0 0.065 0.13 0.195 0.26

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

WAIKATO DISTRICT COUNCIL
DEVELOPMENT OF WATER MODELLING STRATEGY

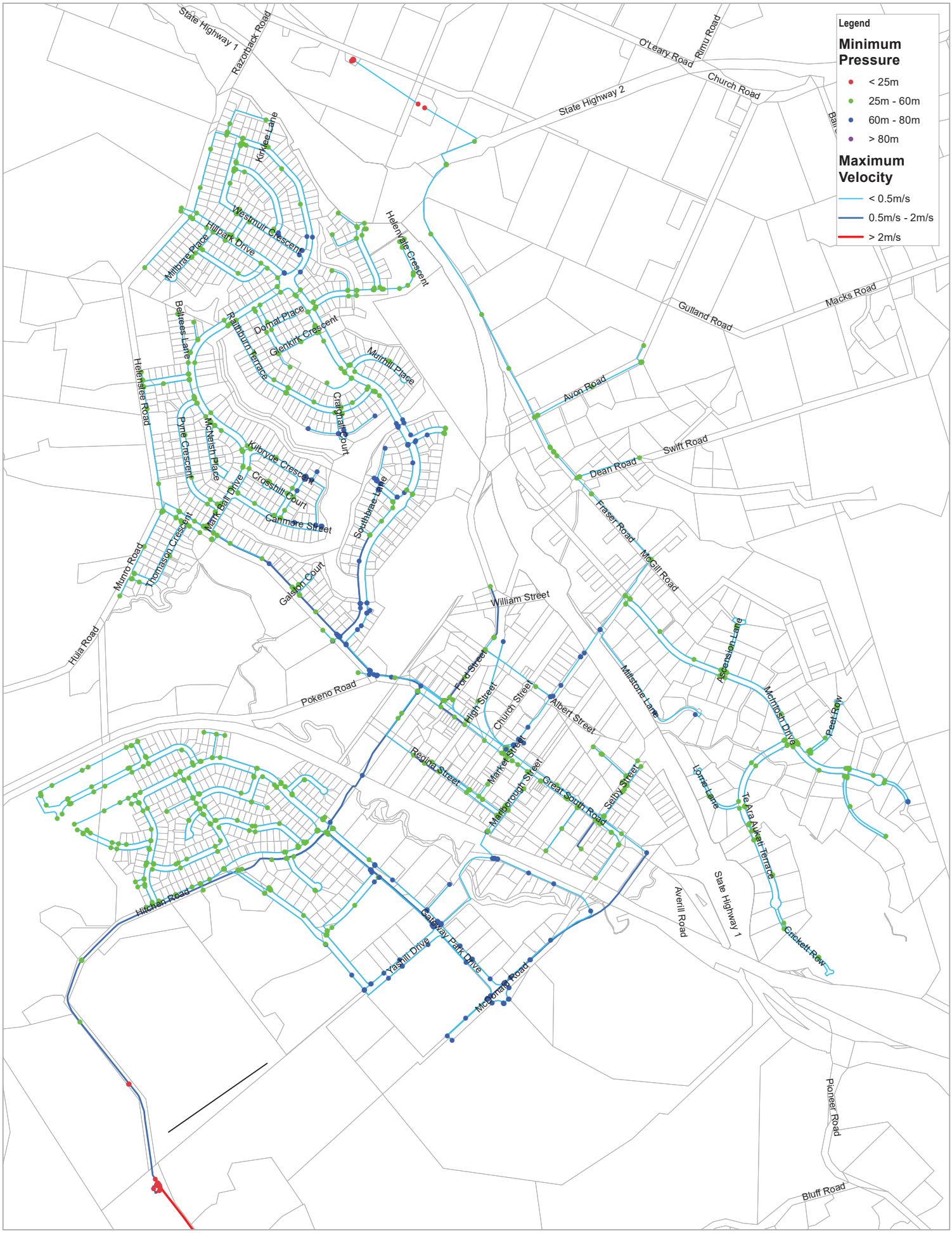
NETWORK PERFORMANCE 2019 PEAK DAY POST UPGRADES

Project No. 12503348
Revision No. A
Date 18/12/2019

FIGURE 1

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\System Performance Maps\Post Upgrade Maps\12503348_G001_Rev1_2019 Peak Day Upgrades SP.mxd
Print date: 18 Dec 2019 - 17:39

Data source: . Created by: chaegoda



Paper Size ISO A3

0 0.07 0.14 0.21 0.28

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

WAIKATO DISTRICT COUNCIL
DEVELOPMENT OF WATER MODELLING STRATEGY

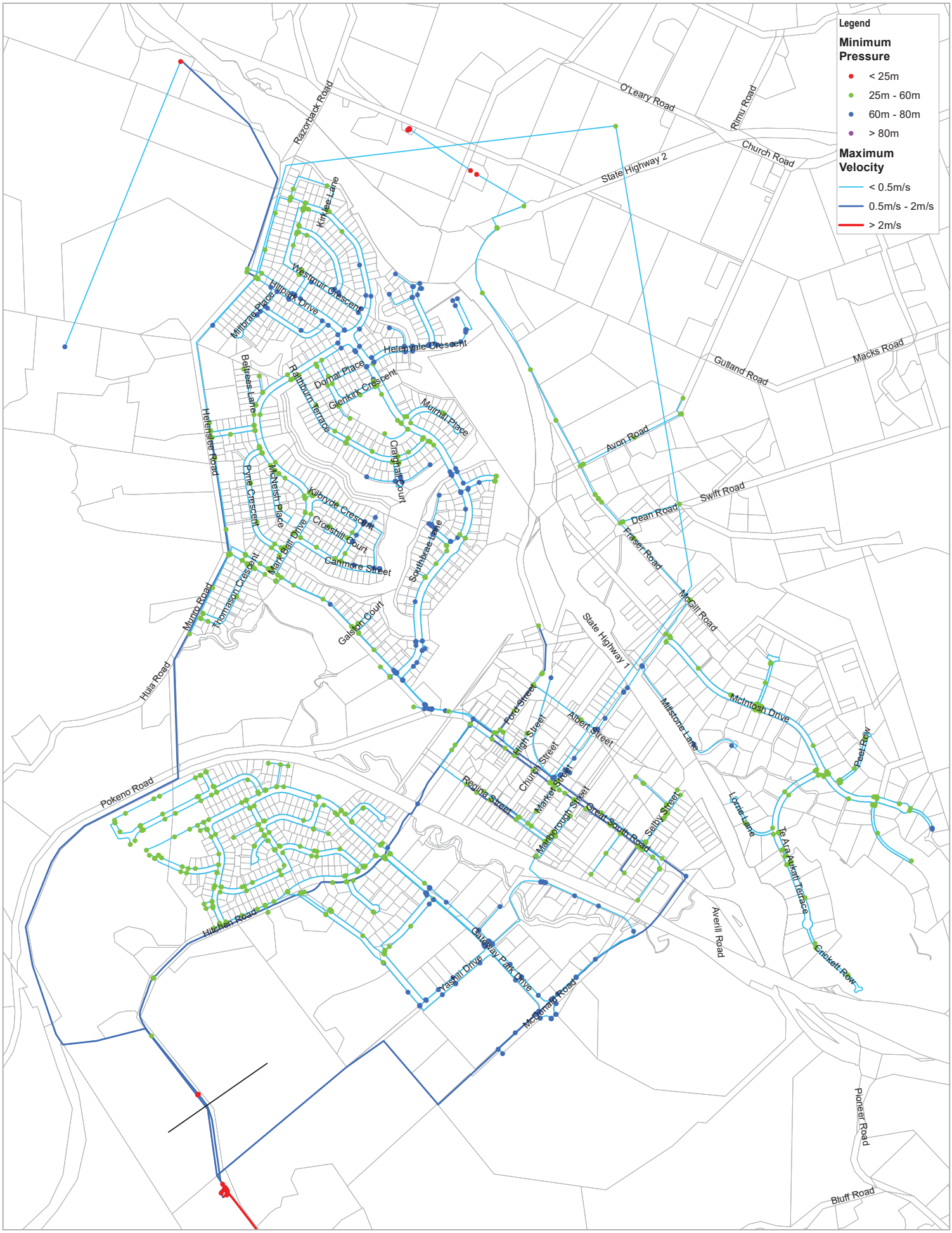
NETWORK PERFORMANCE 2025 PEAK DAY POST UPGRADES

Project No. 12503348
Revision No. A
Date 18/12/2019

FIGURE 2

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\System Performance Maps\Post Upgrade Maps\12503348_G002_Rev1_2025 Peak Day Upgrades SP.mxd
Print date: 18 Dec 2019 - 17:40

Data source: . Created by: chaegoda



Paper Size ISO A3

0 0.075 0.15 0.225 0.3

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

WAIKATO DISTRICT COUNCIL
DEVELOPMENT OF WATER MODELLING STRATEGY

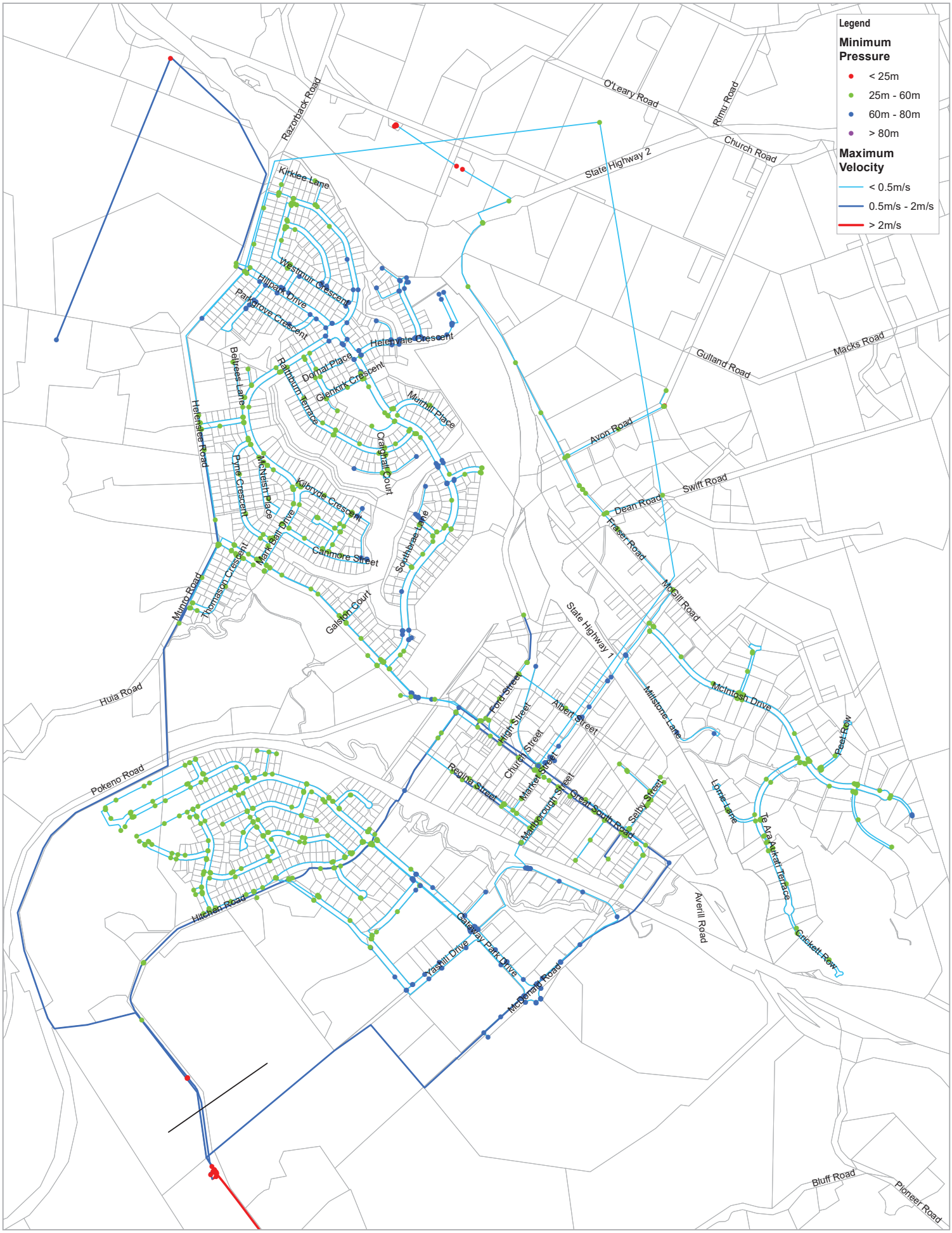
NETWORK PERFORMANCE 2035 PEAK DAY POST UPGRADES

Project No. 12503348
Revision No. A
Date 18/12/2019

FIGURE 3

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\System Performance Maps\Post Upgrade Maps\12503348_G003_Rev1_2035 Peak Day Upgrades SP.mxd
Print date: 18 Dec 2019 - 17:40

Data source: . Created by: chaegoda



Paper Size ISO A3

0 0.075 0.15 0.225 0.3

Kilometers

N

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

GHD

WAIKATO DISTRICT COUNCIL
DEVELOPMENT OF WATER MODELLING STRATEGY

NETWORK PERFORMANCE 2045 PEAK DAY POST UPGRADES

Project No. 12503348
Revision No. A
Date 18/12/2019

FIGURE 4

N:\NZ\Auckland\Projects\51\12503348\GIS\Maps\Deliverables\System Performance Maps\Post Upgrade Maps\12503348_G004_Rev1_2045 Peak Day Upgrades SP.mxd
Print date: 18 Dec 2019 - 17:40

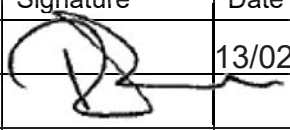
Data source: . Created by: chaegoda

GHD

Level 1
104 Spring Street
T: 64 7 557 0110 F: 64 9 370 8000 E: aklmail@ghd.com

https://projects.ghd.com/oc/NewZealand/pokenomodelupdate/Delivery/Documents/Pokeno Water Supply Masterplan Final.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	CMW	D Rooke		R White		13/02/20

www.ghd.com

APPENDIX

ii) GHD technical memo from Tony Millar to Richard Pullar with subject of “Pokeno W&WW Planning – Technical memo – Growth: Population and Flows”, dated 16 October 2018.

16 October 2018

To	Richard Pullar		
Copy to	Simon Wang, Robert White		
From	Tony Miller	Tel	0274721393
Subject	Pokeno W&WW Planning - Tech Memo - Growth: Population and Flows	Job no.	51/37984/

1 Purpose and Structure

1.1 Purpose

Waikato District Council (WDC) has commissioned GHD to develop a Wastewater Servicing Strategy to update the long term wastewater planning capital works for the Pokeno area.

This Technical Memo documents the methodology, assumptions and outcomesw associated with the development of a growth forecast for Pokeno. The development of a servicing strategy and infrastructure upgrade packages will be presented in a separate memo.

The planning horizon for this assessment is 2018 (present) to 2045 to cover the next Long-Term Plan period.

1.2 Structure

This memo is structured as follows:

1. Purpose and Structure
2. Background
3. Catchment Descriptions
4. Population
    a. Population derivation
    b. Current population
    c. Operative District Plan
    d. Proposed District Plan
    e. Potential Future Urban
5. Design Flows
    a. Methodology
    b. Average Dry Weather
    c. Peak Wet Weather
    d. Wet Industrial
6. Key Assumptions
7. Summary and Recommendations

GHD Limited
GHD Centre Level 3 27 Napier Street Freemans Bay Auckland 1011 PO Box 6543 Wellesley Street Auckland 1141 New Zealand
T +64 9 370 8000 **F** +64 9 370 8001 **E** aklmail@ghd.com **W** www.ghd.com

2 Background

The Pokeno / Tuakau area was previously part of Franklin District Council (FDC). As part of the Auckland Council amalgamation into a Unitary Authority, the northern part of the FDC area was included into the wider Auckland Council. The remainder area including Pokeno and Tuakau was transferred to Waikato District Council.

Pokeno, prior to 2011, consisted of approximately 150 existing houses, gas station, ice cream shop, and café. There was no public wastewater system, with dwellings and shops served by septic tanks.

The Dines Fulton Hogan JV (DFH) sought a private plan change (Plan Change 24) for the development of 460 ha into approx. 2,000 houses including the town centre and an additional 87 ha of industrial land. This Plan Change 24 was granted in Dec 2008. As part of the transfer process from Auckland Council to Waikato District Council, the FDC Plan Change 24 was adopted by Waikato District Council.

Pokeno has since experienced significant growth in the Helenslee catchment to the north of the township. Recent population growth in the Auckland and Waikato regions is influencing demand for housing in Pokeno, with a number of large developments planned and in progress.

GHD has been involved in growth planning for Pokeno since 2011 and has established a thorough understanding of the development aspirations for the area.

3 Catchment Descriptions

3.1 Catchment Overview

The Pokeno catchment is centred around the old Pokeno Township. Recent development has included residential in the Helenslee sub-catchment to the north and industrial zones to the south west.

Significant residential development is in progress and planned on all sides of the original township. Expansion of existing light and heavy industrial areas is also planned. This industrial growth includes a number of new wet industries in the form of dairy factories.

Existing and proposed developments are described below. The developments or ‘sub-catchments’ are grouped by their relative zoning status under the District Plan.

The sub-catchments are illustrated in Figure 1 below. A full version of this drawing is included in Appendix A.

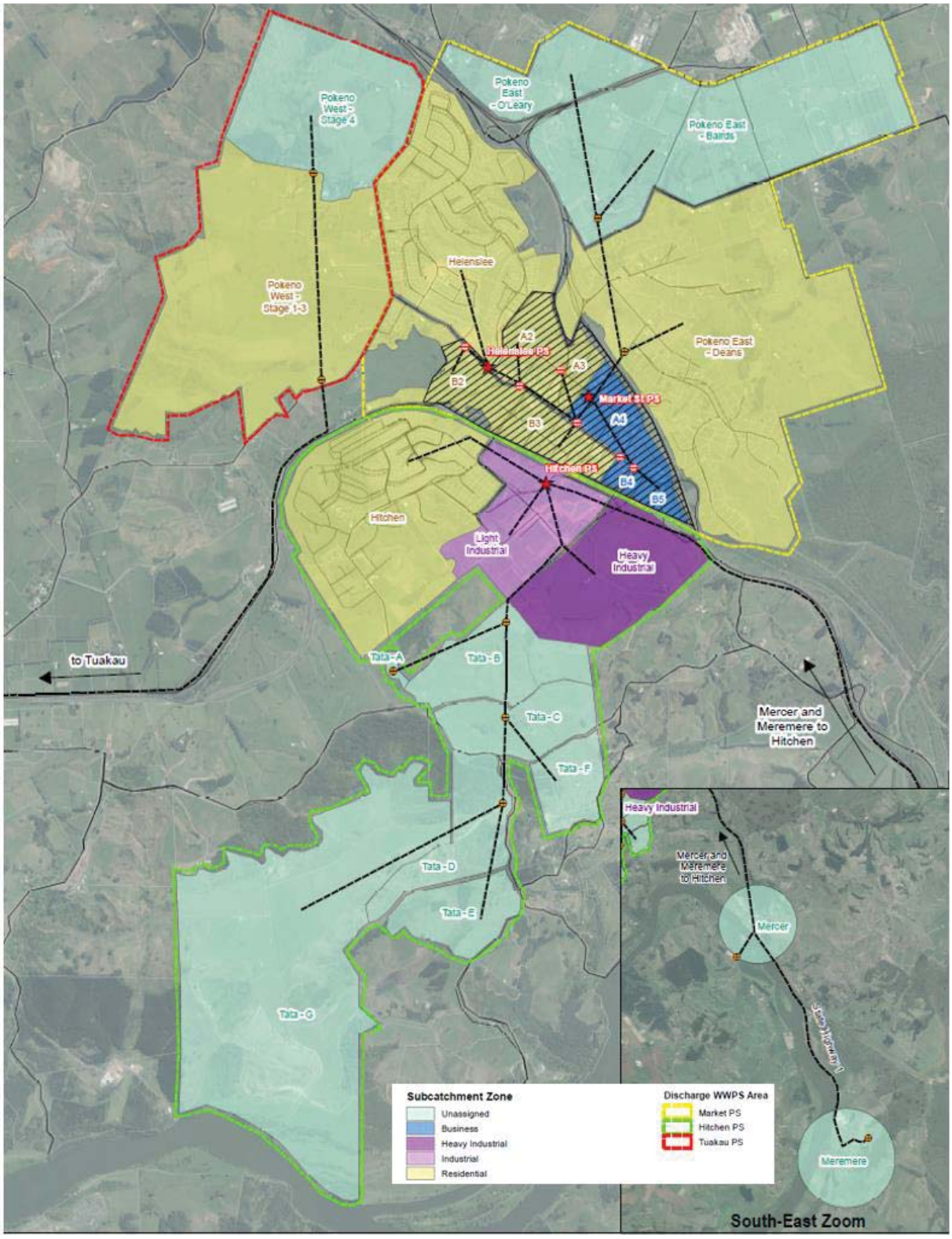


Figure 1 Catchment Overview

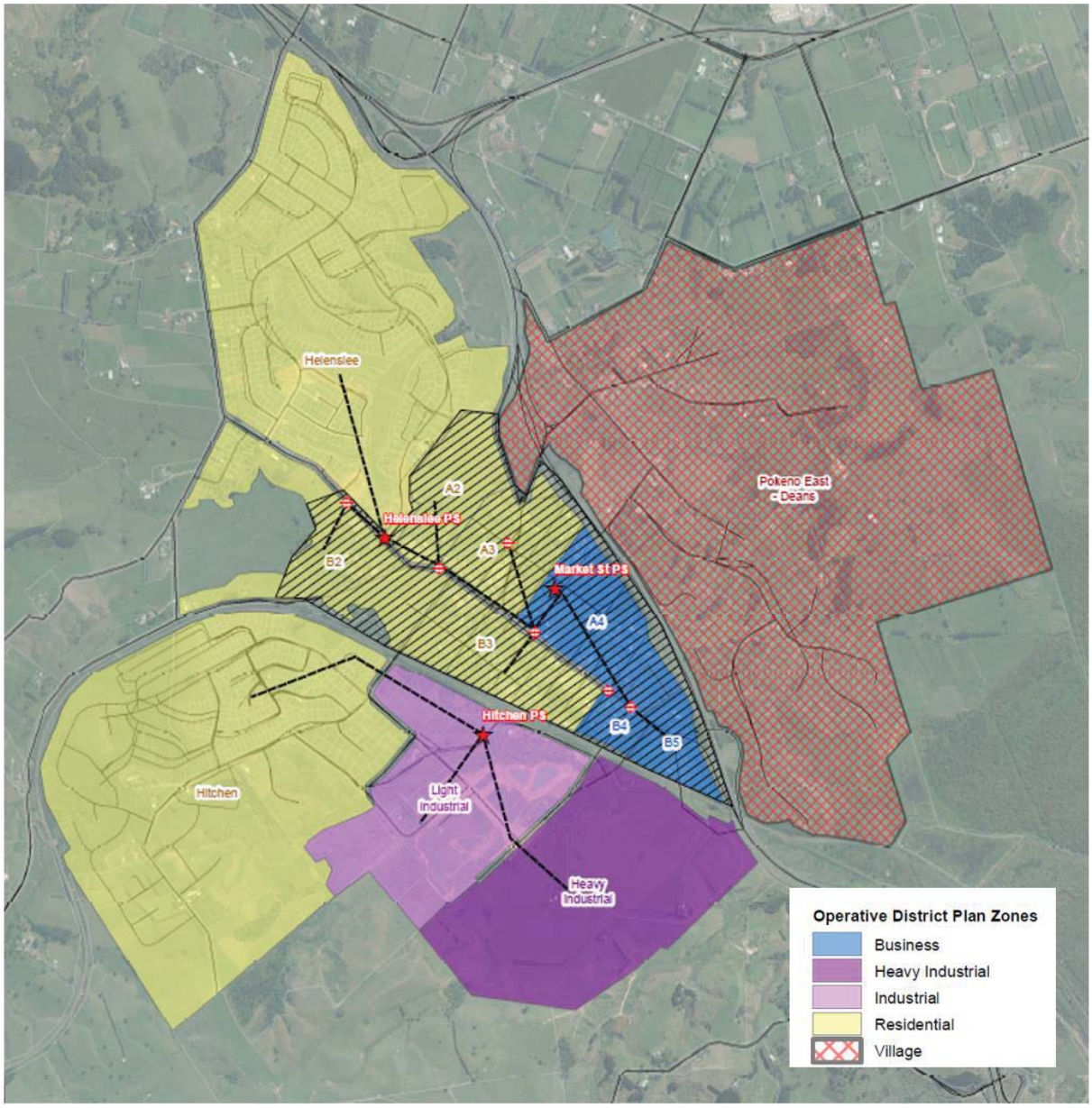


Figure 2 Operative District Plan Zones

3.2 Operative District Plan

Operative District Plan zoning (existing and confirmed development) is illustrated in Figure 2 above. A full version of this drawing is included in Appendix B.

3.2.1 Pokeno Township

The Pokeno Township sub-catchment consists of a mixture of residential and business zones, located between State Highway 1 and the North Island Main Trunk railway line. It is currently serviced by wastewater reticulation, draining to the Market Pump Station.

3.2.2 Helenslee

The Helenslee residential development has been progressively constructed from 2011 by the Dines Fulton Hogan JV. The development is almost complete at the time of writing this memo. Wastewater gravitates to the Helenslee Pump Station, which lifts flow to drain to the Market Pump Station.

3.2.3 Hitchen

Hitchen is a large residential development to the west of the Township. The first stage received engineering approval 2014 with the first tranche of builds complete by early 2016. This sub-catchment is expected to be progressively developed in 11 stages, with completion scheduled by 2023.

A further plan change (Graham Block) has recently been approved and takes the number of stages to 19. These are scheduled to be substantially occupied by 2026. All of this sub-catchment is serviced by gravity to the Hitchen Pump Station.

3.2.4 Industry

The Franklin District Plan Change 24 adopted by Waikato District, allowed for the development of 82 ha of land zoned for industrial activities, located on the west side of the railway corridor.

This land has been subdivided and includes:

- "Industrial 2" zoned land, approximately 51 ha in area has been subdivided into 3 Lots.
- "Light Industrial" zoned land, approximately 39 ha in area has been subdivided into 47 Lots.

A number of these lots have already been sold and have been or are currently under development.

Current operations include the Yashili dairy factory and Hynds pipe manufacturing plant.

The industrial areas are serviced by the Hitchen Pump Station, which in turn pumps to the Market Pump Station.

The wet industry trade waste discharge flows are treated separately and are pumped direct to Market Street Pump Station.

Expansion of the Yashili factory and construction of several new wet industries is expected in the near future. These are detailed further in Section 5.

3.3 Proposed District Plan

Proposed District Plan zoning is illustrated in Figure 3 below. A full version of this drawing is included in Appendix C.

3.3.1 Pokeno West Stage 1-3

Pokeno West is a significant planned residential development and is located to the northwest of the Pokeno Township. Stages 1 to 3 are currently zoned as Residential under the Proposed District Plan. This area is 'subject to appeal'. The gross area for stages 1-3 is 245 ha although we understand from the preliminary development plans there are a number of reserves, drainage areas that will see that not all of this area will be developed housing.

Through discussions with the developers agent, Marven and Associates, we have formed an understanding of the proposed sequencing, density and proposed infrastructure.

3.3.2 Tata Valley

Tata Valley is a large development slated for construction to the southwest of the Township and Industrial areas. It is currently 'under submission' to the Proposed District Plan.

Through discussions with the developer's agent, Civil Plan and Birch Surveyors, we have formed an understanding of the proposed sequencing, density and infrastructure.

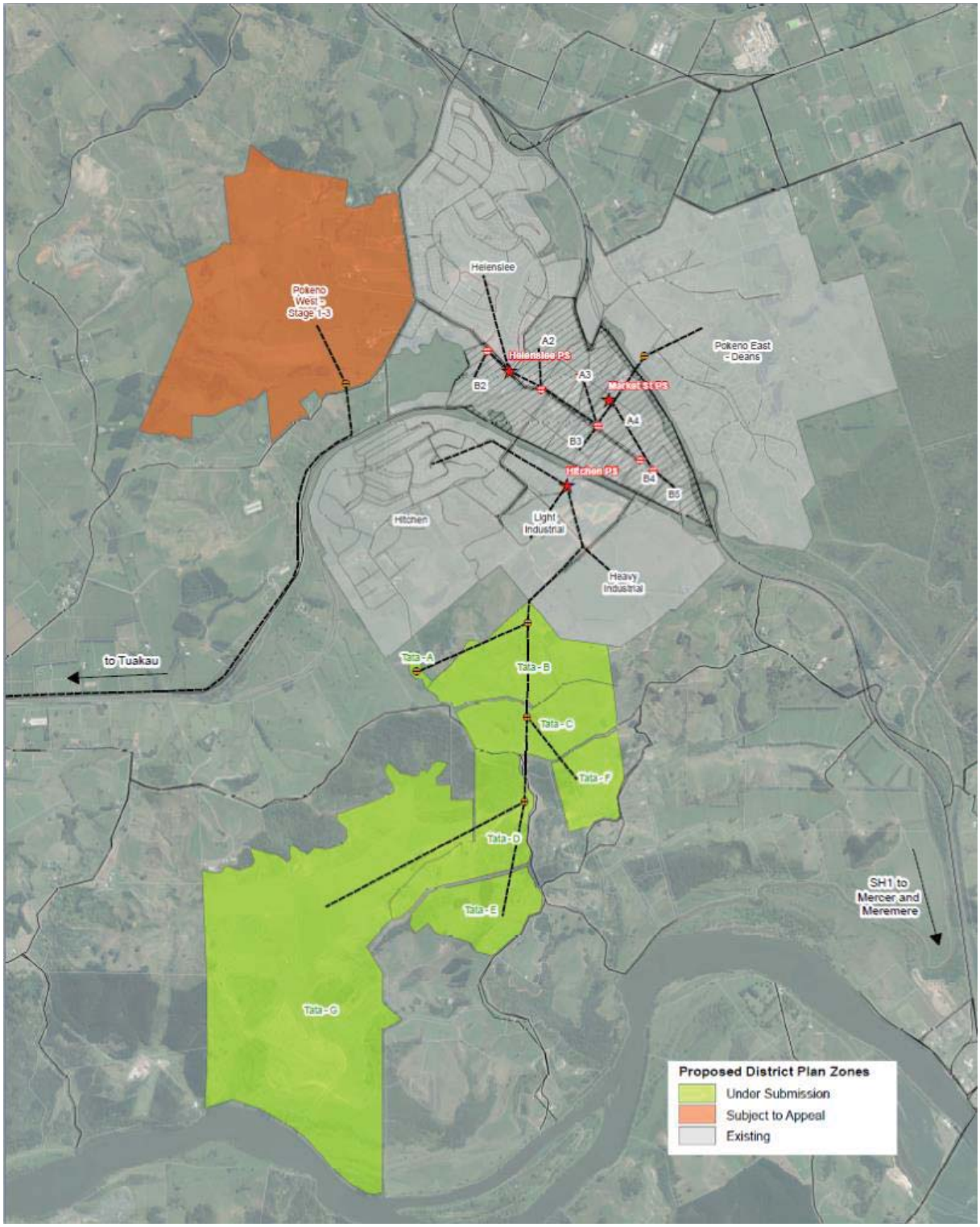


Figure 3 Proposed District Plan Zones

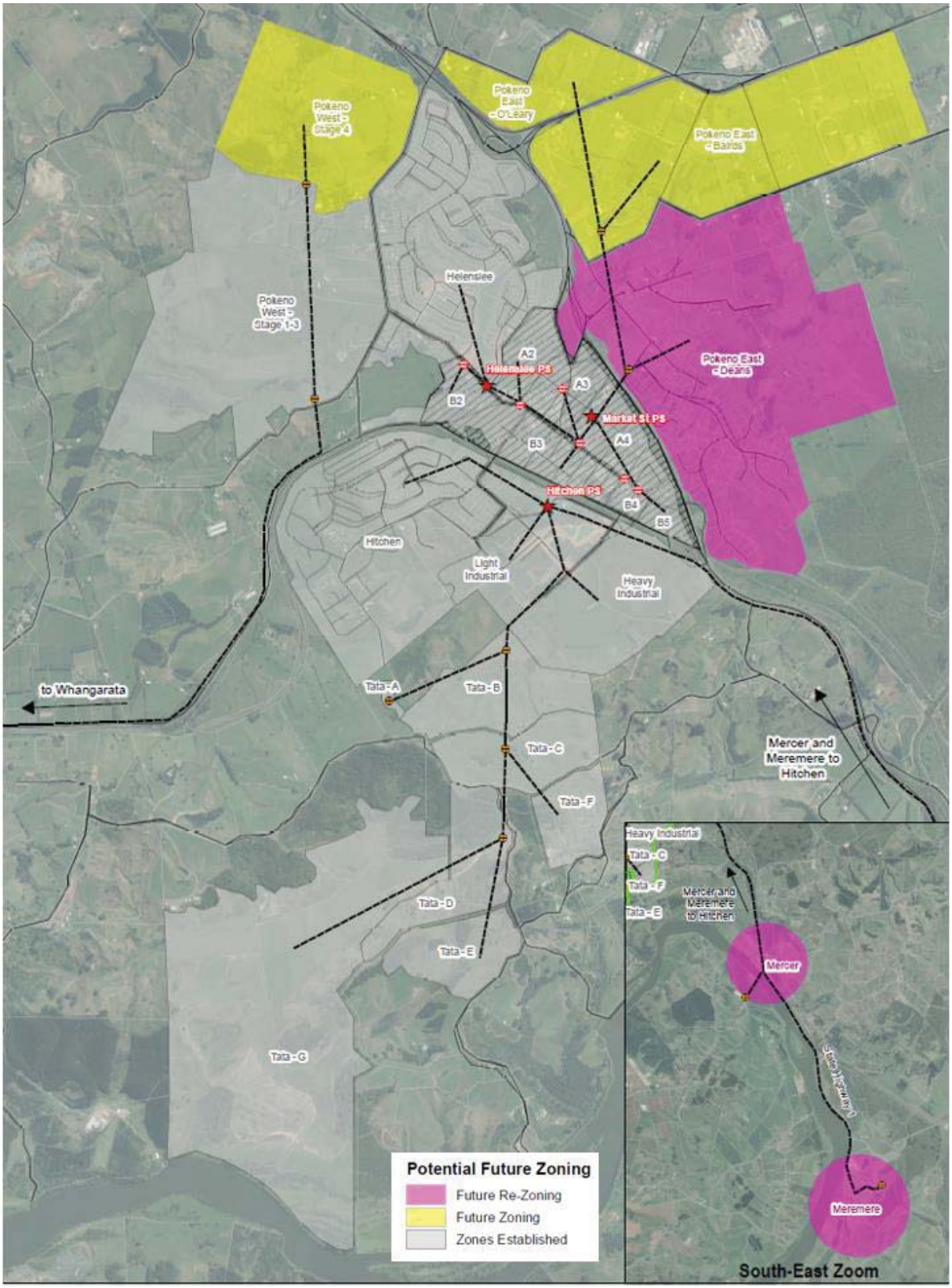


Figure 4 Potential Future Urban Zones

3.4 Potential Future Urban

Potential Future Urban zones are illustrated in Figure 4 above. A full version of this drawing is included in Appendix B.

3.4.1 Pokeno West Stage 4

Pokeno West Stage 4 is a proposed extension to the Pokeno West development. A portion of this Stage 4 land is currently owned by the same developer as Stage 1-3. A new planning application for a zone change would be is expected once development has commenced.

GHD current predictions having the first houses in Stage 4 discharging sewerage by 2027.

3.4.2 Pokeno East

The existing large lot subdivision to the east of the motorway has approximately 60 lots. Wastewater treatment is managed within each lot. This land is currently zoned “Village”.

In future, we expect development pressures to include for subdivision within this area. A logical solution could be a low-pressure system flowing back beneath the motorway to Market Street.

There is currently an additional area of developable land further to the east. This is currently zoned Rural. We have allowed for future development of this land. We expect this to be serviced by conventional gravity system back to Market Street aided by local pump stations as appropriate.

3.4.3 Meremere and Mercer

Meremere and Mercer are townships located to the south of Pokeno.

Meremere

We understand that the existing consent for discharge from the Meremere Wastewater Treatment Plant expired in 2018. We also understand that a new consent has been lodged for 5 years on the basis that the Meremere Township will be connected to the Pokeno wastewater network and treated at the Pukekohe WWTP by 2023.

The existing land zoned as residential is ~40ha and has an existing population of around 500 people. To the immediate north of the existing residential land is a further ~60 ha of land zoned for Industrial use.

There is potential for a rail station to service Meremere.

Mercer

From a land use perspective, the Existing and Proposed District plans are similar. These include 18 ha of Village (residential) zoned land and 10 ha of commercial zoned land. There is no public wastewater collection and treatment system in and around Mercer.

There is potential for a rail station to service Mercer.

In addition to the existing zoned land, there is a significant tranche of developable land in and around Mercer to both the east and west of the River. There is potential for a rail station and good access to the motorway (expressway). Current Pokeno commercial and industrial area is substantially developed.

Residential development is forecasted to increase commencing in 2023, once the Meremere rising main is constructed from Meremere to Mercer. We expect the rising main to be re-pumped again from Mercer to Pokeno. This scheme would allow for local flows from Mercer surrounds to be transferred to Pokeno and treated at the WWTP at Pukekohe.

4 Population

4.1 Population Derivation

Establishing population projections and growth assumptions is a critical component of infrastructure planning.

As part of this growth planning, GHD since 2014 have been working closely with the major developer DFH to establish and develop the staging development and sales data for their area. From this GHD has developed a model to understand when each stage is at the 224C stage.

Based on this data we have estimated the number of sales per quarter and the likely build rate to determine occupancy and the date of the first flush. The first flush is the critical date in which the new infrastructure needs to be live.

Development of the model has been informed by census data, the outcomes of a University of Waikato growth study, developer staging plans, 224C release dates and GHD's understanding of anticipated build rates.

From this information GHD has developed an estimated Household Unit Equivalents (HHU) and developed the population growth model. This was originally developed in 2014 and reviewed twice in 2018.

In addition to residential development, GHD has also assessed the commercial and industrial areas to ascertain the likely working population attached to each of the commercial and industrial areas by using 224c and sales data from the developers associated with these developments.

4.2 Current Population

The current population connected to wastewater services is listed in Table 1 below.

HHU refers to Household Units Equivalents.

Table 1 2018 Pokeno Population

Sub-catchments	HHU
Helenslee Block	740
Pokeno Township	154
Hitchen Block	145
Total HHU	**1069**
Connected Population (at 2.65 persons per HHU)	**2833**

4.3 Residential Development: Operative District Plan

4.3.1 Helenslee and Hitchen

At the time of writing this memo, almost all sections in the Helenslee block have been sold and sales are strong in Stages 1, 2 and 4 of the Hitchen Block. DFH advises that as at mid-2018 the following titles, sales and houses have been built:

- Helenslee Block 770 titles have been issued with 740 sales and 720 houses completed.
- In total DFH has 1,850 titles issued and has sold 1,030 lots. By deduction this puts sales in the Hitchen Block as 1,110 titles issued with 290 sold.

4.4 Residential Development: Proposed District Plan

4.4.1 Pokeno West Stage 1-3

We expect the Proposed District Plan to be operative in part by mid 2019. This would allow the developers to lodge for subdivision consent by mid to late 2019 at the earliest. By the time earthworks and civils are complete 224C may be available by mid 2020.

GHD population projections have the Pokeno West population of 400 by 2022. This relates to 150 HHU which is achievable from title issue two years previously.

The area of Stages 1 – 3 is 159 ha. The developers have a draft layout with 1150 lots. The lower yield is due to topography. The growth model reflects the draft developers layout.

4.4.2 Tata Valley

As the Tata Development is in its early stages, the forecasted developments are likely to change. GHD has had discussions with Civil Plan on behalf of the developer. They have provided a development plan showing expected development over a five-year period. GHD has downscaled this to a yearly prediction. The forecast at the date of this memo is such:

- Tata Block G includes for the development of a hotel complex visitor centre plus worker accommodation. We anticipate this area will be first to be built. The GHD growth model has first flow of 200 people in 2020.
- Tata Block B and part of A could have a gravity connection to McDonald Road. This area offers the largest development potential with the least infrastructure, hence we expect this area will be first to develop. The GHD growth model has 50 HHU connected by 2021 and scheduled for completion 4 years later with almost 300 HHU as identified by Civil Plan as the likely yield. This land is part of the existing 88 Bluff Road. We expect final development of 337 HUU in blocks A & B.
- Tata Block C and F will require a new pump station and significant earthworks. We have scheduled first flush in 2024 and 2035 respectively with a slow ramp up until take up of Block A and B are almost complete. We expect final development of 337 HUU in blocks C & F.
- Tata Block D and E will also require a new pump station and significant earthworks. We have scheduled first flush in 2030 and 2028 respectively. We expect final development of a further 270 HUU in blocks D & E.

4.5 Residential Development: Potential Future Urban

4.5.1 Pokeno West Stage 4

Pokeno West, Stage 4, is expected to be subject to a new plan change lodged by 2023 when development is underway for Stages 1 & 2 of Pokeno West. The growth model shows development in Stage 4 with 160 houses occupied by 2027.

The gross area for the Stage 4 area is 74 ha and a theoretical max density would allow for a population of over 3,300. We have allowed 1,600 to 2045, due to the steeper topography and expected lower yields.

4.5.2 Pokeno East

Currently the area zoned as Village to the East of the motorway is ~209 ha in area. The current development relies on ‘on-site’ sewage treatment and disposal. We expect there to be future development pressures over time for infill housing. Intensification could be serviced by a low pressure system discharging back to Market Pump Station.

Future redevelopment of the Village and Rural zoned land could form part of a future land use change and become low to medium density development.

The GHD growth model allows for development to the east of the motorway and contributing to sewer flows commencing in 2029. There is potential for this to occur up to 5 years earlier if the District Council were to pre-empt this with a trunk sewer connection from Market Street back under the motorway.

4.6 Meremere and Mercer

Following discussions with Waikato District Council, we understand the existing discharge consent from Meremere WWTP expires in 2018. A new 5-year consent (extension) has been applied for.

In the GHD growth model we have assumed that a new connection for Meremere and Mercer will be completed in 2023.

Because of the rising main length and septicity and odour issues we expect the existing treatment system to remain in the short term and pumping of semi treated effluent will occur but disposal will be through to Pukekohe WWTP. Over time and as development increases we expect the type of treatment and storage to change at Meremere. At Mercer there is no existing reticulated sewage.

The GHD growth model allows for:

- At Meremere, an initial connected existing population of 500 currently discharging to the Meremere lagoon treatment system. This flow from ~188 HHU would be 'on-line' from the date of connection (to Pokeno). Growth is expected to ramp up from this date to ~500 HHU by 2045.

  Meremere also has 63 ha of heavy industrial zoned land. We have not allowed for flows from this area, although a Meremere Pump Station could allow for dry industries. Any wet industries would require a rethink of sewer strategy.

- Mercer has an existing area of commercial and residential zoned land and no reticulated sewage. We expect the new Meremere to Pokeno sewer system will trigger development in Mercer.

  We expect a small number of connections from Mercer by 2024 within a year of the sewer pipeline being constructed. We have scheduled a 50 person/year increase in the growth model although we expect the increases to be larger but more spread out as each new local pump station is hooked up and discharges occur to the trunk station.

4.7 Population Projection

The GHD growth model has been used to create population projections at 4-year intervals for the agreed planning horizon. The projections are summarised in Table 2 below.

Table 2 Summary of Pokeno Population Projections

Sub-catchment	2018	2022	2026	2030	2034
Pokeno Township	**53**	**567**	**1216**	**1558**	**1558**
Helenslee Block	1972	2041	2041	2041	2041
Hitchen Block	384	1736	2449	2449	2449
Tata Valley	0	1016	3374	5974	6912
Pokeno West	0	398	2743	3843	3843
Pokeno East	0	0	0	1829	4301
Mercer & Meremere	0	0	900	1700	2800
Connected Population (at 2.65 p per HHU)	**2048**	**5756**	**12722**	**19392**	**23902**
Total Predicted HHU	**909**	**2172**	**4801**	**7318**	**9020**

5 Design Flows

5.1 Methodology

Design flow rates have been derived for each of the sub-catchments using the Hamilton City Design Manual / Regional Infrastructure Technical Specification (HDM / RITS).

5.1.1 Average Dry Weather

Average Dry Weather Flow (ADWF) has been derived based on the following criteria:

- 2.65 persons per household at a rate of 200 l/p/day
- Peaking factor applied to population flows
- Groundwater infiltration rate over full 24 hours, based upon 2.25 m³/ha of developed area

5.1.2 Peak Wet Weather

Peak Wet Weather Flow (PWWF) has been derived based on the following criteria:

- 2.65 persons per household at a rate of 200 l/p/day
- Peaking factor applied to population flows
- Groundwater infiltration rate over full 24 hours, based upon 2.25 m³/ha of developed area
- Surface water ingress rate of 16.5 m³/day over the full 24 hours of the day

5.1.3 Commercial

Existing commercial zoned land under the Existing and Proposed District Plan can be seen in the appropriate planning maps. A small commercial area can be seen along Great South Road. From a sewer planning perspective, this also includes hospitals, schools motels etc. Some of these are within the existing zoned commercial land but others like schools occurs outside of this zone.

Wastewater flows for the Industrial sub-catchments have been calculated using criteria for commercial as set out in the HCDM/RITS. This includes:

- Person Equivalent (PE) flows of:
    - 24 PE/ha/day for commercial zoned land,
    - 45 -150 PE for schools
    - Hospital and Motels at 3.5 and 0.6 PE equivalent per bed.
- Peaking factor applied to population flows
- Groundwater infiltration rate over full 24 hours, based upon 2.25 m³/ha of developed area
- Surface water ingress rate of 16.5 m³/day over the full 24 hours of the day

We expect that as additional housing land is developed there will be additional commercial areas zoned for supermarkets, shopping areas, schools etc. We have not allowed for any additional commercial zoned land, but consider the population based flows will account for future commercial areas.

5.1.4 Industrial (non-wet)

Within Plan Change 24 there is:

- 51 ha of heavy industrial zoned land, and
- 39 ha of light industrial zoned land.
- 63 ha of industrial zoned land at Meremere

As for commercial land, the industrial land uses

- Person Equivalent (PE) flows of 45 p/ha/day for industrial zoned land, times the appropriate peaking factor,
- Groundwater infiltration rate over full 24 hours, based upon 2.25 m³/ha of developed area
- Surface water ingress rate of 16.5 m³/day over the full 24 hours of the day

We expect that over time there may be additional land zoned as industrial however as the impacts of this land are potentially significant, then new industrial land may be limited.

Flows from 'wet' industries are excluded and have been derived based on proposed discharge rates from each industry (see Section 5.4).

5.2 Average Dry Weather Flow

Using the population projections, methodology and assumptions described in this memo, the Average Dry Weather Flow projections at 4-year intervals for the agreed planning horizon are summarised in Table 3 below.

Table 3 Average Dry Weather Flows by Sub-catchment (excluding wet industry)

Sub-catchment	2018 (L/s)	2022 (L/s)	2026 (L/s)	2030 (L/s)	2034 (L/s)
Pokeno Township	1.2	2.7	4.5	5.5	5.5
Commercial / Industrial	4.4	7.2	9.2	10.8	13.8
Helenslee Block	5.7	5.9	5.9	5.9	5.9
Hitchen Block	1.1	5.0	7.1	7.1	7.1
Tata Valley	0.0	2.9	9.8	17.3	20.0
Pokeno West	0.0	1.1	7.9	11.1	11.1
Pokeno East	0.0	0.0	0.0	5.3	12.4
Mercer / Meremere	0.0	0.0	2.6	4.9	8.1
Meremere Industrial	0.0	0.0	0.0	0.0	0.0
Total Catchment	**12**	**25**	**47**	**68**	**84**

The Average Dry Weather Flow needs to be pumped out at a rate faster than the arrival rate at each pump station, assuming there is no working storage at each pump station. The degree of safety factor of arrival rate against pumped rate is discussed again below under PWWF.

The ADWF flow calculation is also used in the calculation of emergency storage. The current emergency storage requirements as follows:

- HCDM requires 6 hours ADWF emergency storage at each pump station, and
- RITS requires 9 hours ADWF emergency storage at each pump station.

5.3 Peak Wet Weather Flow

Using the population projections, methodology and assumptions described in this memo, the Peak Wet Weather Flow projections at 4-year intervals for the agreed planning horizon are summarised in Table 4 below.

Table 4 Peak Wet Weather Flows by Sub-catchment (excluding wet industry)

Sub-catchment	2018 (L/s)	2022 (L/s)	2026 (L/s)	2030 (L/s)	2034 (L/s)
Pokeno Township	4.6	10.0	17.0	20.7	20.7
Commercial / Industrial	16.6	21.4	32.1	36.4	46.1
Helenslee Block	22.3	22.1	22.1	22.1	22.1
Hitchen Block	7.9	19.6	26.6	26.6	26.6
Tata Valley	0.0	11.5	36.6	64.8	74.9
Pokeno West	0.0	5.3	31.0	41.7	41.7
Pokeno East	0.0	0.0	0.0	19.8	46.6
Mercer / Meremere	0.0	0.0	9.8	18.4	30.4

The peak wet weather flow to each pump station needs to be:

- Pumped out at the rate of arrival, or
- Pumped out in part, with the balance held in storage until the end of the rainstorm event.

During the development of the sewage scheme in combination with increasing flow from growth, there may be opportunities to use a portion of the unused emergency storage for working storage as a temporary measure. Otherwise, working storage will need to be constructed such that spills do not occur.

5.4 Industrial Wet Flows

5.4.1 Yashili

Stage 1 is complete and has been operational since 2015. This is one of the wet industries with a consent to discharge up to 1,150 m³/day (average of 13.3 L/s). An adjacent site remains undeveloped however this is planned to be in production by 2022 with a potential to discharge an additional 1,400 m³/day (New total average of 29.5 L/s).

Yashili Stage 1 is currently averaging 600 to 900 m³/day (2018 advice from plant manager – Kerry Morrison). Yashili are planning to shortly add another shift to increase production and as such they are expected to come close to the agreed discharge limit.

Yashili had previous plans for a 2nd drying plant with an earliest on-stream time of 2019 although this time frame has slipped. Based upon recent discussion with their plant manager their 2nd plant could now be on-stream by 2019/20 and as such their anticipated waste production could double by 2020 instead of 2022.

Yashili Stage 2 is delayed until 2022 and will result in an increase in production. However we understand that a new UHT processing stream is about to be approved which has potential to bring production forward.

5.4.2 Synlait:

Stage 1 of Synlait is due to commence production by May 2019. The planned waste production is 1,200 m³/day (Average 13.8 l/s) with a further 4 Stages to increase total waste production to 5,000 m³/day (Average 57.9 l/s). Based on early discussions, this could ramp up every year and be at full production by 2023 although GHD expect production increase to be at a slower rate. (Information source is Babbage Consultants acting for Synlait).

Synlait has requested the ability to discharge at up to 20 L/s from May 2019 and 24 L/s (Stage 2) from May 2020.

5.4.3 Proposed Wet Industry

Winstone Nutritional Dairy Factory has secured land although the operational start date is yet to be confirmed. The expected waste production is 600 m³/day. (Source –discussion with their consultant Babbage who was part of the resource consent application).

Amrita Nutrition is currently in production in Wiri, Manukau. We understand the land has been secured and development plans are currently on hold. We estimate their total waste production to be approximately 600 m³/day. This rate has been based upon their current waste production from their Wiri plant.

5.4.4 Wet Industry Peak Flow

Using methodology and assumptions described in this memo, the Peak Flow for wet industry projections at 4-year intervals for the agreed planning horizon are summarised in Table 5 below.

Note, wet industry flows are presented in m^3/d and are based on consented industrial discharge flows.

Table 5 Wet Industry Peak Flow

Sub-catchment	2018 (m^3/d)	2022 (m^3/d)	2026 (m^3/d)	2030 (m^3/d)	2034 (m^3/d)
Yashili	1400	2100	2100	2100	2100
Synlait	0	2200	3300	3300	3300
Winstone Nutritional	0	600	600	600	600
Amrita Nutritional	0	0	600	600	600
Total	**1400**	**4900**	**6600**	**6600**	**6600**

6 Key Assumptions

The population and flow projections described in this memo are based on a number of assumptions. The critical assumptions are listed below and should be re-visited at regular intervals.

- The catchment is subject to existing planning zones with some in place, others are part of current submissions and further areas expected for development but outside the current submissions and appeals to the Proposed District Plan.
- Current commitment to development of Pokeno West plan change area, with a future ability to extend development up the hillside to include the stage 4 area.
- GHD has used the 5 year development rates as supplied by Civil Plan on behalf of the land developers for the Tata Valley sub-catchment, but downscaled their predictions to an annual expected growth rate.

- WDC has advised there is a new commitment to have Meremere sewage piped north by 2023 when the existing extension to the discharge consent expires. Likelihood and timing of connection of Mercer and Meremere communities to the Pokeno wastewater network has been scheduled for 2023 and this connection is expected to trigger new development.
- Timing of further development at the Yashili and Synlait Dairy factories with possible further extensions to this industry sector scheduled in the GHD predictions.

7 Summary and Recommendations

This memo documents the methodology, assumptions and outcomes associated with the development of a growth forecast for Pokeno. Population and design flow projections are provided at 4-year intervals for the agreed planning horizon (2018-2034).

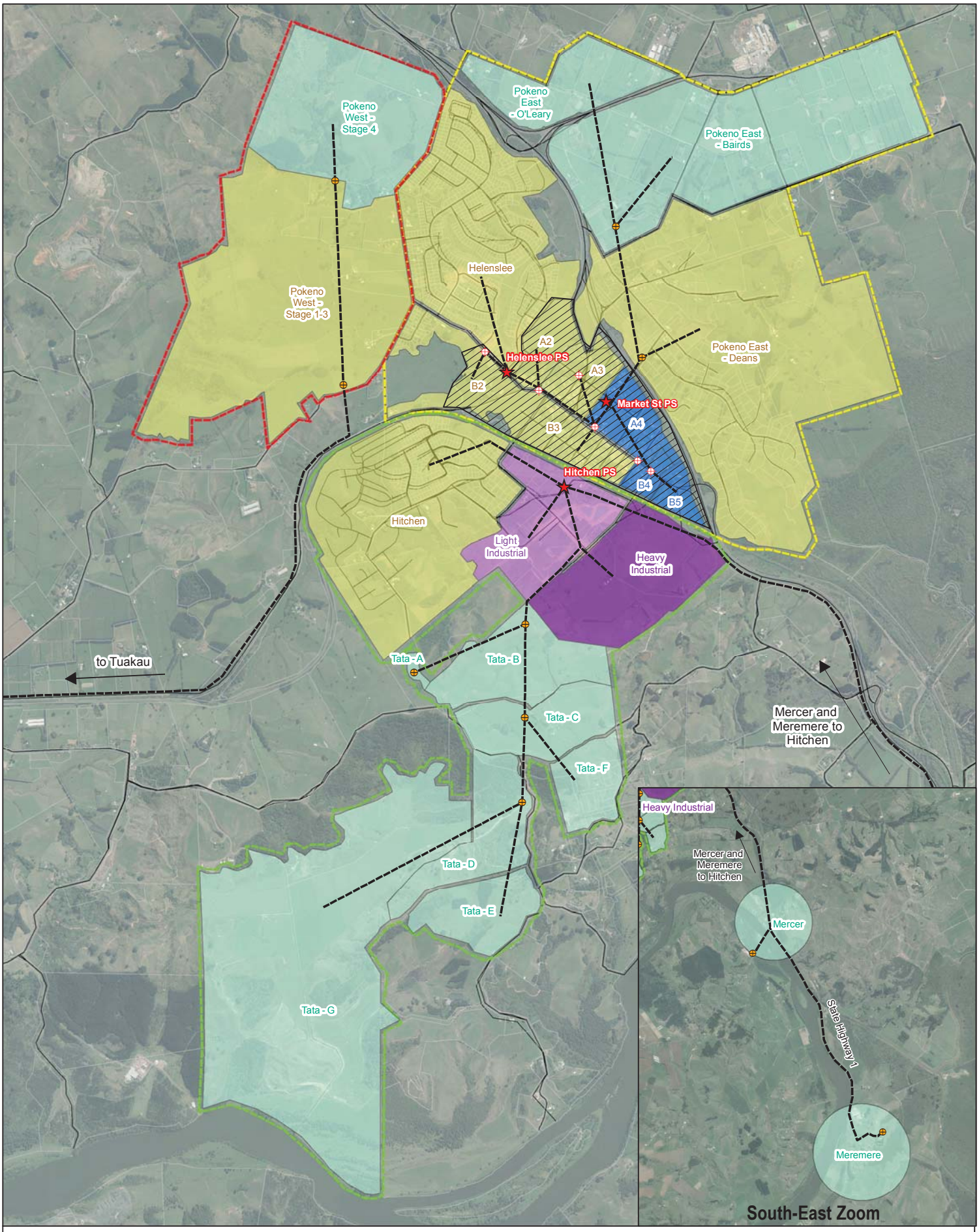
The key assumptions listed in Section 6 above should be reviewed at regular intervals.

The projections can be used to develop a servicing strategy and proposed infrastructure upgrade packages.

Regards

Tony Miller
Technical Director - Water & Civil

Appendix A Figure 1 Catchment Overview



NOTES:
Map and information is based on interpretation of developer information. Actual development and timing is likely to change.

Paper Size ISO A3
0 0.5 1
Kilometers
Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Waikato District Council

Pokeno Wastewater Subcatchments

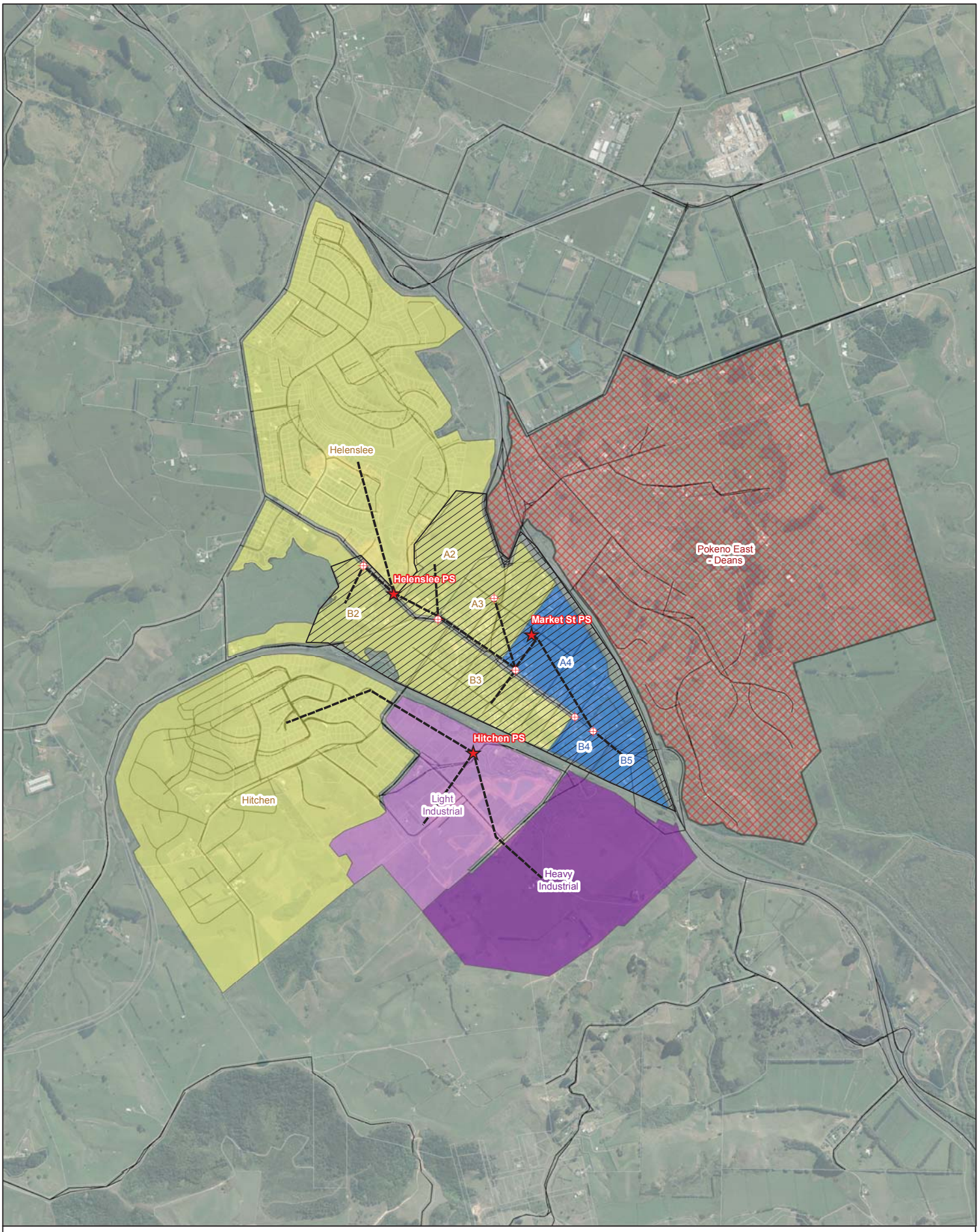
Project No. 51-38070
Revision No. 0
Date 11 Oct 2018

Figure 1

N:\NZ\Auckland\Projects\51\37984\GIS\Maps\Deliverables\5137984_Z001_Pokeno_WW_Subcatchments_20181011.mxd

Source: Linz: Roads, Properties Boundaries - 2018, Aerials - 2012; GHD: Future Anticipated Nodes, Existing Wastewater Manholes, Wastewater Pump Stations, Subcatchment Discharge Indicators, Pokeno Township, Discharge WWPS Areas, Subcatchment Zones - Oct 2018.

Appendix B Figure 2 Operative District Plan Zones



NOTES:
Map and information is based on interpretation of developer information. Actual development and timing is likely to change.

Paper Size ISO A3
0 250 500
Meters
Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Waikato District Council

Pokeno
Operative District Plan Zoning

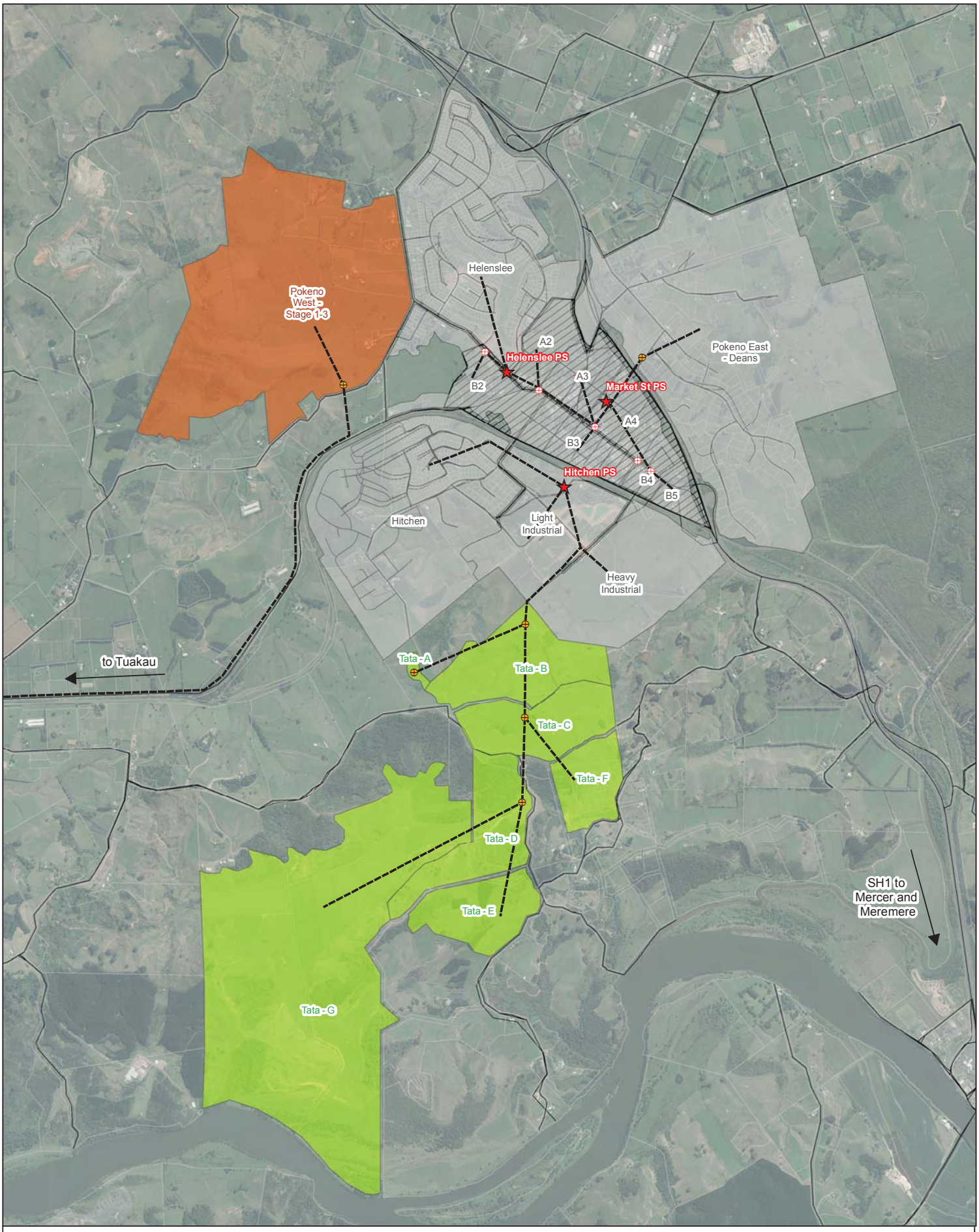
Project No. 51-38070
Revision No. 0
Date 11 Oct 2018

Figure 2

N:\NZ\Auckland\Projects\51\37984\GIS\Maps\Deliverables\5137984_Z002_Operative_District_Plan_Zoning_Subcatchments_20181011.mxd

Source: Linz: Roads, Properties Boundaries - 2018, Aerials - 2012; GHD: Future Anticipated Nodes, Existing Wastewater Manholes, Wastewater Pump Stations, Discharge Indicators, Pokeno Township, Operative District Plan Zones - Oct 2018.

Appendix C Figure 3 Proposed District Plan Zones



NOTES:
Map and information is based on interpretation of developer information. Actual development and timing is likely to change.

Paper Size ISO A3
0 250 500
Meters
Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

Waikato District Council

Pokeno
Proposed District Plan Zoning

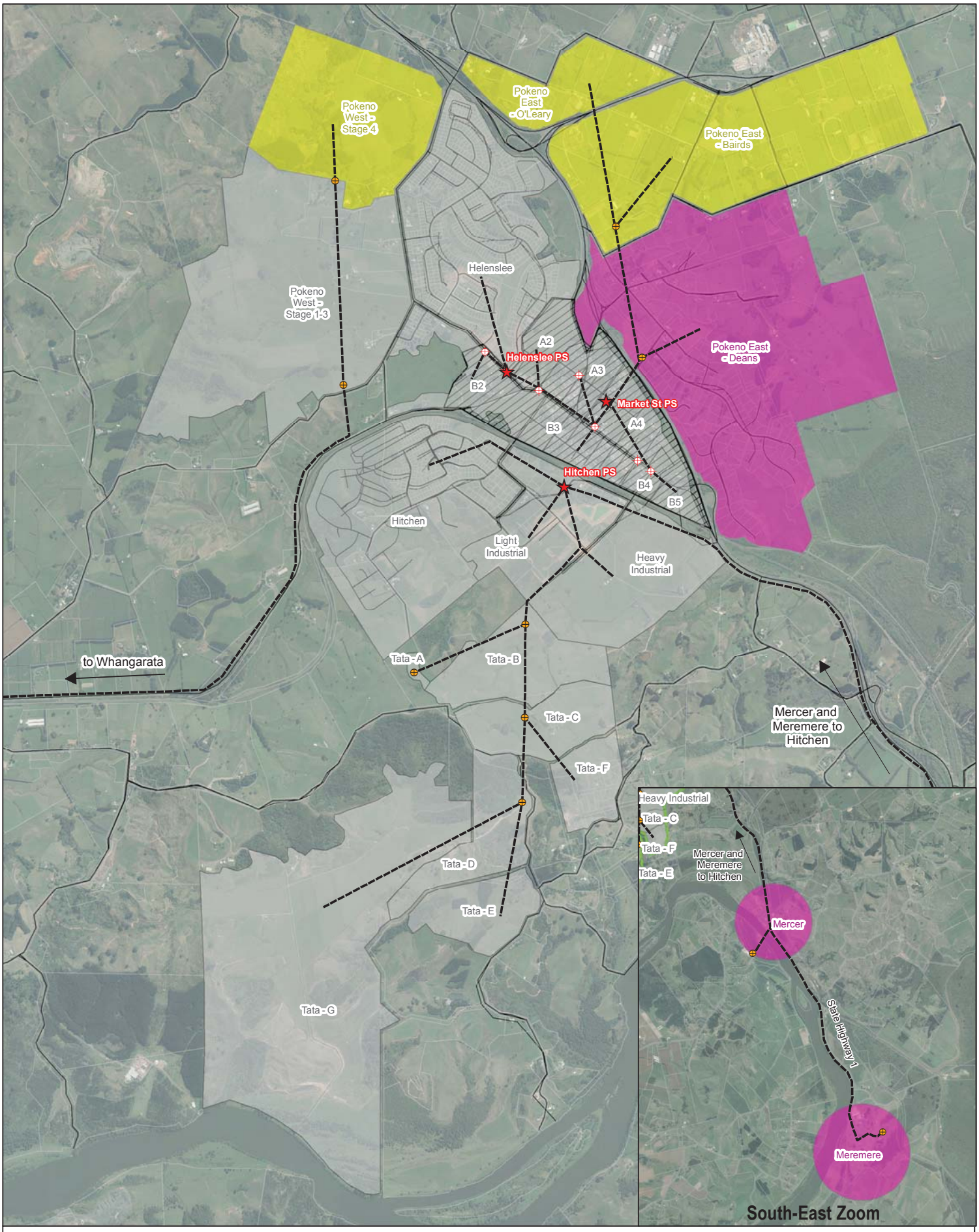
Project No. 51-38070
Revision No. 0
Date 15 Oct 2018

Figure 3

N:\NZ\Auckland\Projects\51\37984\GIS\Maps\Deliverables\5137984_Z003_Proposed_DP_Zoning_20181011.mxd

Source: Linz: Roads, Properties Boundaries - 2018, Aerials - 2012; GHD: Future Anticipated Nodes, Existing Wastewater Manholes, Wastewater Pump Stations, Discharge Indicators, Pokeno Township, Proposed District Plan Zones - Oct 2018.

Appendix D Figure 4 Potential Future Urban Zones



NOTES:
Map and information is based on interpretation of developer information. Actual development and timing is likely to change.

Paper Size ISO A3
0 0.5 1
Kilometers
Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Waikato District Council

Pokeno
Potential Future Urban Zones

Project No. 51-38070
Revision No. 0
Date 11 Oct 2018

Figure 4

N:\NZ\Auckland\Projects\51\37984\GIS\Maps\Deliverables\5137984_Z004_Potential_Future_Urban_Zones_20181011.mxd

Source: Linz: Roads, Properties Boundaries - 2018, Aerials - 2012; GHD: Future Anticipated Nodes, Existing Wastewater Manholes, Wastewater Pump Stations, Subcatchment Discharge Indicators, Pokeno Township, Potential Future Urban Zones - Oct 2018.

APPENDIX

iii) GHD technical memo from Tony Millar to Richard Pullar with subject of “Pokeno W&WW Planning – Technical memo – Population, Growth & Planning”, dated 22 January 2019.

Memorandum

22 January 2019

To	Richard Pullar		
Copy to	James Peveril, Simon Wang, Robert White		
From	Tony Miller	Tel	0274721393
Subject	Pokeno W&WW Planning - Tech Memo - Population, Growth & Planning	Job no.	51/37984/

1 Purpose and Structure

1.1 Purpose

Waikato District Council (WDC) has commissioned GHD to develop a Wastewater Servicing Strategy for the Pokeno area.

This Technical Memo documents the methodology, assumptions and outcomes associated with the development of the strategy, with which to update the long-term wastewater planning capital works for Pokeno.

The planning horizon for this assessment is 2018 (present) to 2034+, to cover the next Long-Term Plan period.

1.2 Structure

This memo is structured as follows:

1. Purpose
2. Background
3. Existing Wastewater Network and Current Capacity
4. Servicing Strategy
5. Risks and Opportunities
6. Next Steps

GHD Limited
GHD Centre Level 3 27 Napier Street Freemans Bay Auckland 1011 PO Box 6543 Wellesley Street Auckland 1141 New Zealand
T +64 9 370 8000 **F** +64 9 370 8001 **E** aklmail@ghd.com **W** www.ghd.com

2 Background

2.1 Pokeno Growth

The Pokeno / Tuakau area was previously part of Franklin District Council (FDC). As part of the Auckland Council amalgamation into a Unitary Authority, the northern part of the FDC area was included into the wider Auckland Council. The remaining area including Pokeno and Tuakau was transferred to Waikato District Council.

Pokeno, prior to 2011, consisted of approximately 150 existing houses, gas station, ice cream shop, and café. There was no public wastewater system, with dwellings and shops served by septic tanks and other on-site treatment methods.

The Dines Fulton Hogan JV (DFH) sought a private plan change (Plan Change 24) for the development of 460 ha into approx. 2,000 houses including a town centre and an additional 87 ha of industrial land. This Plan Change 24 was granted in Dec 2008 by FDC. As part of the transfer process from Auckland Council to Waikato District Council, the FDC Plan Change 24 was adopted by Waikato District Council.

Pokeno has since experienced significant growth in the Helenslee catchment to the north of the township.

Recent population growth in the Auckland and Waikato regions is influencing demand for housing in the Pokeno area, with a number of large developments planned and in progress.

GHD has been involved in growth planning for Pokeno since 2011 and has established a thorough understanding of the development aspirations for the area.

2.2 Growth Projection

Projected population growth and the resulting wastewater flows from the Pokeno catchment are documented in GHD's '*Tech Memo – Growth: Population and Flows*', October 2018.

This wastewater servicing strategy is based on providing wastewater infrastructure to cater for the projected growth. Projections should be reviewed against actual growth and the latest development estimates on a regular basis to ensure that the strategy remains up to date.

The *Growth: Population and Flows* memo includes catchment descriptions and diagrams illustrating the various 'sub-catchments' that make up the Pokeno area.

A Tuakau Catchment Plan has been developed to illustrate projected growth in the Tuakau area that will contribute to the Tuakau assets that convey Pokeno wastewater flows. A copy of this plan is included in **Appendix B**.

3 Existing Wastewater Network and Current Capacity

3.1 Network Components

The existing Pokeno wastewater network can be divided into four main components:

- Hitchen Pump Station and Rising Main
- Market Pump Station and Rising Main
- Bollard to Tuakau Gravity Sewer
- Tuakau Pump Station to Pukekohe WWTP

These components are described in further detail in the sections below.

The wastewater network configuration and location of assets is illustrated in the Wastewater Network Overview Map in **Appendix A**.

3.2 Network Configuration

The configuration of the existing network can be summarised as follows:

1. Hitchen Pump Station transfers flows from the Hitchen residential and industrial catchments to Market Pump Station;
2. Market Pump Station transfers flow from the Pokeno Township and Helenslee catchments, plus flows received direct to Hitchen Pump Station, to the head of Bollard Road Gravity Main at the intersection of Whangarata Road and Bollard Road;
3. Flows gravitate down the Bollard Road Gravity Main and Kowhai Street Gravity Trunk Sewer to the Tuakau Pump Station;
4. Tuakau Pump Station lifts flows received from Pokeno and small local catchments to the head of the Buckland Road Gravity Main at 36 Buckland Road. This main discharges in to the Watercare Interceptor at 2289 Buckland Road. The interceptor conveys flows to the Pukekohe wastewater treatment plant.

3.3 Hitchen Pump Station and Rising Main

A visual representation of the existing capacity vs. anticipated flows can be seen in Figure 1 in Section 4.6.1 below.

3.3.1 Asset Description

Sub-components:

- Hitchen Pump station, located at the end of William McRobbie Road, just west of the rail corridor.
- Rising main to Market Pump Station, crossing a small watercourse and the rail corridor.

Hitchen Pump Station consists of the following:

- Satellite manhole: 1800 mm diameter and ~5 m deep,
- Wet well: 1800 mm diameter and 7.0 m deep,
- Pumps: 2 of 5.7 kW operating as duty/standby,
- Rising main: 566 m long, DN 200 mm PE100 PN12.5 from Hitchen Pump Station to Market Pump Station,
- Fibre communication: DN63 mm PE duct between the pump stations, and
- Storage: 4 No. 63 m³ fibreglass tanks to give a total emergency storage of 255 m³ plus the storage in the wet well and incoming pipework and manholes (equivalent to 6 hours Average Dry Flow). The 6 hours storage requirement was defined in the HCDM[1]. It was identified that once the ADWF exceeded 12 L/s then additional storage would be required.

Since the design was completed in 2013 and 2015, the controlling document was the HCDM. WDC has since adopted the ITS which has some design requirement modifications. The most noticeable is the increase in emergency storage in the ITS document to 9 hours ADWF including GW Ingress.

[1] HCDM – Hamilton City Design Manual

A concept design for an EssFlow[2] system was allowed for in the original pump station design, which was partially constructed in 2013. This would cater for an additional 500 m³ of storage in below and above ground storage. The design allowed for future construction of this facility as demand for storage increased.

3.3.2 Existing Capacity

Hitchen pump station and rising main has a capacity of 27 L/s with the installed pumps. If the pumps are operated as duty/assist the flows increase to 32 L/s.

Transfer of flow from Hitchen to Market Pump Station can be blocked when levels are high in the Market wet well.

During power cuts or when the blocking command is enacted, overflow will occur first into the emergency storage then overflow to the adjacent Tani Te Whiora Stream.

3.3.3 Wet Industry (Yashili Dairy Factory)

Yashili Dairy Factory has consent to discharge up to 1,150 m^3/day (average discharge rate of 13.3 L/s) to the Pokeno wastewater network.

Current average (2018) production rates for wet industry discharge at Yashili is generally between 600 to 900 m³/day. This flow is expected to increase to the consented limit with a planned increase in production before 2022.

Flow from Yashili is controlled based on the level in Market Pump Station. When the level in the Market wet well is high, flow from Yashili is blocked and contained within their on-site storage.

Yashili are currently planning for an additional process to produce UHT Milk. Their waste production is expected to increase further up to a total of 2,800 m³/day or for an average discharge of 29.5 L/s by the early or mid 2020's.

A dedicated DN200 mm PN12.5 rising main transfers industrial flows from the Yashili factory waste process plant at the south eastern corner of their site to the Hitchen Pump Station. At the Yashili plant there is storage associated with the DAF treatment plant, plus working storage to assist with balancing flows:

- Two of 400 m³ pre-treatment storage tanks, and
- One 1400 m³ balancing storage.

The rising main from Yashili discharges-directly into the Hitchen rising main. It is noted that the main from the Yashili site to Hitchen pump station rising main is a public asset owned by WDC, but it is not recorded on the Council GIS system.

The capacity of the Hitchen Pump Station reduces to approximately 17 L/s (from 27 L/s) when Yashili is discharging at a rate of 14 L/s.

Domestic waste from Yashili (i.e. from showers, kitchens, and bathrooms) is conveyed in the public wastewater gravity network.

[2] EssFlow – Proprietary system of use of combined below ground storage and treatment discharging to larger above ground storage facility

3.4 Market Pump Station and Rising Main

A visual representation of the existing capacity vs. anticipated flows can be seen in Figure 2 in Section 4.6.2 below.

3.4.1 Asset Description

Sub-components:

- Market Pump Station, located at 37 Market Street.
- Twin rising mains to the head of the Bollard Road gravity main, which follow a Market Street – Pokeno Road – Whangarata Road alignment. The rising mains are 160 mm DN and 280/315 mm DN PE pipes respectively, with varying pressure ratings.

Market Pump Station consists of the following:

- Satellite manhole: 2050 mm diameter and ~5 m deep
- Wet well: 3000 mm diameter and 7.25 m deep
- Pumps: two pairs of twin 119 kW pumps operating in series, (duty / standby).
- Rising main 1: 6785 m long, DN 160 mm PE100 pipeline from Market Pump Station to Bollard Road. This main has pipe classes of PN16, PN12.5 and PN10.
- Rising main 2: 6,800 m long, PE100 pipeline from Market Pump Station to Bollard Road. This main consists of 2433 m of DN280 with pipe classes of PN16 and 12.5 and the balance of 4367 m of DN 315 of PN10.
- 11 kV transformer and dedicated power supply. The original supply was for 400 amps.
- Storage: 4 No. 63 m³ fibreglass tanks to give a total emergency storage of 255 m³ plus the storage in the wet well and incoming pipework and manholes. As for Hitchen, the station emergency storage was designed under the HCDM standard, which required a 6-hour emergency storage of ADWF.

Once the storage volume is exceeded then overflow will occur to the Helenslee Stream.

3.4.2 Existing Capacity

The capacity of the existing Market Pump Station has been calculated using Colebrook White formula with a roughness of 0.3 mm. The flows have also been measured in the field and are recorded in Table 1 below.

Table 1 Flow rates from Market Street Pump station

Scenario	Theoretical flow rate	Theoretical head	Measured flow rate	Measured head
Single DN160 rising main with one pump set at 50 Hz	15 L/s	112 m	18 L/s	105.1 m
Single DN160 rising main with one pump set at 60 Hz[3]	20 L/s	162 m		
Single DN280/315 rising main with one pump set at 60 Hz	87 L/s	134 m	T1 - 71.3 L/s T2 - 71.3 L/s	124.5 m 124.5 m
Single DN280/315 rising main with two pump sets at 60 Hz	95 L/s	151 m		

[3] This is a potentially unsafe mode of operation as the peak head is above the pipe class

Scenario	Theoretical flow rate	Theoretical head	Measured flow rate	Measured head
Dual DN280/315 & DN160 rising main with one pump set at 50 Hz	(64 & 13.2) 77.2 L/s	94 m	T3 – 61 L/s	86.7 m
Dual DN280/315 & DN160 rising main with one pump set at 60 Hz	(84.5 & 17.2) 101.7 L/s	128 m	T4 - 86.9 L/s	117.3 m
Dual DN280/315 & DN160 rising main with both pump set at 60 Hz	(94 & 18) 112 L/s	147 m		

Following discussion with Nathan Shaw at HAL we record the following comments:

- Magflow meter on DN160 rising main is potentially over reading by 30 - 50%
- There is reasonable correlation between pressure gauges on RM1 and RM2. However, the theoretical pressure is not being achieved. This may indicate impellor wear.
- The pump runs at 60 Hz have been relatively short. Thus slime shear may not be being achieved over full length of rising main leading to increased roughness and decreased flow.
- HAL have back calculated the Colebrook White friction coefficient and advise their value is 0.55mm. GHD have used 0.3mm in our analysis.

Further testing will be required to confirm whether these pump rates are achievable.

3.5 Bollard to Tuakau Gravity Sewer

A visual representation of the existing capacity vs. anticipated flows can be seen in Figure 3 in Section 4.6.3.

3.5.1 Asset Description

Sub-components:

- Bollard Road gravity main (falling main), from the intersection with Whangarata Road ("Bollard High") to the head of the Kowhai Street trunk sewer, located near the intersection of Bollard Road and Tuakau Saleyard Road ("Bollard Low");
- Kowhai Street trunk sewer, from the Bollard Road gravity main to the Tuakau Pump Station.

The Bollard Road gravity main is 1400 m long, DN 355 mm PE100 and PN10 falling main (i.e. no inflows other than from the Pokeno rising main – with no manholes along its length). There is a pig-receiving manhole on Whangarata Road at the end of Bollard Road. This pipe has a downhill grade varying between 0.5% and 5%.

The Kowhai Street trunk sewer is a 450 mm concrete sewer line, designed to take flow from Pokeno, plus a large development area to the north east of Tuakau. The last portion of this line increases to DN 525 mm. The soffit of this larger pipe is below the pump 'On' level, so fills with each pump cycle.

3.5.2 Existing Capacity

The theoretical capacity of the assets is:

- Bollard Road gravity main: The theoretical capacity of this falling main is 105 L/s without surcharge and is based upon pipe capacity at the shallowest gradient of 0.5%. Surcharge on this line is possible before spilling will occur at the higher end of the pipeline. In this case, the potential capacity would be approximately 180 L/s (however, minor works would be required to manage air issues).

- Kowhai Street trunk sewer (450mm @ 0.5%): ~237 L/s

3.6 Tuakau Pump Station to Pukekohe WWTP

3.6.1 Asset Description

Sub-components:

- Tuakau Pump Station, located off Kowhai Street in Tuakau township
- Rising main to the Buckland Road gravity main
- Buckland Road gravity main
- Watercare Interceptor

Tuakau Pump Station consists of the following:

- Wet well: 3 m diameter and 7.1 m deep
- Two existing pumps of 57 kW each, with pumps operating as duty / assist, with space for a third stand-by pump to be installed,
- Rising main: 1050 m long, DN 355 mm PE100 PN16 pipeline from Tuakau Pump Station to the Buckland Road gravity main.

Buckland Road gravity main is a DN375 mm PVC pipe. This pipeline varies in gradient with the first section at a gradient of 1% controlling the maximum flow conveyance to ~250 L/s. Later sections of the line are steeper and thus have a higher conveyance potential.

The Watercare Interceptor is a DN 525 mm concrete pipe. We have no As-Built data for this pipeline, nor the connections and restrictions into the Pukekohe WWTP.

3.6.2 Existing Capacity

The theoretical capacity of the assets is:

- Tuakau Pump Station and rising main, with existing 57 kW pumps running at 52Hz: 100 L/s.
- It is proposed to upgrade the pumps to NP3315, 119 kW operating up to 60 Hz. These new pumps can push up to 160 L/s through the existing rising main.
- Buckland Road gravity main: initial critical grade for 350 m of 1.0% and its associated capacity of 216 L/s. The slope increases to 1.4% and 2.4% and steeper before the discharge to Watercare trunk interceptor. The associated capacity also increases to 250 L/s at the change in gradient to 1.4%.
- Watercare Interceptor: based on the following:
    - 105 m of 450 mmø pipe with a gradient of 0.48%. This line has a nominal capacity or 230 L/s.
    - 1233 m of 525 mmø pipe with a gradient of 0.22%. This line has a nominal capacity or 234 L/s.
    - This information has been derived from the Watercare GIS system and needs to be confirmed.
- The hydraulic capacity of the WWTP and any backwater effect that the plant may push back to the incoming sewer needs to be checked also. A logical solution may be to increase pumping capacity at the receiving end of the WWTP process.

3.7 Discharge to Pukekohe WWTP

Wastewater from the Pokeno area is treated at Pukekohe WWTP, located off Parker Lane off Buckland Road. The plant has been operational for many years.

The plant is subject to a $150 M upgrade which it is understood is due for completion in 2022. This will have the capacity to treat an additional 50,000 m³/day.

We are not aware of a formal commercial agreement between WDC and Watercare to discharge to the WWTP. We strongly recommend that WDC instigate conversations with Watercare and develop a discharge agreement, in order to ensure the ongoing viability of servicing the Pokeno area.

3.8 Capacity Summary

The capacity of the existing Pokeno wastewater network is summarised in Table 2 below.

Table 2 Summary of Existing Network Capacity

Asset	Theoretical Capacity (l/s)	Current restriction
Existing Hitchen PS (without Yashili discharging)	27/32	Pumps
Hitchen to Market Rising Main	60	Pumps
Existing Hitchen PS and Rising Main (with Yashili discharging at 14 L/s)	17	Pumps
Market PS through existing 280/315 Rising Main only	87	Rising mains Measured at 71 L/s
Market PS through existing 280/315 and 160 mm Rising Mains	102	Rising mains Measured at 87[4] L/s
Bollard Road Gravity Main	105 – 180	Pipe at minimum grade of 0.5% With surcharge potential capacity
Kowhai Street Trunk Sewer	237	Pipe (450 mm ø at 0.5%)
Tuakau PS to Buckland Road	100	Pumps Measured at 105[5] L/s
Buckland Road Gravity Main	216	Pipe
Watercare Interceptor from Buckland to WWTP	~240	Pipe

[4] As from above, the observed flow rate through the 166 mm pipe magflow may be over reading by 30 – 50% making the observed flow down by ~6 L/s.

[5] Flow rate observed during pump trials was 105L/s. This reading was taken some two weeks after dual pumping at 52 Hz. We thus expect that significant slime shear has taken place and this is the new pipe capacity with the current pumps.

4 Servicing Strategy

4.1 Overview

This servicing strategy has been developed to inform infrastructure planning and capital expenditure forecasting. The proposed 'upgrade packages', and the sequencing of these upgrades, have been selected based on ensuring that sufficient capacity is available in the wastewater network at the right time period, to enable residential, commercial and industrial growth in the Pokeno area.

For the purposes of strategy development, the Pokeno wastewater network is divided into four main 'components'. For each component, the current capacity has been determined based on the capacity of its sub-components (assets).

4.2 Options considered

In determining an upgrade strategy to deal with increasing flows we have assessed a variety of options. In general these are related to:

4.2.1 Original Option

Upgrade the Market Street rising main to deal with transferring all flows from Pokeno to Whangarata. In summary, this strategy had a limit of ~200+ L/s with an upgrade of the rising main. This strategy also requires transfer of flows from the high waste generating Pokeno base dairy factories together with future flows from Meremere/Mercer all to the Market Street Pump Station.

4.2.2 Alternative Option

An alternative strategy was developed whereby a new "Hitchen 2" pump station and new rising main would be constructed in stages. There is potential that the construction and commissioning of this new station can be put back to ~2022 by utilising the new rising main but pumping from Market Street Pump Station in the short term. This new Hitchen 2 Pump station would have an initial capacity of 220 to 250 L/s but subject to detailed design and conformation following further modelling.

Predicted peak inflows to Pokeno are expected to exceed 250 L/s in 2028. Pokeno West is predicted to contribute approximately 41 L/s of PWWF. Pokeno West would utilise the old 280/315 rising main. By 2033 the PWWF to Pokeno (less Pokeno West) would exceed 200 L/s. Thus additional capacity in the Hitchen 2 pump station would be required following 2033. The ultimate capacity of the Hitchen 2 Station needs to be allowed for in the initial design but can be staged to allow the ultimate capacity to exceed 250 L/s rate from 2033 onwards.

The Hitchen 2 pump station would be located on the land immediately beside the existing Hitchen 1 pump station site.

Based upon this new Hitchen 2 pump station then the logical choice would be to route flows from Meremere/Mercer all to the new pump station. Interlink controls would be required to block flows from the south when the capacity of Hitchen 2 is nearing capacity. This strategy would require storage at Mercer and/or Meremere or at a location just before discharging to Hitchen 2 where flows could be stored and released by gravity down to the new Hitchen 2 station[6].

This alternative strategy also preserves the value of the Market Street station for use past say 2030 – 2035 when Pokeno East flows are expected to increase dramatically. In this case a new rising main from Market to Whangarata would be required.

[6] A potential site could be on adjacent to Pioneer Road to the south of Pokeno, above and adjacent to the motorway where drainage by gravity to Pokeno could be achieved.

4.2.3 Recommended Option

The alternative strategy identified in Section 4.2.2 above is recommended.

Asset upgrades have been developed to address servicing needs. In order to minimise construction of short-term assets and provide best value to WDC, the following over-arching direction has been adopted:

- Maintain flows from Market to Tuakau in the short term. Increase capacity in the lines by:
    - Using both 160 and 280/315 rising mains,
    - Reduction in rising main length initially by construction of a new gravity sewer from Whangarata to Bollard Low,
    - Installing part of the new Hitchen 2 rising main from Munro Road to Whangarata/Rail. This interim solution still uses the Market Street Pump Station. The benefit of this phase reduction in friction head out of Market due to a large diameter rising main. The reduction in friction head allows a greater flow rate from the Market St Pump Station.
- Hitchen 2 pump station will service the majority of flows from the Pokeno sub-catchments in the mid to long-term, as new residential areas are developed and new wet industry flows comes online in the Hitchen catchment together with anticipated flows from Mercer and Meremere (2026);
- Hitchen 2 pump station will be the primary station for transfer of flows to Tuakau and onwards to the WWTP (The Hitchen 2 Pump Station has a larger potential catchment than Market Street);
- The pumping philosophy will switch to a Market to Hitchen approach, rather than the current Hitchen to Market arrangement. The existing rising main between Hitchen to Market and proposed Synlait rising main will be re-used, with flows pumped in the opposite direction.
- In the long term (2034+) there is potential to re-liven Market to Whangarata Rail pump station and the associated rising main upgrade if development east of motorway continues as predicted.
- The flows from the new Pokeno West development area can be accommodated from a new pump station but utilising the existing 280/315 rising main along Pokeno Road from Munro to Whangarata.

4.3 Pumping of Peak flows

Traditional pump station design has been to pump at the peak sewer arrival rate at each pump station. This philosophy of design is also set out in the ITS standards. If the peak pump rate cannot match the arrival rate, then internal storage within the pump station is used until overflows occur to the emergency storage and if these exceed the capacity of the storage, then overflows will occur to the environment.

There is an alternative strategy whereby pumping rates do not meet the peak arrival rates and operational storage is provided for the time the peak exceeds the pump out rate plus the time to empty the storage.

The pump out rate must always exceed the average arrival rate, otherwise storage would need to be infinite.

Operational storage generally needs to be in excess of emergency storage. However, for short term situations it may be possible to utilise emergency storage as operational storage.

4.4 Development of Design Flows

This assessment of the flow rates arriving at key assets is based on the over-arching strategy that Hitchen 2 Pump Station will become the primary means of transferring wastewater from Pokeno to Tuakau in the future.

Average Dry Weather Flow (ADWF) and Peak Wet Weather (Peak) flow rates have been calculated for each of the network components.

The flow rates include predicted residential growth and wet industry development and have been calculated using the methodology and catchment flow data documented in the *Growth: Population and Flows* memo. The build-up of flow rate over time is illustrated in the series of figures below.

4.5 Storage

Storage comes in a range of applications. These include:

- Wet well and associated upstream pipework,
- Use of constructed emergency storage,
- Use of constructed process storage in the private processing at the dairy factory pre-treatment plants,
- New dedicated operational storage facilities including:
    - Expanded below ground emergency storage
    - Essflow-type covered storage, pre-treatment and overflow facilities to larger above ground storage

In Figure 1 to Figure 6 below there is a general increase in PWWF based upon our population and flow projections (blue line). The existing pumped capacity is represented by a red dashed line. Where the blue line raises above the red dashed line, the inflow exceeds pumped out capacity.

In order to avoid overflows (either to the environment or to emergency storage) we need to:

- Upgrade the pumped capacity, or
- Use emergency storage (short term only) or
- Use new working constructed storage.

PWWF occur for a limited duration from 6 – 12 hours. If storage of the difference between PWWF and pumped capacity is possible, then no overflows will occur. The pumped rate always needs to exceed the ADWF plus a margin to allow for emptying of the storage used during wet weather events.

In Figure 5 below we have indicated where operational storage can be successfully used to delay significant upgrades the downstream infrastructure (where capacity is not sufficient to convey the peak wastewater arrival rate).

In Figure 5 below the shortfall in pumping capacity is 40 L/s. If this flow were to occur for 6 hours the flow volume is 864 m^3. Thus storage forms an essential part of the sewer pumping strategy. This storage will be made up in part from forced storage at the industrial dairy factories but also storage at the Hitchen Road site. This would be either, using the existing emergency storage or a new constructed working storage facility.

4.6 System Capacity

4.6.1 Existing Hitchen Pump Station

The following graph shows the predicted inflows to the Hitchen pump station and the current pump capacity from Hitchen to Market

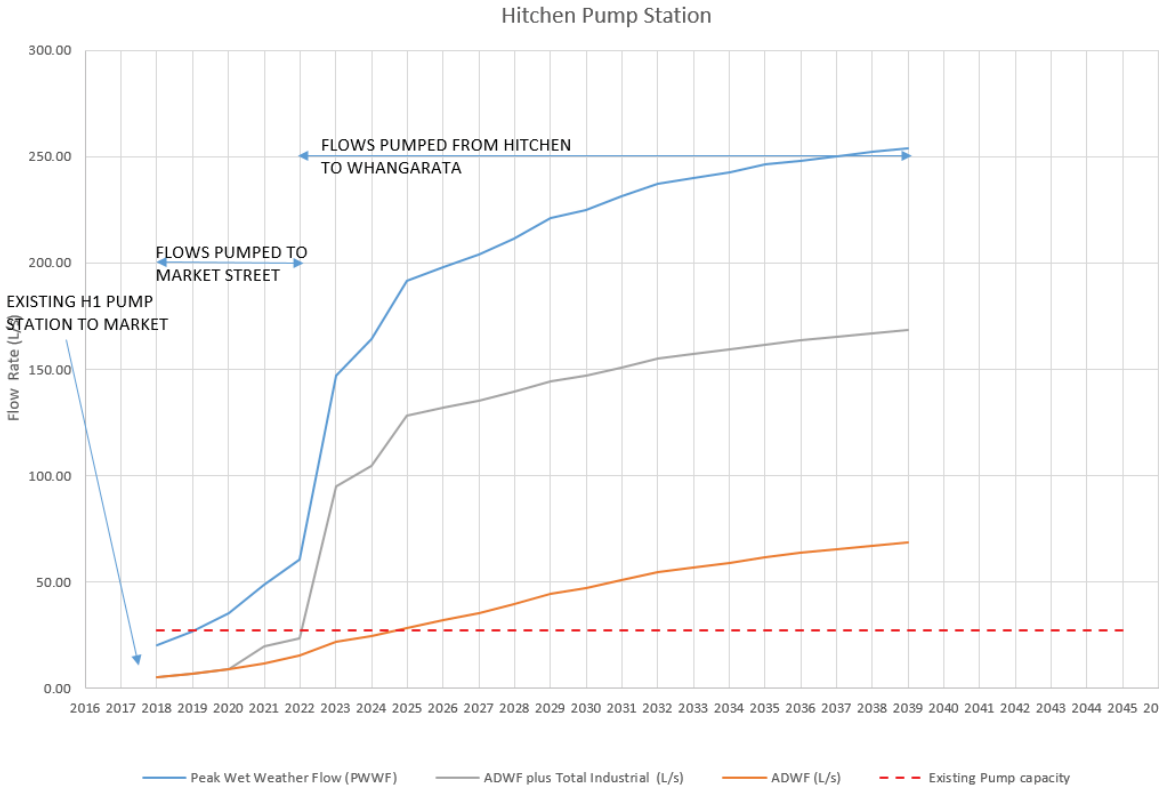


Figure 1 Hitchen Pump Station and Rising Main

Figure 1 above shows:

- ADWF (orange),
- ADWF plus industrial wet industries (grey) and
- PWWF (blue).
- The dashed red is the existing capacity of the existing Hitchen (1) pump station.

The reason for the big increase in inflows from 2023, is that these flows include:

- Market to Hitchen 2 flows
- Diversion of all industrial flows to the new Hitchen 2 pump station (to be commissioned by 2022)
- Flows from Mercer/Meremere by 2026

4.6.2 *Existing Market Pump Station*

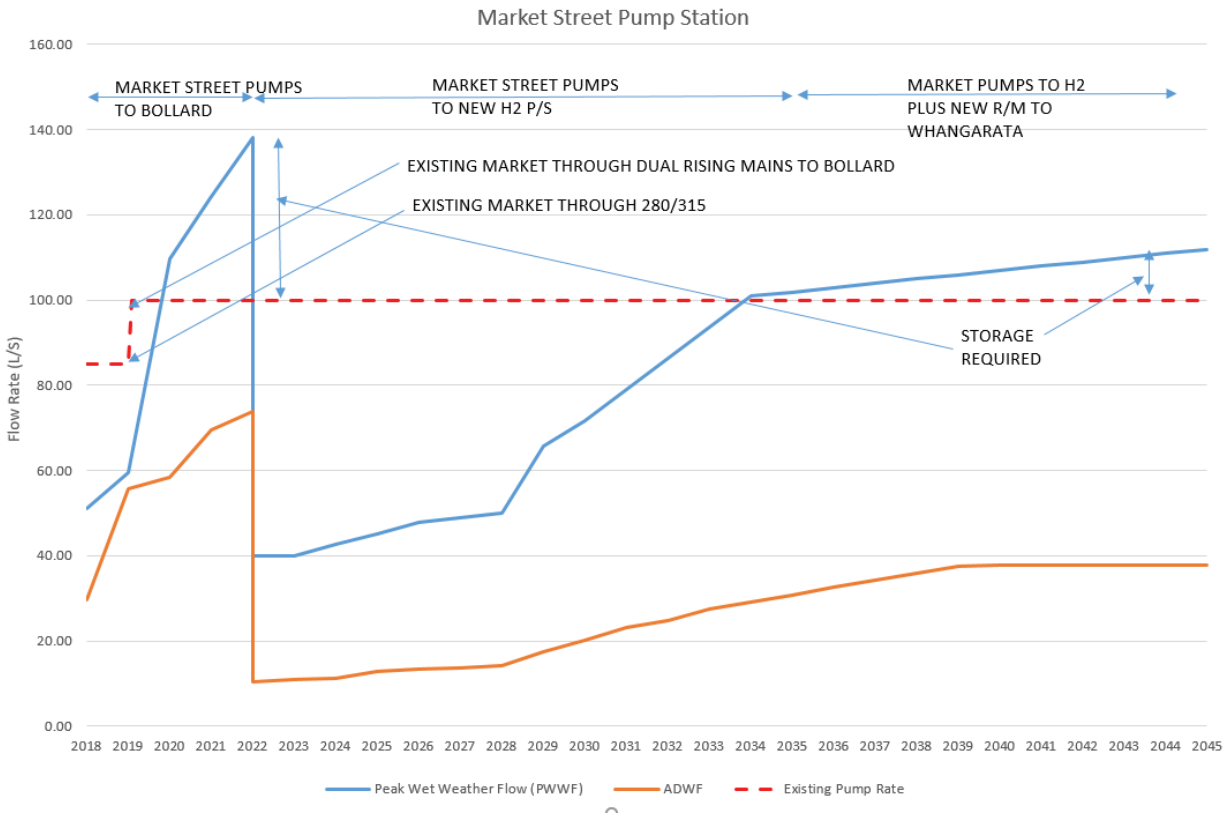


Figure 2 Market Pump Station and Rising Main Peak Flow

The reduction in inflows in 2022 shown in Figure 2 above is as a result of the strategy to build Hitchen 2 pump station and divert flows to that station.

Based upon our spreadsheet modelling, Hitchen 2 would be commissioned by 2022 and the reduction in 2022 reflects that flows from Hitchen 1 and from the industrial consumers will now be diverted directly to Hitchen 2, instead of being pumped out of Market.

From 2019 to 2020, the peak flows to Market will exceed 100 L/s, which is the nominal capacity of the rising main from Pokeno to Bollard. The Whangarata line to Bollard Road pipeline is required by mid 2020. This will allow an approximate increase of another 10 L/s.

The theoretical pumped capacity from Market is 100 L/s whereas the measured flow rate is 89 L/s. This uncertainty needs to be resolved.

Storage of 30 – 40 L/s is required. This relates to 648 to 864 m³ for a 6 hour storm. There is potential to manage temporary or working storage of waste at the Hitchen P/S site and at the industrial plant storage facility.

4.6.3 *Existing Tuakau Pump Station*

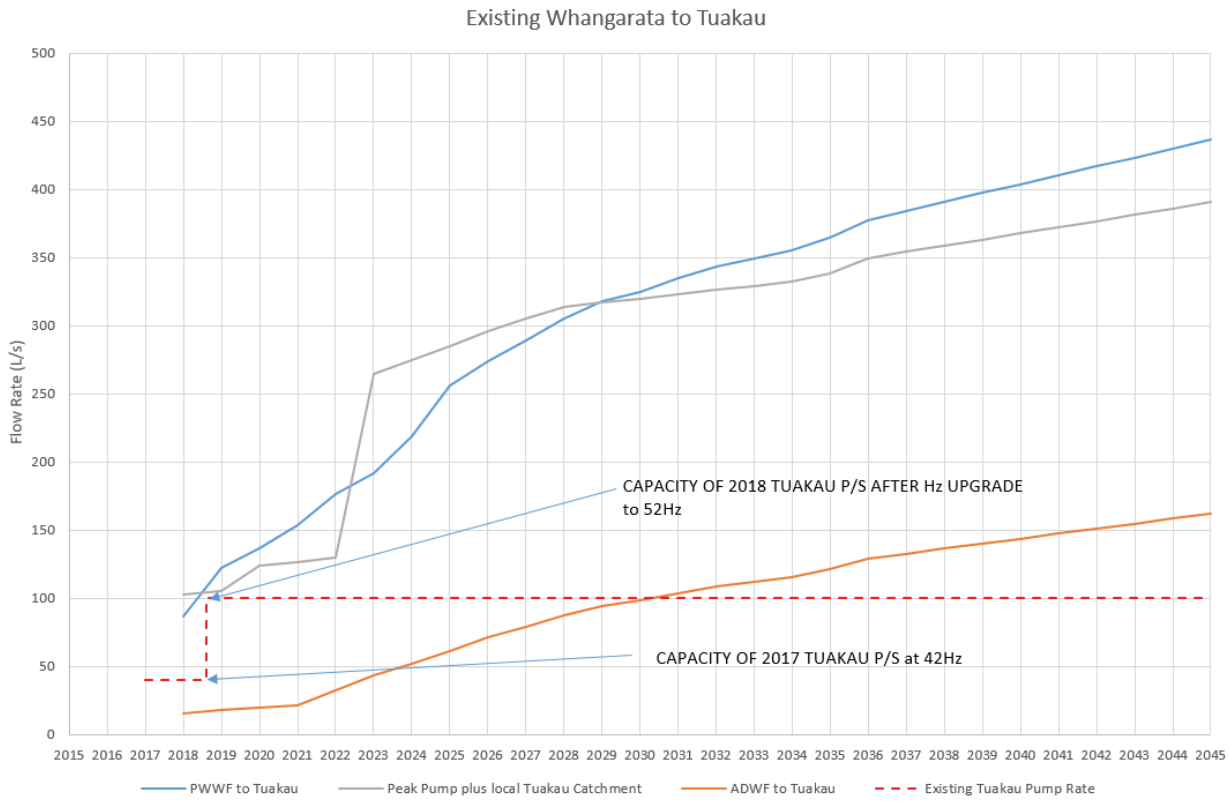


Figure 3: Whangarata to Tuakau Pump Station Peak Flow

In Figure 3 above the lines are representation of:

- Orange: ADWF in upstream pump stations being transferred to Tuakau. This includes the local Tuakau catchments including the Whangarata Business Park.
- Blue includes for the same but for PWWF.
- Grey includes for peak pump rates from Market, Hitchen 1 or Hitchen 2, Pokeno West and ADWF from the local Tuakau catchments.
- Red dashed is the current pump out rate from Tuakau (i.e. 100 L/s).

Of note in Figure 3, is the existing capacity of the 450 concrete Tuakau interceptor between 'Bollard Road Low' and the pump station. This line has a capacity of 235 L/s. The catchment for this line comes from Pokeno, Whangarata Business Park and new Tuakau development to the north of the rail line. The capacity of this line is likely to be exceeded by 2024 to 2025. Thus supplement of this capacity will be required or an alternative strategy to by progressively bypass Tuakau will be required.

The charts above provide flow profiles, based on the information available at the time of writing this memo, which can be used to plan infrastructure upgrade works.

4.6.4 *Discharge to WWTP*

The system capacity between Pokeno and WWTP has been checked with the following results:

- Buckland Road down to the old Watercare interceptor. This is a new 375 mm uPVC line with grades varying between 1 and 4% with a corresponding capacity of 200 to 400 L/s. The dual rising main can be configured to over pump the first 1% sector and thus the potential capacity of this sector is notionally~250 L/s.

- The existing Watercare 425/525 mm ø line between Buckland Road and WWTP is some 1.4 km long. This pipe has a gradient of ~0.4 to 22%. At notionally full with no downstream backwater effect from the WWTP, the notional capacity is 240 L/s.

4.7 Capital Works

Capital works 'upgrade packages' have been developed to address the need for addition network capacity over time. The upgrades are described below and illustrated on the Servicing Strategy Plans in **Appendix C**.

Alignments and sizing are approximate and subject to change during design development. Estimated high level capital costs are provided in **Appendix E**.

*The high level capital costs in **Appendix E** are provided based on broad assumptions. The estimates should be fully checked and reviewed by a qualified professional before being used.*

4.7.1 Package 1: Rising Main from Synlait to Market Pump Station

A new pipeline is required to convey wastewater from the Synlait Dairy Factory to the Pokeno wastewater network. We understand Babbage has been commissioned to undertake design of this main.

The proposed Synlait rising main is a DN250 mm pumped main from the Synlait Dairy Factory site directly to Market Pump Station. The proposed pipeline is approximately 1300 m long, and will cross beneath the Tani Te Wharioa stream and the North Island Main Trunk (NIMT) rail corridor. The main will follow an alignment that passes next to the Hitchen Pump Station site, with the opportunity to connect to provide operational flexibility.

It is proposed to utilise the new main to deliver flows from both the proposed Synlait factory and the existing Yashili factory directly to Market Pump Station. This will free-up capacity in the existing Hitchen rising main to cater for residential growth.

Wastewater storage will be required at Synlait to facilitate flow balancing.

4.7.2 Package 2: Tuakau Pump Station – Initial Upgrade

Tuakau Pump Station currently has a capacity of approximately 100 L/s based upon the existing pumps running at Duty, Assist at 52 Hz.

It is proposed to upgrade the station by replacing the existing two 57 kW pumps (including a third pump as standby) and installing new 119 kW 60 Hz pumps and new VSD's in a new control room. This will increase output to approximately 160 L/s utilising the existing single 355 mm DN rising main.

4.7.3 Package 3: Whangarata Rail to Bollard Low Gravity Sewer

This is a new 600 – 700 mm diameter gravity sewer laid adjacent to the NIMT rail corridor between Whangarata Rail and Bollard Low. It will service all Pokeno wastewater flows, plus local catchments, e.g. Whangarata Industrial Park.

This upgrade will increase capacity of the network by bypassing the Bollard Road gravity main section and reduction in length of the Market to Bollard Road rising mains.

The implementation of this project is also expected to increase the output of Market Pump Station by approximately 20% from 100 L/s to 120 L/s, due to the reduction in rising main length (and the associated reduction in friction losses).

Based upon recent field testing the actual rate may be closer to 110 L/s.

4.7.4 Package 4: Hitchen 2 Rising Main (Munro to Whangarata)

In order to increase capacity out of the existing Market pump station, a reduction in head will result in increased flow.

It is proposed to design and construct the downstream section of the proposed Hitchen 2 pump station rising main, from the Munro Road / Pokeno Road intersection to Whangarata Rail, as early works. This new section of main will connect with the existing DN280 and DN160 mm Market rising mains at Munro Road and the proposed Whangarata to Bollard Low gravity sewer (above).

The new rising main is expected to be approximately DN 500 mm. Constructing this section of the main early will increase the capacity of Market Pump Station by a further 20 L/s to 140 L/s.

Once this stage is complete, the existing DN280/315 rising main on the same alignment will become spare. It is proposed that the 280 mm pipework will be utilised as a rising main for the new Pokeno West Subdivision, to pump directly through to the head of the Whangarata to Bollard Low gravity sewer in the future.

4.7.5 Package 5: Hitchen 2 Pump Station

This Hitchen 2 Pump Station is expected to be required when total flows out of Pokeno exceed ~140 L/s. Construction of this pump station will also trigger need for the future upgrades at the Tuakau Pump Station and duplicate rising main (below).

Hitchen 2 Pump Station will be constructed on the Hitchen 1 Pump Station site and is expected to be sized to accommodate ~220 to 250 L/s. The final flow rate will be dependent upon final pump selection and rising main size. An increased flow rate could also be allowed for in the detailed design to further future-proof the pump station for flows post 2033 An ultimate capacity above 300 L/s are possible. Once operational, the operating philosophy for the Hitchen and Market pump stations will be modified to transfers flow from Market to Hitchen 2.

4.7.6 Package 6: Hitchen 2 Rising Main (Pump Station to Munro)

The remainder of the Hitchen 2 rising main will be constructed at the same time as the Hitchen 2 Pump Station. It will connect with the section of main constructed under Package 4 above at the Munro Road intersection.

The new rising main from Hitchen 2 is expected to be approximately DN 500 mm. Implementation of the Hitchen 2 scheme will increase the capacity of wastewater network between Pokeno and Bollard Low to approximately 250 L/s.

4.7.7 Package 7: Tuakau Pump Station – Future Upgrade and Rising Main Duplication

A further upgrade of the Tuakau Pump Station is expected to be required when incoming flows exceed 160 L/s. The pump station capacity will be increased to 250 L/s.

A duplicate rising main form Tuakau Pump Station to the Buckland Road gravity main is required when flows exceed approximately 160 L/s. At flows greater than 210 L/s the rising main needs to be extended further down Buckland Road, as the capacity of the initial section of the Buckland Road gravity main is exceeded.

4.7.8 Package 8: Tuakau Bypass

The Kowhai Street trunk sewer has a capacity of approximately 235 L/s. In addition to the flows in this Tuakau trunk sewer is a residential catchment below the pump station.

Based upon our initial assessment of the capacity between Buckland Road low and the WWTP, the existing capacity is ~240 L/s.

Once the capacity of the trunk sewer capacity has reached ~240 L/s, there are two options:

- Increase capacity of trunk sewer between Bollard Low and the Tuakau pump station plus upgrade of the Buckland low to WWTP section., or
- Construct new Tuakau Bypass either with an inverted siphon direct to the WWTP or by a new pump station adjacent to Bollard low discharging downstream of Tuakau with a new line through to a upgraded gravity line to the WWTP.

To allow the Whangarata Business Park to discharge by gravity, the Whangarata to Bollard pipeline will need to be a gravity line, with a pump station to bypass Tuakau. If an inverted siphon solution was proposed, the Business Park would need to be serviced by either by a separate gravity system feeding into the Kowhai Street trunk or be pumped into the siphon line.

4.7.9 Package 9: Pokeno West Connection

The Pokeno West sub-division is expected to start discharging wastewater in 2020. Once Package 4 above is complete, the existing DN280/315 Market rising main on the same alignment will become spare. It is proposed that this pipework be utilised as a rising main for the new Pokeno West Subdivision, to pump directly through to the head of the Whangarata to Bollard Low gravity sewer in the future.

4.8 Flow Chart

The flow chart in Figure 4 below illustrates the proposed sequencing of the upgrade packages. A full version of the flow chart is included in **Appendix D**. The colours align with the colour-coding on the Servicing Strategy Plans in **Appendix C**.

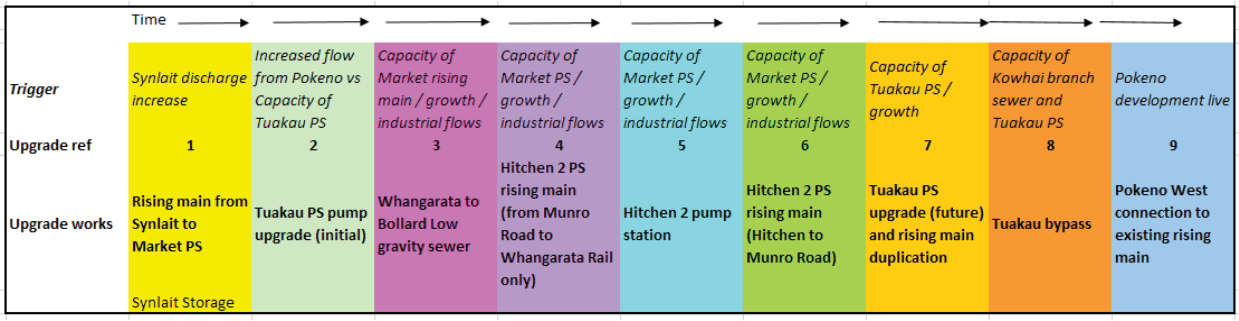


Figure 4: Anticipated sequence of Upgrades Flowchart

4.9 Capacity Implementation

The proposed upgrade packages described above are illustrated on the design flow charts for each of the wastewater networks components shown in Figure 5 to Figure 7 below.

4.9.1 Flows and upgrade from Hitchen Pump Station

This section includes for the proposed upgrades including the new Hitchen 2 pump station to be commissioned by 2022.

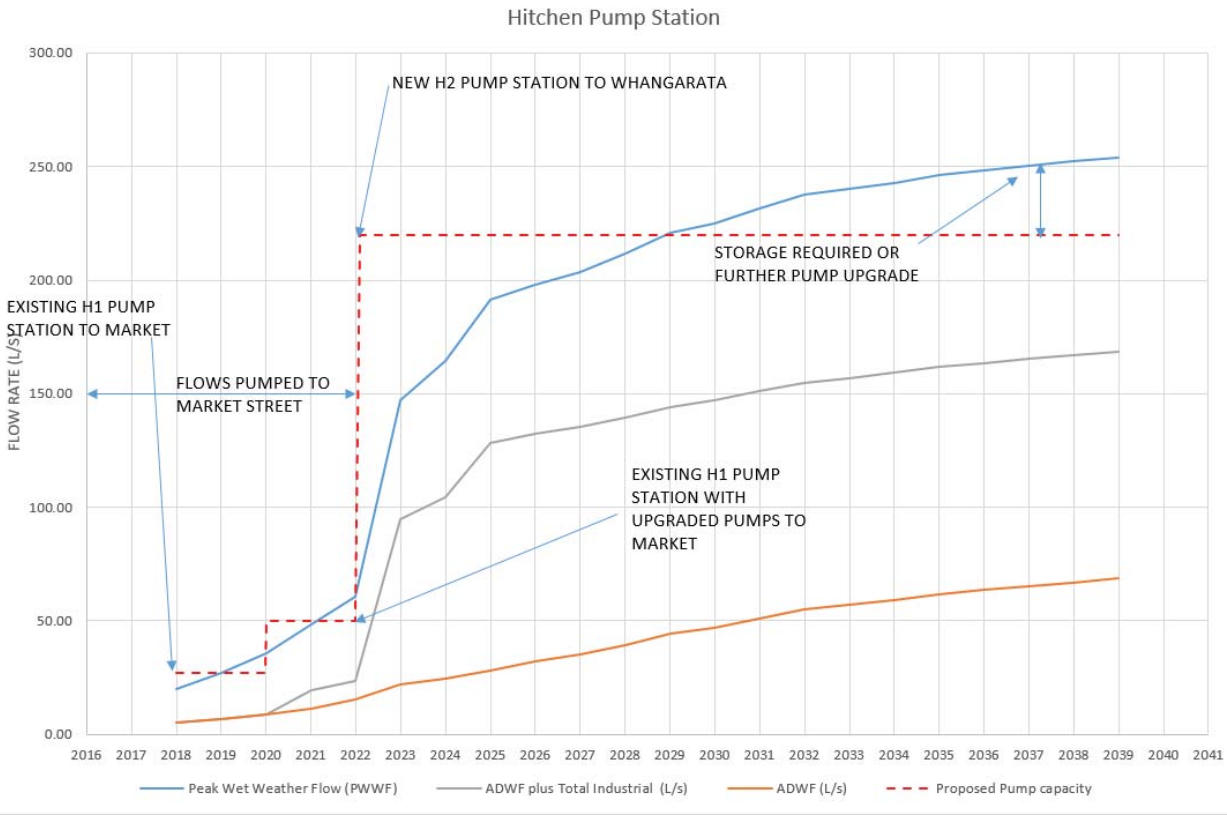


Figure 5: Hitchen Pump Station and Rising Main Peak Flow vs Upgrade Packages

This Figure 5 shows:

- ADWF in orange being the same flows identified in Figure 1 above.
- ADWF plus industrial flows shown in grey
- PWWF in blue
- Pumped capacity in red dashed.

The first step in 2020 relates to a proposed interim upgrade of the transfer pumps between Hitchen and Market. The design of these pumps will need to consider the combined discharge from Yashili and Hitchen 1 pump station, unless Yashili has already been combined with the Synlait flow rising main.

The second step in pumped capacity in 2022 reflects the new capacity available from a new Hitchen 2 pump station. Expected initial capacity of Hitchen 2 is 220 to 250 L/s.

The graph of peak arrival rate exceeds 250 L/s by 2029. Flows above this flow rate can be achieved with further pump modifications or an alternative strategy adopted by use of active storage. This could be achieved by utilising of storage within the industrial plants or by use of additional constructed storage facility to flatten out peak PWWF arriving at the Hitchen 2 site. The next logical constructed storage would be on the Mercer and Meremere rising main.

4.9.2 Flows and upgrade from Market Street Pump Station

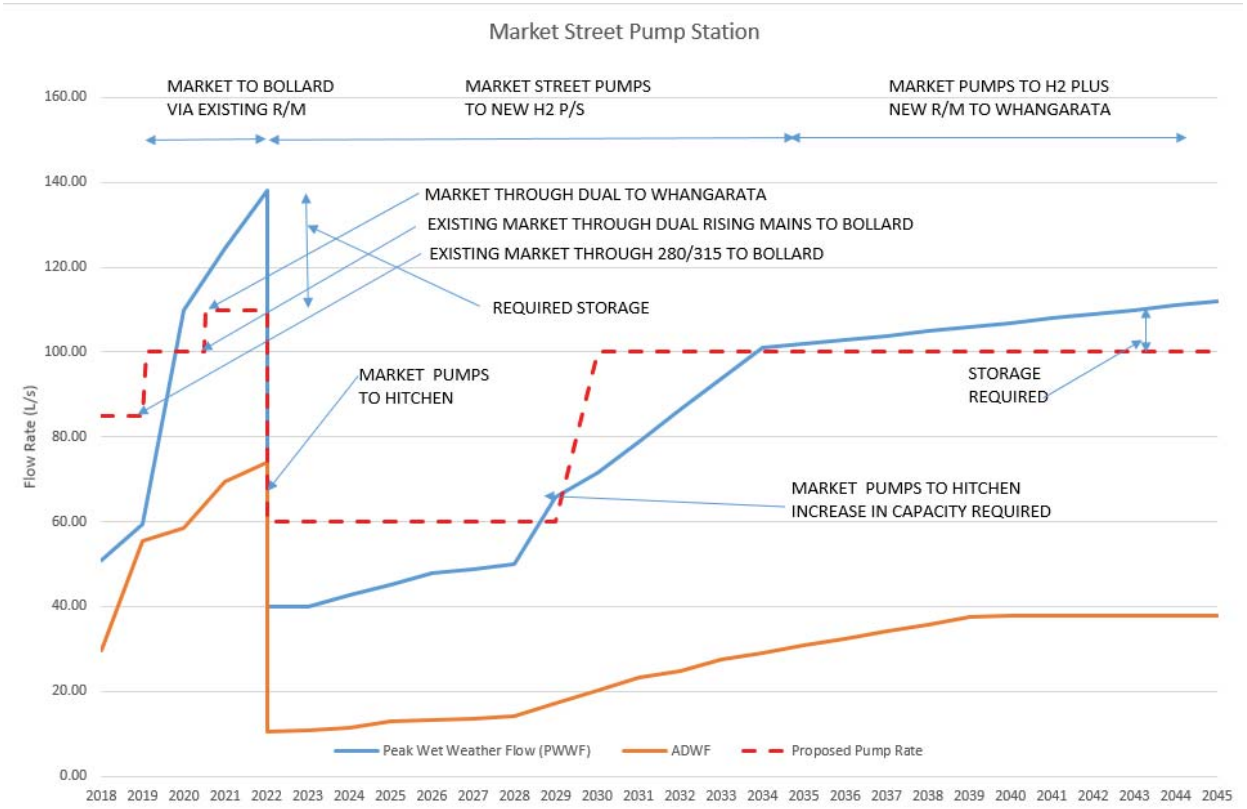


Figure 6: Market Pump Station and Rising Main Peak Flow vs Upgrade Packages

As seen in the previous Figure 2, the flow rates have been duplicated in this Figure 6. The pump rate shown in dashed red reflects the strategy to:

- Pump from Market direct to Bollard from 2018 (as at present) until 2020,
- Pump from Market to Whangarata from 2020. This relies upon construction of the Whangarata/Rail to 'Bollard Low' gravity bypass from 2020 (110 l/s @126m head) and
- Storage required. 30 L/s for say 6 hours = 648 m³. Construct at Hitchen or utilise industrial or both,
- Transfer pump from Market to Hitchen 2 following construction of Hitchen 2 pump station in 2022.
- Upgraded transfer pump from Market to Hitchen in 2029
- Future ability to pump from Market to Whangarata with construction of new rising main from 2035 once the expected development pressure from Pokeno East begins from late 2020's.

The predicted flow rate of 110 L/s from Market in 2021 will increase again once the section of the Hitchen 2 rising main (Munro to Whangarata) has been constructed and the connection made from Market to the new rising main.

4.9.3 *Flows and upgrade from Tuakau Pump Station*

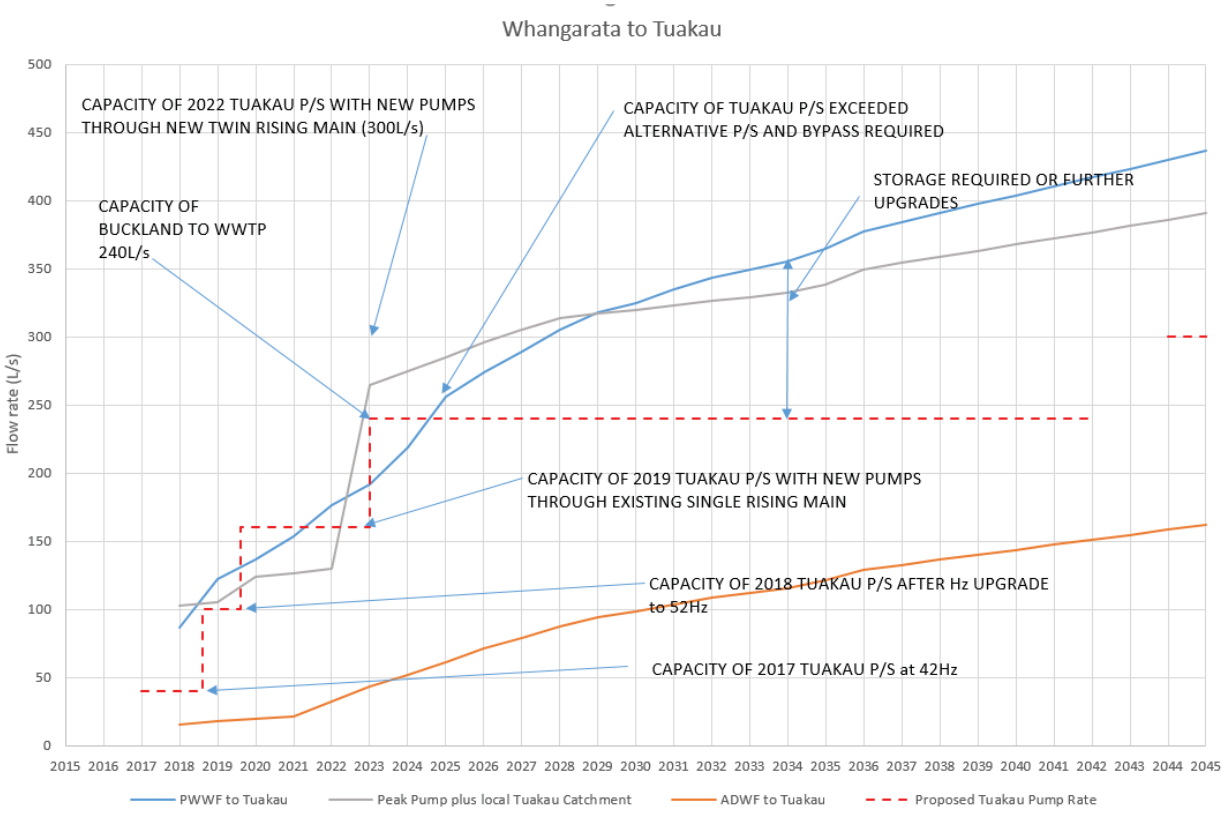


Figure 7: Whangarata to Tuakau Pump Station Peak Flow vs Upgrade Packages

From this Figure 7 we observe:

- New pumps required at Tuakau from 2019 (change from 53kW to 119kW)
- Buckland 375mm PVC line capacity (200 L/s) exceeded by 2023
- Dual Rising mains required by 2023 from Tuakau to Buckland (with potential to achieve 240 L/s by discharging 2nd main a further 300m down Buckland Road)
- Capacity of Buckland to WWTP exceeded by 2023
- Use of system storage or new Tuakau Bypass to WWTP required from 2025

As this strategy is reviewed and updated in light of actual growth and revised development projections, flows vs time can be monitored on the charts to understand when an upgrade is required. The upgrade can then be implemented with sufficient lead time to ensure that capacity is available when required.

5 Assumptions

The work to develop this advice has been based upon flow and population spreadsheets presented in technical memo titled “Pokeno W&WW Planning - Tech Memo - Population, Growth & Planning” and dated 10 September 2018. Based upon further industrial upgrades and additional developments the latest populations and flows are set out in the spreadsheet dated 9/11/2018.

In order to develop the flows, flow rate and pumping capacity we have used both spreadsheet calculations and an Infoworks ICM dynamic model build. The GHD model is not yet complete and can and should be used to confirm spreadsheet modelling to test system performance.

This report relies upon spreadsheet modelling of individual system elements but not overall system performance.

Further modelling work will be required to confirm system performance including:

- Sizing of the recommended working storage
- Used in conjunction with further design work to refine the Whangarata Road gravity section and new rising mains
- Refine pump selection for the pumps
- Deal with any logical staging/timing to deal with cash flow and budget constraints
- To provide evidence for Council to determine capital contributions from developers

5.1 Timing

This report provides an overview of the wastewater servicing strategy to deal with growth and timing based upon GHD 2018 flow projections.

The actual increase in flows may be accelerated (i.e. triggered earlier) or be delayed (i.e. triggered later) based upon the individual development needs. This programme of works, in particular work items scheduled post-2025 needs to be flexible to cater for the changing growth demands and capacity issues. It is envisaged many of the unknowns will be clearer in 5-10 years time.

The trigger points identified in Figure 4 are illustrated in detail in Figure 5 through to Figure 7 inclusive, where the blue line crosses the red dashed line. However, based upon storage management there is a potential to delay the upgrades but no later than where the grey line crosses the red dashed.

6 Risks and Opportunities

The following risks and opportunities have been identified during development of this servicing strategy:

- Development may not occur as predicted – it may occur faster or slower. This strategy should be reviewed on a regular basis.
- The basis of calculating peak flow rate may be too conservative, which will lead to over-sizing or building assets too early. Flow calculations are based on HCDM / ITS. There is an opportunity to refine calculation in consultation with WDC and use real time monitoring to reassess the theoretical flow rate vs. actual flow rates.

  Monitoring of actual flow rates can be undertaken to assist with refining the servicing strategy.

7 Next Steps

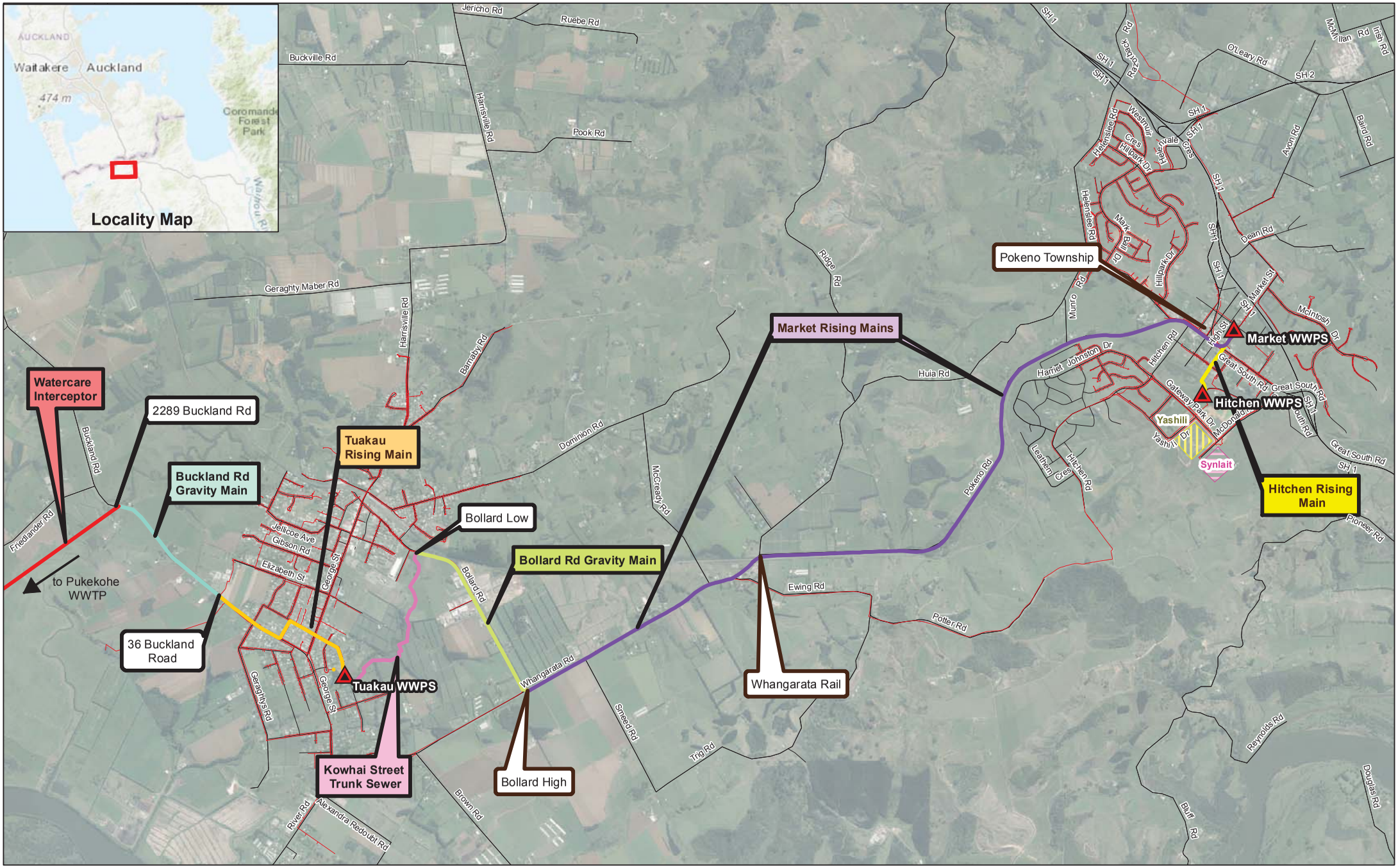
The following next steps are recommended:

- Confirm / agree strategy with WDC
- Full review of cost estimates by qualified professional for LTCP purposes
- Develop 'Upgrade Packages' – scope, concept design, cost estimates to inform budgeting using new model to optimise system.
- Design and implement urgent upgrades
- Review strategy annually and track upgrade needs based on actual development and latest understanding of planned development.
- Develop a monitoring programme to assess theoretical flow rates vs. real time inflow rates.

Regards

Tony Miller
Technical Director - Water & Civil
For and on behalf of GHD Ltd

Appendix A – Network Overview Map



Waikato District Council
Pokeno Servicing Strategy

Project No. 51-38070
Revision No. C
Date 05 Nov 2018

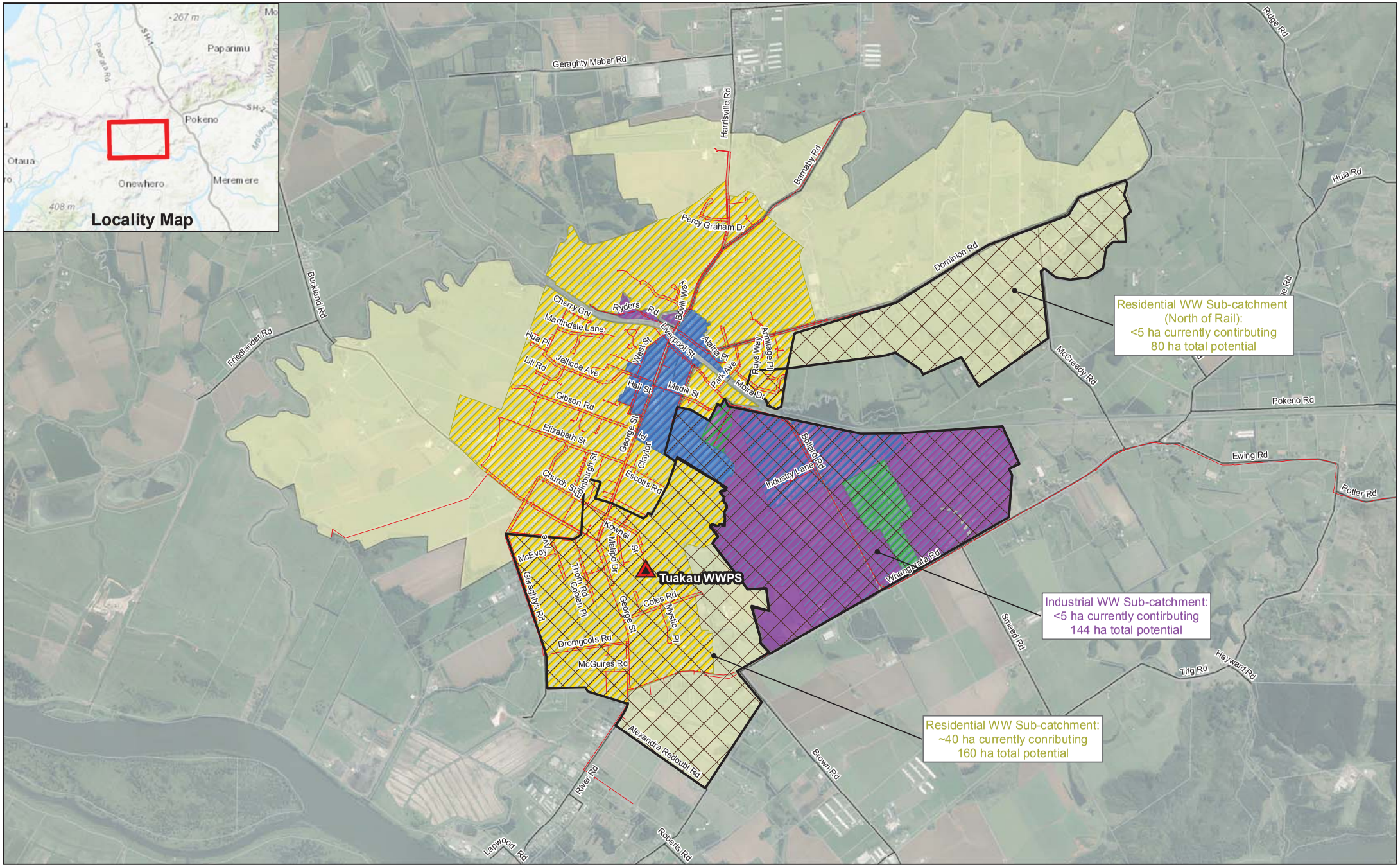
Wastewater Network Overview Map

Figure 1

G:\51\37984\GIS\Maps\Deliverables\Revised Memo Figure Reporting\5137984_Z001_RevD_Wastewater_Network_Overview.mxd
Data Source: . Print date: 05 Nov 2018 - 16:03

Created by: celliott / celliott2

Appendix B – Tuakau Catchment Plan



Paper Size ISO A3

0 100 200 400

Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

- Existing WW Network
- Roads
- Existing Transmission WWPS
- Future Contributing Catchments
- Property Boundaries

Operative DP	Proposed DP
Business	Business
Industrial	Industrial
Residential	Residential
Park Reserve	Park Reserve

NOTES:
Map and information is based on interpretation of developer information. Actual development and timing is likely to change.

N

GHD

Waikato District Council

Waikato District Council
Pokeno Servicing Strategy

Tuakau WWPS Sub-Catchments Proposed District Plan Zoning

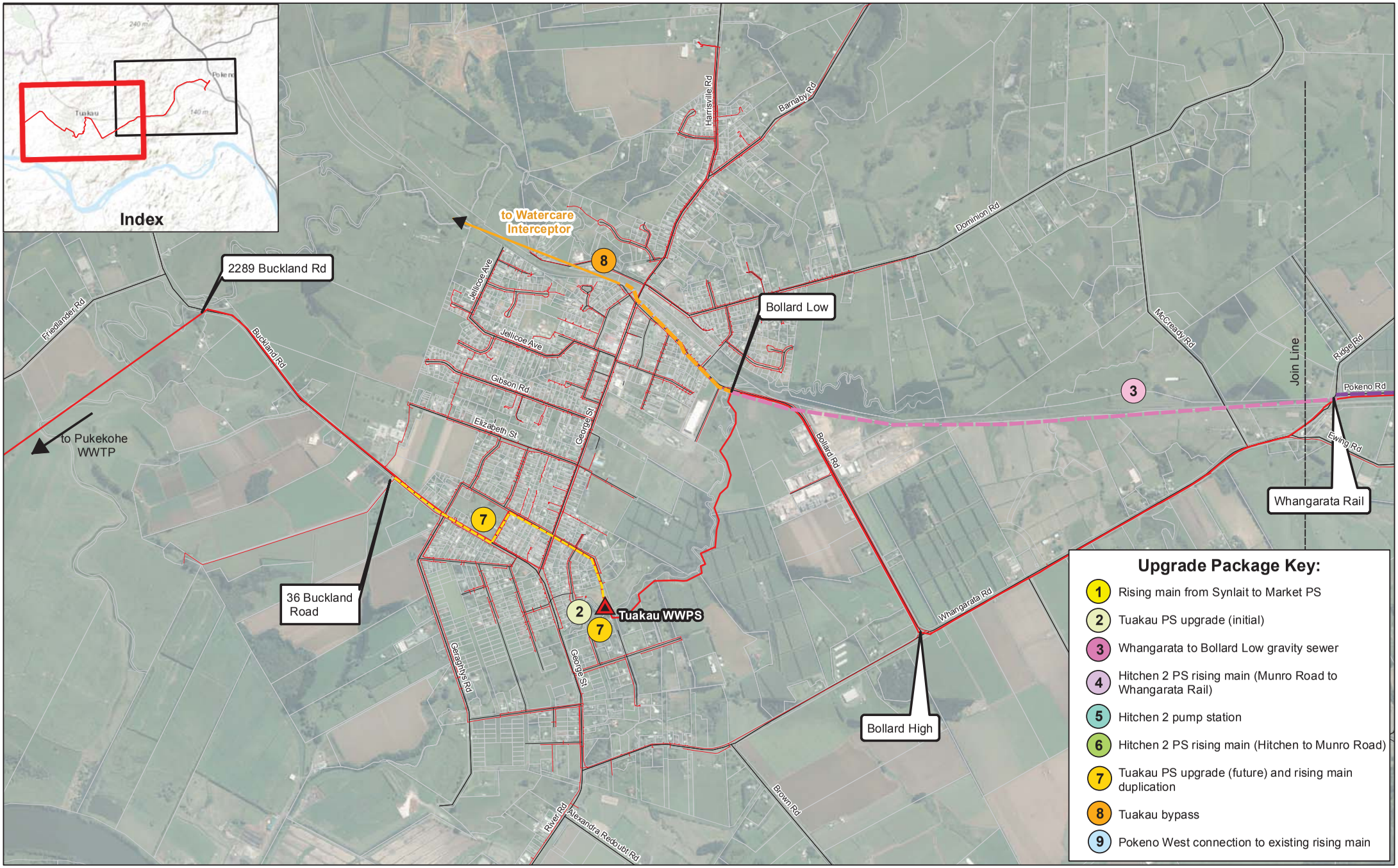
Project No. 51-38070
Revision No. 0
Date 23 Nov 2018

Figure 1

N:\NZ\Auckland\Projects\51\37984\GIS\Maps\Deliverables\Revised Memo Figure Reporting\5137984_Z003_Rev0_Tuakau_Proposed_District_Plan.mxd
Data Source: Local WW Network - 2018. Linz: Roads, Properties Boundaries - 2018, Aerials - 2012; Waikato Ditrict Council: Operative District Plan, Proposed District Plan - 2018. GHD: Future Contributing Catchments - Nov 2018. Print date: 23 Nov 2018 - 16:36

Created by: celliott / celliott2

Appendix C – Servicing Strategy Maps



Paper Size ISO A3

0 250 500

Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

- Existing Transmission WWPS
- Roads
- Existing Transmission WW Pipes
- Local WW Network
- Synlait
- Yashili
- Property Boundaries

NOTES:
Upgrade package triggers are based on interpretation of developer information at the time this figure was issued. Actual development and timing is likely to change.

N

Waikato District Council
Pokeno Servicing Strategy

Page 1 of 2

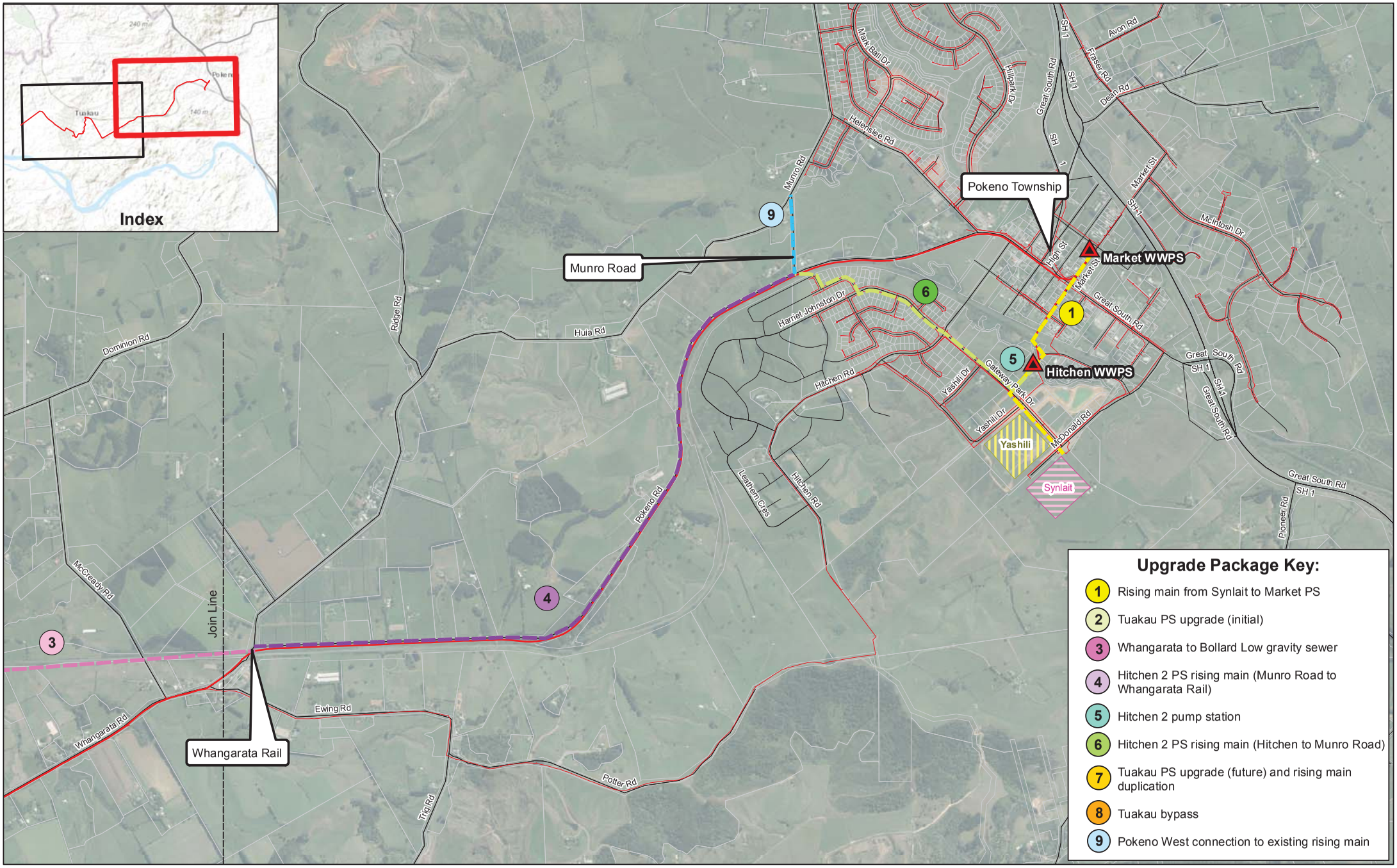
Servicing Strategy Plan

Project No. 51-38070
Revision No. 0
Date 28 Nov 2018

Figure 2

N:\NZ\Auckland\Projects\51\37984\GIS\Maps\Deliverables\Revised Memo Figure Reporting\5137984_Z002_Rev0_Servicing_Strategy_Plan.mxd
Data Source: Waikato District Council: Existing Wastewater Services - 2018. Linz: Roads, Properties Boundaries - 2018, Aerials - 2012; GHD: Upgrade Packages, Synlait and Yashili - Nov 2018. Print date: 28 Nov 2018 - 12:08

Created by: celliott / celliott2



Paper Size ISO A3

0 250 500

Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

Existing Transmission WWPS
Roads
Existing Transmission WW Pipes
Local WW Network
Synlait
Yashili
Property Boundaries

NOTES:
Upgrade package triggers are based on interpretation of developer information at the time this figure was issued. Actual development and timing is likely to change.

N

GHD

Waikato District Council

Waikato District Council
Pokeno Servicing Strategy

Page 2 of 2

Servicing Strategy Plan

Project No. **51-38070**
Revision No. **0**
Date **28 Nov 2018**

Figure 2

N:\NZ\Auckland\Projects\51\37984\GIS\Maps\Deliverables\Revised Memo Figure Reporting\5137984_Z002_Rev0_Servicing_Strategy_Plan.mxd
Data Source: Waikato District Council: Existing Wastewater Services - 2018. Linz: Roads, Properties Boundaries - 2018, Aerials - 2012; GHD: Upgrade Packages, Synlait and Yashili - Nov 2018. Print date: 28 Nov 2018 - 12:08

Created by: celliott / celliott2

Appendix D – Upgrade Packages Flow Chart

	Time →	→	→	→	→	→	→	→	→
Trigger	*Synlait discharge*	*Increased flow from Pokeno vs Capacity of Tuakau PS*	*Capacity of Market rising main / growth / industrial flows*	*Capacity of Market PS / growth / industrial flows*	*Capacity of Market PS / growth / industrial flows*	*Capacity of Market PS / growth / industrial flows*	*Capacity of Tuakau PS / growth*	*Capacity of Kowhai branch sewer and Tuakau PS*	*Pokeno development live*
Upgrade Reference (Servicing Strategy Plans)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Upgrade works	**Rising main from Synlait to Market PS** Synlait Storage	**Tuakau PS pump upgrade (initial)**	**Whangarata to Bollard Low gravity sewer**	**Hitchen 2 PS rising main (from Munro Road to Whangarata Rail only)**	**Hitchen 2 pump station**	**Hitchen 2 PS rising main (Hitchen to Munro Road)**	**Tuakau PS upgrade (future) and rising main duplication**	**Tuakau bypass**	**Pokeno West connection to existing rising main**
Benefit	Enable Synlait to discharge; Hitchen to Market capacity increase		Increase capacity of existing Market RMS (length reduced);	Increase capacity of Market RM (new main temp connected to Market PS)	Increase capacity of pumping from Pokeno	Increase capacity of network in Pokeno			
	RM re-used in reverse direction in future		Increase capacity of network between Whangarata and Bollard Low		Free up capacity for pumping from Pokeno West				

Servicing Strategy Timeline (based on predicted growth and proposed upgrades)

Appendix E – Master Programme and High Level Cost Estimate

The high level capital costs in Appendix E are provided based on broad assumptions. The estimates should be fully checked and reviewed by a qualified professional before being used.

	Pokeno & Tuakau Sewer Strategy Master Programme & High Level Cost Estimate																																	
	The high level capital costs in Appendix E are provided based on broad assumptions. The estimates should be fully checked and reviewed by a qualified professional before being used.																																	
		Year	2019				2020				2021				2022				2023				2024				2025				2026			
		Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Package	**Description**	**Predesessors / Notes**																																
Task																																		
	Combined PWWF from Tuakau		122				136				154				176				192				219				256							
1	**Rising Main from Synlait to Market Pump Station**	Under design & Construction	Desig	C																														
2	**Tuakau Pump Station – Initial Upgrade**	Needs to be inplace by Whangarata completion and flows to Bollard low exceed 100 l/s - new capacity 160 l/s		Desig	Approv	Const																												
				0		0.342																												
3	**Whangarata Rail to Bollard Low Gravity Sewer**	Urgent as this increases capacity of Market by 10+ L/s	Design	Desig	Conse	Conse	Const	Const																										
				0.12		1.939	1.939	1.939																										
4A	**Hitchen working storage**	Required now as PWWF exceed measured pump out capacity from Market																																
		Use of Yashili Storage	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x												
		Use of Synlait Storage			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x												
		New working Storage at H2			Desig	Approv	Const	Const																										
					0.15		0.663																											
4	**Hitchen 2 Rising Main (Munro to Whangarata)**	Semi urgent as this improves capacity from Market by another 10 -15 L/s			Desig	Conse	Conse	Const	Const																									
					0.2			1.918	1.918																									
5	**Hitchen 2 Pump Station**	Required by 2022 date variable subject to new flows coming on stream. Predessor = Task 4 above)						Desig	Desig	Desig	Conse	Conse	Conse	Const	Const	Const	Const																	
										0.25				1.4	1.4	1.4	1.4																	
6	**Hitchen 2 Rising Main (Pump Station to Munro)**	Must be done in parallel with Task 5 above for same end date and comissioning						Desig	Desig	Desig	Conse	Conse				Const	Const																	
										0.075						0.843	0.843																	
7	**Tuakau Pump Station – Future Upgrade and Rising Main Duplication**	Existing capacity = 100l/s. New pumps (Task2) capacity 160l/s. Thus once flows exceed 160 then second main required.																																
8	**Tuakau Bypass**	Once capacity exceeds 240L/s from Tuakau P/s then downstream capacity to WWTP has reached limit. Bypass pump station required from Bollard Low through to WWTP														Desig	Desig	Desig	Conser	Conser	Approv	Approv	Const	Const										
																		0.35					3.25	3.25										
9	**Pokeno West**	Cant be used until Task 4 is complete to free up existing 280/315 main. Required prior to first housing on Pokeno West. Current developer programme scheduled by 2020					Desig	Conse	Const	Const																								
							0.12		1.15	1.15																								
10	**Mercer and Meremere to H2**	Current consent extension expires 2025, hence construction required by 2026. Predessor is H2																			Desig	Desig	Desig	Conser	Conser	Approv	Approv	Const	Const	Const	Const			
																							0.3					2.065	2.065	2.065	2.065			
		Total by Quarter ($M)	0	0.12	0.35	2.28	2.72	3.86	3.07	1.48	0	0	0	1.4	1.4	2.24	2.24	0.35	0	0	0	0	3.55	3.25	0	0	0	2.06	2.06	2.06	2.06			
		Total by July Year end ($M)		0.12				9.21				4.54				5.04				2.59				6.8				2.06				6.19		

Package	Works description	pipe	rate/m		land	rate/m²		civil	P&G	Cont	Subtotal	Design and supervision	Total
1	GHD understand the works are all to Synlait account, however strategy is for Yashili to discharge to HtoM line. Hence cost share required for Yashili or alternative contribution from WDC.												
2	New pumps 3 at $100,000 = cost plus civils. New elect	pumps			elect build		elect supply					Design and supervision	
		3	80000	$ 240,000	$ 85,000		$ 450,000		$ 100,000	$ 150,000	**$ 1,025,000**	$ 120,000	**$ 1,145,000**
3		pipe	rate/m		land	rate/m²		civil	P&G	Cont			**Total**
	2.37 km plus civils.	2480	1100	$ 2,728,000	12400	100	$ 1,240,000	$ 750,000	$ 600,000	$ 500,000	**$ 5,818,000**	$ 250,000	**$ 6,068,000**
4A													
		tank			civils								
		$ 1,000,000			$ 150,000				$ 75,000	$ 100,000	**$ 1,325,000**	$ 150,000	**$ 1,475,000**
		pipe			civils & Mech								
4	3450 m of 500 dia	3450	800	$ 2,760,000	750000				75000	250000	**$ 3,835,000**	$ 200,000	**$ 4,035,000**
					elect	civils access							
5	Market street * 2	2500000	2	$ 5,000,000	$ 200,000	$ 100,000			$ 100,000	$ 200,000	**$ 5,600,000**	$ 250,000	**$ 5,850,000**
6		1325	800	$ 1,060,000	$ 500,000				$ 25,000	$ 100,000	**$ 1,685,000**	$ 75,000	**$ 1,760,000**
7		1100	500	$ 550,000	$ 150,000				$ 75,000	$ 150,000	**$ 925,000**	$ 120,000	**$ 1,045,000**
						land & Access							
8		3900	1000	$ 3,900,000	$ 1,150,000	$ 200,000			$ 250,000	$ 1,000,000	**$ 6,500,000**	$ 350,000	**$ 6,850,000**
							Pump Station	electrical supply					
9		150	500	$ 75,000	$ 150,000		$ 1,500,000	$ 250,000	$ 75,000	$ 250,000	**$ 2,300,000**	$ 120,000	**$ 2,420,000**
					civil	storage							
10	mercer to H2	4300	400	$ 1,720,000	$ 150,000	$ 250,000			$ 75,000	$ 250,000	**$ 2,195,000**	$ 75,000	**$ 2,270,000**
					civil		p/s	elect					
	mercer p/s				$ 50,000		$ 1,250,000	$ 150,000	$ 75,000	$ 150,000	**$ 1,675,000**	$ 75,000	**$ 1,750,000**
	meremere to mercer	4971	400	$ 1,988,400	$ 100,000	$ -			$ 75,000	$ 250,000	**$ 2,413,400**	$ 75,000	**$ 2,488,400**
	meremere p/s				$ 50,000		$ 1,250,000	$ 150,000	$ 75,000	$ 150,000	**$ 1,675,000**	$ 75,000	**$ 1,750,000**
	add package to connect to retic												
											$ 7,958,400	$ 300,000	**$ 8,258,400**

APPENDIX

iv) CivilPlan Staged Water and Wastewater Demand Calculations, dated 16 September 2019.

CIVILPLAN CONSULTANTS

Water Demand Estimate - Tata Valley and Havelock Village

CLIENT:	Tata Valley Limited	DESIGNER:	AJH
PROJECT:	Tata Valley	JOB NO:	2020
OUTFALL:	Water and Wastewater Demand estimates - 2034 final buildout summary	DATE:	16/09/2019
		REV:	2

	high estimate	low estimate
Water Demand at Full Build Out		
Total Residential/Commercial		
Daily Demand (m^3)	1305	1031
Peak flow rate (l/s)	76	60
Total Farming/Horticulture		
Daily Demand (m^3)	589	309
Peak flow rate (l/s)	7	4
Total		
Daily Demand (m^3)	1894	1340
Peak flow rate (l/s)	82	63
Equivalent Population (260 l/p/d)	7284	5154
Equivalent Dwellings (2.7 ppl/dwelling)	2698	1909
Wastewater Demand at Full Build Out		
Total Residential/Commercial (excluding I&I)		
Daily Demand (m^3)	1137	863
Peak flow rate (l/s)	38	28
Total Farming/I&I		
Daily Demand (m^3)	150	150
Peak flow rate (l/s)	17	17
Total		
Average Daily Flow (m^3)	1272	998
Peak Wet Weather Flow (l/s)	51	41

Water Demand Estimate - Tata Valley and Havelock Village

CLIENT:	**Tata Valley Limited**
PROJECT:	**Tata Valley**
OUTFALL:	**Water and Wastewater Demand estimates - summary**
DESIGNER:	**AJH**
JOB NO:	**2020**
DATE:	**16/09/2019**
REV:	**2**

	second half Q3 2021	fourth quarter Q4 2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Water demand growth - high estimate based on wet retail and higher irrigation rate																				
Total Residential/Commercial																				
Daily Demand (m³)	396	568	568	568	641	714	786	859	941	1014	1086	1159	1232	1305	1305	1305	1305	1305	1305	1305
Peak flow rate (l/s)	23	33	33	33	37	41	46	50	54	59	63	67	71	76	76	76	76	76	76	76
Total Farming/Horticulture																				
Daily Demand (m³)	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589
Peak flow rate (l/s)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Total																				
Daily Demand (m³)	985	1157	1157	1157	1230	1303	1375	1448	1530	1603	1675	1748	1821	1894	1894	1894	1894	1894	1894	1894
Peak flow rate (l/s)	30	40	40	40	44	48	52	57	61	65	70	74	78	82	82	82	82	82	82	82
Equivalent Population (260 l/p/d)	3788	4450	4450	4450	4730	5010	5290	5570	5884	6164	6444	6724	7004	7284	7284	7284	7284	7284	7284	7284
Equivalent Dwellings (2.7 ppl/dwelling)	1403	1648	1648	1648	1752	1856	1959	2063	2179	2283	2387	2490	2594	2698	2698	2698	2698	2698	2698	2698
Wastewater demand growth - high estimate based on wet retail																				
Total Residential/Commercial (excluding I&I)																				
Daily Demand (m³)	396	568	568	568	624	680	736	792	857	913	969	1025	1081	1137	1137	1137	1137	1137	1137	1137
Peak flow rate (l/s)	14	20	20	20	22	24	26	27	30	31	33	35	36	38	38	38	38	38	38	38
Total Farming/I&I																				
Daily Demand (m³)	15	15	15	15	28	42	55	69	82	96	109	123	136	150	150	150	150	150	150	150
Peak flow rate (l/s)	4	4	4	4	5	7	8	9	11	12	13	14	16	17	17	17	17	17	17	17
Total																				
Average Daily Flow (m³)	396	568	568	568	638	707	777	846	924	994	1063	1133	1203	1272	1272	1272	1272	1272	1272	1272
Peak Wet Weather Flow (l/s)	14	20	20	20	24	27	30	33	36	39	42	45	48	51	51	51	51	51	51	51
Water demand growth - low estimate based on dry retail and lower irrigation rate																				
Total Residential/Commercial																				
Daily Demand (m³)	122	294	294	294	367	440	513	586	667	740	813	886	958	1031	1031	1031	1031	1031	1031	1031
Peak flow rate (l/s)	7	17	17	17	21	25	30	34	39	43	47	51	55	60	60	60	60	60	60	60
Total Farming/Horticulture																				
Daily Demand (m³)	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309
Peak flow rate (l/s)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total																				
Daily Demand (m³)	431	603	603	603	676	749	822	895	976	1049	1122	1195	1267	1340	1340	1340	1340	1340	1340	1340
Peak flow rate (l/s)	11	21	21	21	25	29	33	37	42	46	51	55	59	63	63	63	63	63	63	63
Equivalent Population (260 l/p/d)	1658	2321	2321	2321	2601	2881	3161	3441	3754	4034	4314	4594	4874	5154	5154	5154	5154	5154	5154	5154
Equivalent Dwellings (2.7 ppl/dwelling)	614	860	860	860	963	1067	1171	1274	1390	1494	1598	1702	1805	1909	1909	1909	1909	1909	1909	1909
Wastewater demand growth - low estimate based on dry retail																				
Total Residential/Commercial (excluding I&I)																				
Daily Demand (m³)	122	294	294	294	350	406	462	518	583	639	695	751	807	863	863	863	863	863	863	863
Peak flow rate (l/s)	3	9	9	9	12	14	15	17	19	21	23	24	26	28	28	28	28	28	28	28
Total Farming/I&I																				
Daily Demand (m³)	15	15	15	15	28	42	55	69	82	96	109	123	136	150	150	150	150	150	150	150
Peak flow rate (l/s)	4	4	4	4	5	7	8	9	11	12	13	14	16	17	17	17	17	17	17	17
Total																				
Average Daily Flow (m³)	122	294	294	294	364	433	503	573	651	720	790	859	929	998	998	998	998	998	998	998
Peak Wet Weather Flow (l/s)	3	9	9	9	13	16	19	22	26	29	32	35	38	41	41	41	41	41	41	41

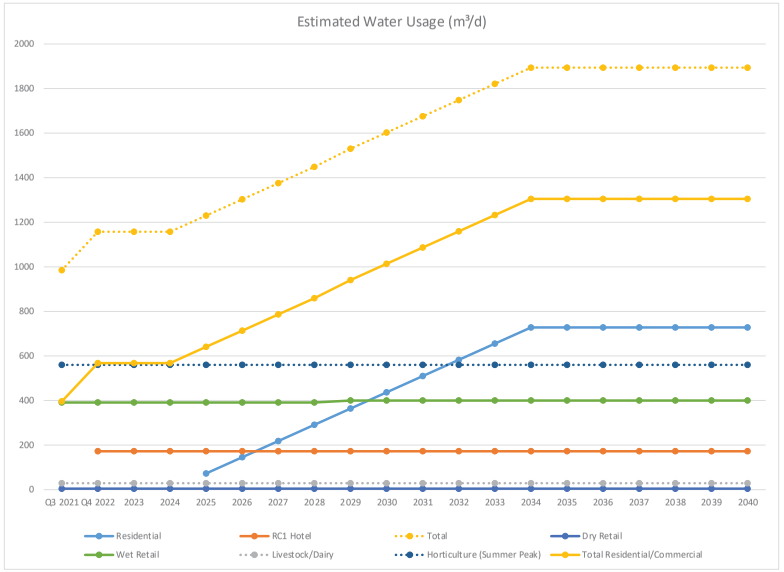
Water Demand Estimate - Tata Valley and Havelock Village

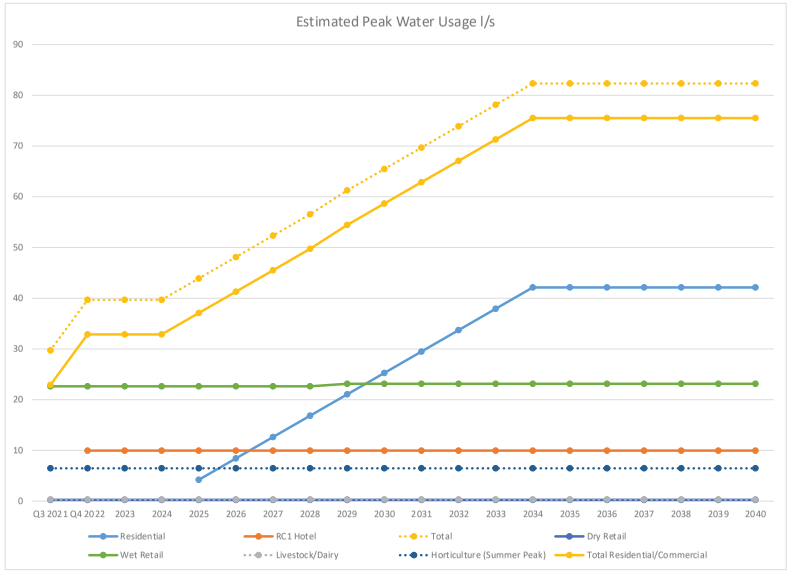
CLIENT: Tata Valley Limited
PROJECT: Tata Valley
OUTFALL: Water demand growth - high estimate based on wet retail and higher irrigation rate

DESIGNER: AJH
JOB NO: 2020
DATE: 16/09/2019
REV: 2

		second half Q3 2021	fourth quarter Q4 2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040 and onwards	Notes
"Havelock Village" Residential		Build time	10 years		Start year	2024																	
Total Population	2800	Consumption	260 l/p/d		Peak Factor	5																	Based on RITS 6.2.3
Population						280	560	840	1120	1400	1680	1960	2240	2520	2800	2800	2800	2800	2800	2800	2800		
Daily Demand (m³)						73	146	218	291	364	437	510	582	655	728	728	728	728	728	728	728		
Peak flow rate (l/s)						4	8	13	17	21	25	29	34	38	42	42	42	42	42	42	42		
RC1 Hotel					Peak Factor	5																	
Daily Demand (m³)			172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172		
Peak flow rate (l/s)			10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		Based on TP58; c.f. 160m³/day based on Watercare IGC guide. Refer to separate sheet for calculations.
RC3																							
Dry retail with customer toilets			m³/person		15	l/p/d	65	Peak Factor	5														Based on Watercare Standard. Alternatively industrial for sheds 1 to 5 at 4.5 to 11l/m²/day = 25656 x 4.5 or 11 = 115 to 282 m³/dav, plus 4.5 for farm show.
	Area (m²)	Daily Demand (m³)																					
Farm Show (Shed 7)	1048	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
Total	1048	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
Peak flow rate (l/s)		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3		
Wet Retail			l/d/m²		15	Peak Factor	5																Based on Watercare Standard. These might be high - the average Auckland restaurant only uses 2m³/d
	Area (m²)	Daily Demand (m³)																					
Shed 1	2551	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3		
Shed 2	3392	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9		
Shed 3	4518	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8		
Shed 4	4518	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8		
Shed 5	10677	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2		
Café (Shed 6)	426	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4		
Winery	580									8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7		Internet research suggests that actual wine production (e.g. washing equipment) may consume 3l/l of wine, at 3500l wine /ha/yr ~=0.1m³/day
Total	26662	391	391	391	391	391	391	391	391	400	400	400	400	400	400	400	400	400	400	400	400		
Peak flow rate (l/s)		22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1		
Livestock & Milking Shed (Shed 8)*			l/sheep/day		15	l/cow/day	140	Peak Factor	1														Peak factor 1 assumes 24hrs storage provided on site (if town water is being used it can be added to the storage being provided for fire supply), otherwise daily peak factor would be very high, with a significant impact on overall peak flows.
	No.	Daily Demand (m³)																					
Dairy Cows	100	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14		Refer https://www.dairynz.co.nz/environment/water-use/water-meters-and-monitoring; compares well with other sources, but depends on details of the washdown system, milking schedules etc; actual use could be double this.
Sheep	1000	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15		Sheep 10l/d comes from a canadian document. 10l washdown /d comes from https://www.massey.ac.nz/massey/fms/school_of_management/EXTERNAL%20ASSETS/sheepmilknz/7-%20Natalie%20Watkins.pdf?08D16543F4B7D77C59B6AE3583D4B0C3 i.e. based on sheep milking - washdown should probably not be applied to the full number of sheep.
Total	1000	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29		
Peak flow rate (l/s)		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3		
Horticulture - Peak Summer Irrigation*			mm/day		8	Peak Factor	1																Peak factor 1 assumes watering is 24hrs, with low rates. Source is https://www.irrigationnz.co.nz/KnowledgeResources/FAQ
	Area (m²)	Daily Demand (m³)																					
Vineyard	40000	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0		"During the New Zealand summer plants use an average of 4-5mm of water a day. During peak growth they can use more than 8mm a day" - type of plants not specified.
Kiwifruit	10000	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0		
Other Orchard	20000	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0		These figures compare well with 3-10mm/d calculated for vineyards from a Marlborough Council reference.
Total	70000	560	560	560	560	560	560	560	560	560	560	560	560	560	560	560	560	560	560	560	560		
Peak flow rate (l/s)		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5		
Total Residential/Commercial																							
Daily Demand (m³)		396	568	568	568	641	714	786	859	941	1014	1086	1159	1232	1305	1305	1305	1305	1305	1305	1305		
Peak flow rate (l/s)		23	33	33	33	37	41	46	50	54	59	63	67	71	76	76	76	76	76	76	76		
Total Farming/Horticulture																							
Daily Demand (m³)		589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589		
Peak flow rate (l/s)		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7		Demand will vary significantly, particularly due to irrigating in the peak of summer, or only in drought conditions.
Total																							
Daily Demand (m³)		985	1157	1157	1157	1230	1303	1375	1448	1530	1603	1675	1748	1821	1894	1894	1894	1894	1894	1894	1894		
Peak flow rate (l/s)		30	40	40	40	44	48	52	57	61	65	70	74	78	82	82	82	82	82	82	82		
Equivalent Population (260 l/p/d)		3788	4450	4450	4450	4730	5010	5290	5570	5884	6164	6444	6724	7004	7284	7284	7284	7284	7284	7284	7284		
Equivalent Dwellings (2.7 ppl/dwelling)		1403	1648	1648	1648	1752	1856	1959	2063	2179	2283	2387	2490	2594	2698	2698	2698	2698	2698	2698	2698		

*Provisional; i.e. ideally these will be supplied by a bore on site (or a dam, or taken from the river?)


Estimated Water Usage (m³/d)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Q3 2021 Q4 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Residential
RC1 Hotel
Total
Dry Retail
Wet Retail
Livestock/Dairy
Horticulture (Summer Peak)
Total Residential/Commercial


Estimated Peak Water Usage l/s
90
80
70
60
50
40
30
20
10
0
Q3 2021 Q4 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Residential
RC1 Hotel
Total
Dry Retail
Wet Retail
Livestock/Dairy
Horticulture (Summer Peak)
Total Residential/Commercial

CIVILPLAN CONSULTANTS

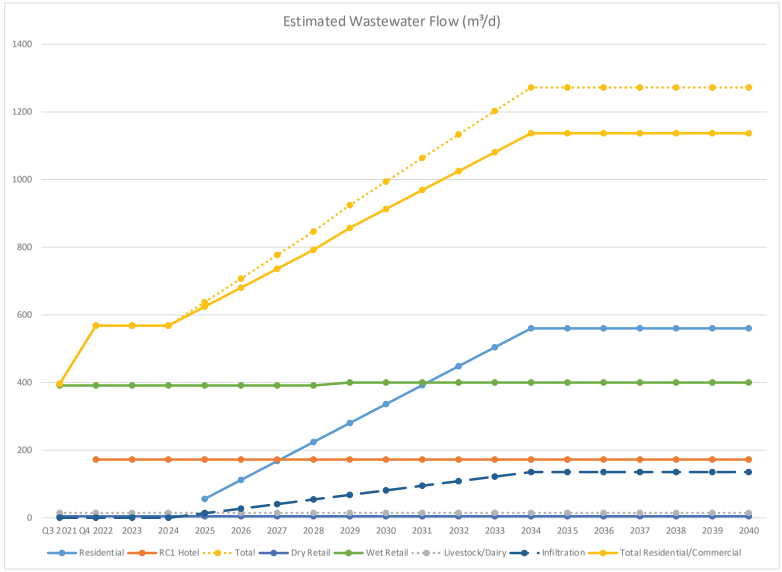
Wastewater Demand Estimate - Tata Valley and Havelock Village

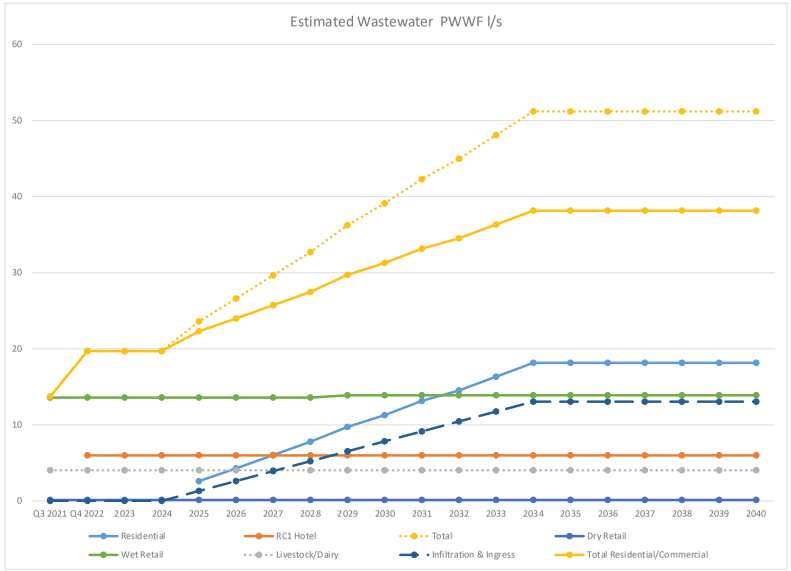
CLIENT: Tata Valley Limited
PROJECT: Tata Valley
OUTFALL: Wastewater demand growth - high estimate based on wet retail

DESIGNER: AJH
JOB NO: 2020
DATE: 16/09/2019
REV: 2

		second half Q3 2021	fourth quarter Q4 2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040 and onwards	Notes
"Havelock Village" Residential		Build time	**10** years		Start year	**2024**																
Total Population	**2800**	Consumption	**200** l/p/d		Peak Factor	**4**	**3.3**	**3.1**	**3**	**3**	**2.9**	**2.9**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	
Population						280	560	840	1120	1400	1680	1960	2240	2520	2800	2800	2800	2800	2800	2800	2800	
Daily Demand (m³)						56	112	168	224	280	336	392	448	504	560	560	560	560	560	560	560	
Peak flow rate (l/s)						3	4	6	8	10	11	13	15	16	18	18	18	18	18	18	18	
RC1 Hotel					Peak Factor	**3**																
Daily Demand (m³)			172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	
Peak flow rate (l/s)			6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
RC3																						
Dry retail with customer toilets				m²/person	**15** l/p/d		**65** Peak Factor	**2.4**														
	Area (m²)	Daily Demand (m³)																				
Farm Show (Shed 7)	1048	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Total	1048	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Peak flow rate (l/s)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Wet Retail				l/d/m²	**15** Peak Factor		**3**															
	Area (m²)	Daily Demand (m³)																				
Shed 1	2551	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	
Shed 2	3392	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	50.9	
Shed 3	4518	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	
Shed 4	4518	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	
Shed 5	10677	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2	
Café (Shed 6)	426	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	
Winery	580									8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	
Total	26662	391.2	391.2	391.2	391.2	391.2	391.2	391.2	391.2	399.9	399.9	399.9	399.9	399.9	399.9	399.9	399.9	399.9	399.9	399.9	399.9	
Peak flow rate (l/s)		13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	
Livestock & Milking Shed (Shed 8)*				l/sheep/day	**7.5** l/cow/day		**70** Peak Factor	**24**														Based on half water use being for washdown
	No.	Daily Demand (m³)																				
Dairy Cows	100	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	
Sheep	1000	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	These flows are excluded from the town WW demand and are to be treated on site.
Total	1000	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	
Peak flow rate (l/s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Infiltration & Ingress				Infiltration l/ha/day	**2250**		Ingress l/ha/day	**16500**														assumes a sealed system so no infiltration or ingress except for residential Havelock Village
	Total Area (m²)	Area (m²)																				
Residential Area	601400	0.0	0.0	0.0	0.0	60140.0	120280.0	180420.0	240560.0	300700.0	360840.0	420980.0	481120.0	541260.0	601400.0	601400.0	601400.0	601400.0	601400.0	601400.0	601400.0	
	Total Area (m²)	Daily Demand (m³)																				
Residential Infiltration		0.0	0.0	0.0	0.0	13.5	27.1	40.6	54.1	67.7	81.2	94.7	108.3	121.8	135.3	135.3	135.3	135.3	135.3	135.3	135.3	
Commercial Infiltration	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Infiltration (m³/day)	601400	0.0	0.0	0.0	0.0	13.5	27.1	40.6	54.1	67.7	81.2	94.7	108.3	121.8	135.3	135.3	135.3	135.3	135.3	135.3	135.3	
Total Ingress (m³/day)		0.0	0.0	0.0	0.0	99.2	198.5	297.7	396.9	496.2	595.4	694.6	793.8	893.1	992.3	992.3	992.3	992.3	992.3	992.3	992.3	
Total Infiltration & Ingress (l/s)		0.0	0.0	0.0	0.0	1.3	2.6	3.9	5.2	6.5	7.8	9.1	10.4	11.7	13.1	13.1	13.1	13.1	13.1	13.1	13.1	
Total Residential/Commercial (excluding I&I)																						
Daily Demand (m³)		396	568	568	568	624	680	736	792	857	913	969	1025	1081	1137	1137	1137	1137	1137	1137	1137	
Peak flow rate (l/s)		14	20	20	20	22	24	26	27	30	31	33	35	36	38	38	38	38	38	38	38	
Total																						
Average Daily Flow (m³)		396	568	568	568	638	707	777	846	924	994	1063	1133	1203	1272	1272	1272	1272	1272	1272	1272	
Peak Wet Weather Flow (l/s)		14	20	20	20	24	27	30	33	36	39	42	45	48	51	51	51	51	51	51	51	

*Provisional; i.e. ideally this will be managed on site i.e. effluent irrigation


Estimated Wastewater Flow (m³/d)
1400
1200
1000
800
600
400
200
0
Q3 2021 Q4 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Residential
RC1 Hotel
Total
Dry Retail
Wet Retail
Livestock/Dairy
Infiltration
Total Residential/Commercial


Estimated Wastewater PWWF l/s
60
50
40
30
20
10
0
Q3 2021 Q4 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Residential
RC1 Hotel
Total
Dry Retail
Wet Retail
Livestock/Dairy
Infiltration & Ingress
Total Residential/Commercial

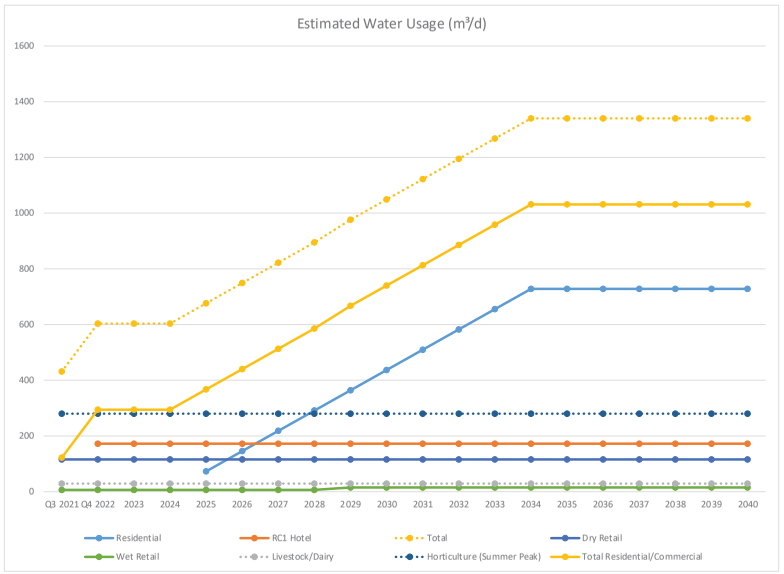
Water Demand Estimate - Tata Valley and Havelock Village

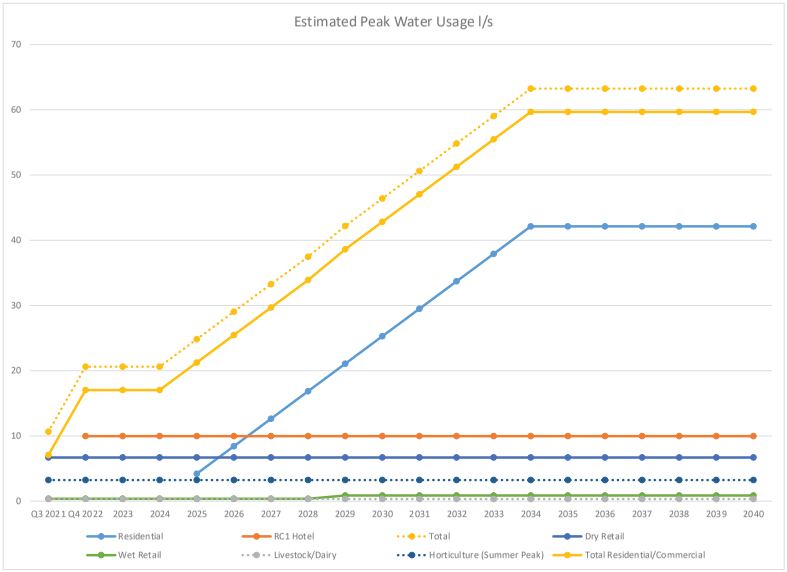
CLIENT: Tata Valley Limited
PROJECT: Tata Valley
OUTFALL: Water demand growth - low estimate based on dry retail and lower irrigation rate

DESIGNER: AJH
JOB NO: 2020
DATE: 16/09/2019
REV: 2

			second half Q3 2021	fourth quarter Q4 2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040 and onwards	Notes
"Havelock Village" Residential		Build time		**10**	years	Start year	**2024**																	Based on RITS 6.2.3
Total Population	**2800**	Consumption		**260**	l/p/d	Peak Factor	**5**																	
Population							280	560	840	1120	1400	1680	1960	2240	2520	2800	2800	2800	2800	2800	2800	2800	
Daily Demand (m³)							73	146	218	291	364	437	510	582	655	728	728	728	728	728	728	728	
Peak flow rate (l/s)							4	8	13	17	21	25	29	34	38	42	42	42	42	42	42	42	
RC1 Hotel						Peak Factor	**5**																
Daily Demand (m³)			172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	Based on TP58; c.f. 160m³/day based on Watercare IGC guide. Refer to separate sheet for
Peak flow rate (l/s)			10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	calculations.
RC3																							
Dry retail with customer toilets				m³/person		**15**	l/p/d	**65**	Peak Factor	**5**													Based on Watercare Standard. Alternatively industrial for sheds 1 to 5 at 4.5 to 11l/m²/day = 2565.6 x 4.5 or 11 = 115 to 282 m³/dav, plus 4.5 for farm show.
	Area (m²)	Daily Demand (m³)																					
Shed 1	2551	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	
Shed 2	3392	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	
Shed 3	4518	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	
Shed 4	4518	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	
Shed 5	10677	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	
Farm Show (Shed 7)	1048	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Total	26704	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	
Peak flow rate (l/s)		6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	
Wet Retail				l/d/m²		**15**	Peak Factor	**5**															Based on Watercare Standard. These might be high - the average Auckland restaurant only uses 2m³/d
	Area (m²)	Daily Demand (m³)																					
Café (Shed 6)	426	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	
Winery	580										8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	Internet research suggests that actual wine production (e.g. washing equipment) may consume 3l/l of wine, at 3500l wine /ha/yr ~=0.1m³/day
Total	1006	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	
Peak flow rate (l/s)		0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	
Livestock & Milking Shed (Shed 8)*				l/sheep/day		**15**	l/cow/day	**140**	Peak Factor	**1**													Peak factor 1 assumes 24hrs storage provided on site (if town water is being used it can be added to the storage being provided for fire supply), otherwise daily peak factor would be very high, with a significant impact on overall peak flows.
	No.	Daily Demand (m³)																					
Dairy Cows	100	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	Refer https://www.dairynz.co.nz/environment/water-use/water-meters-and-monitoring; compares well with other sources, but depends on details of the washdown system, milking schedules etc; actual use could be double this.
Sheep	1000	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	Sheep 10l/d comes from a canadian document. 10l washdown /d comes from https://www.massey.ac.nz/massey/fms/school_of_management/EXTERNAL%20ASSETS/sheepmilknz/7-%20Natalie%20Watkins.pdf?08D16543F4B7D77C59B6AE3583D4B0C3 i.e. based on sheep milking - washdown should probably not be applied to the full number of sheep.
Total	1000	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	
Peak flow rate (l/s)		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
Horticulture - Peak Summer Irrigation*				mm/day		**4**	Peak Factor	**1**															Peak factor 1 assumes watering is 24hrs, with low rates. Source is https://www.irrigationnz.co.nz/KnowledgeResources/FAQ
	Area (m²)	Daily Demand (m³)																					
Vineyard	40000	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	"During the New Zealand summer plants use an average of 4-5mm of water a day. During peak
Kiwifruit	10000	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	growth they can use more than 8mm a day" - type of plants not specified.
Other Orchard	20000	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	These figures compare well with 3-10mm/d calculated for vineyards from a Marlborough Council reference.
Total	70000	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	
Peak flow rate (l/s)		3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	
Total Residential/Commercial																							
Daily Demand (m³)		122	294	294	294	367	440	513	586	667	740	813	886	958	1031	1031	1031	1031	1031	1031	1031	1031	
Peak flow rate (l/s)		7	17	17	17	21	25	30	34	39	43	47	51	55	60	60	60	60	60	60	60	60	
Total Farming/Horticulture																							
Daily Demand (m³)		309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	Demand will vary significantly, particularly due to irrigating in the peak of summer, or only in
Peak flow rate (l/s)		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	drought conditions.
Total																							
Daily Demand (m³)		431	603	603	603	676	749	822	895	976	1049	1122	1195	1267	1340	1340	1340	1340	1340	1340	1340	1340	
Peak flow rate (l/s)		11	21	21	21	25	29	33	37	42	46	51	55	59	63	63	63	63	63	63	63	63	
Equivalent Population (260 l/p/d)		1658	2321	2321	2321	2601	2881	3161	3441	3754	4034	4314	4594	4874	5154	5154	5154	5154	5154	5154	5154	5154	
Equivalent Dwellings (2.7 ppl/dwelling)		614	860	860	860	963	1067	1171	1274	1390	1494	1598	1702	1805	1909	1909	1909	1909	1909	1909	1909	1909	

*Provisional; i.e. ideally these will be supplied by a bore on site (or a dam, or taken from the river?)


Estimated Water Usage (m³/d)
1600
1400
1200
1000
800
600
400
200
0
Q3 2021 Q4 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Residential
RC1 Hotel
Total
Dry Retail
Wet Retail
Livestock/Dairy
Horticulture (Summer Peak)
Total Residential/Commercial


Estimated Peak Water Usage l/s
70
60
50
40
30
20
10
0
Q3 2021 Q4 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Residential
RC1 Hotel
Total
Dry Retail
Wet Retail
Livestock/Dairy
Horticulture (Summer Peak)
Total Residential/Commercial

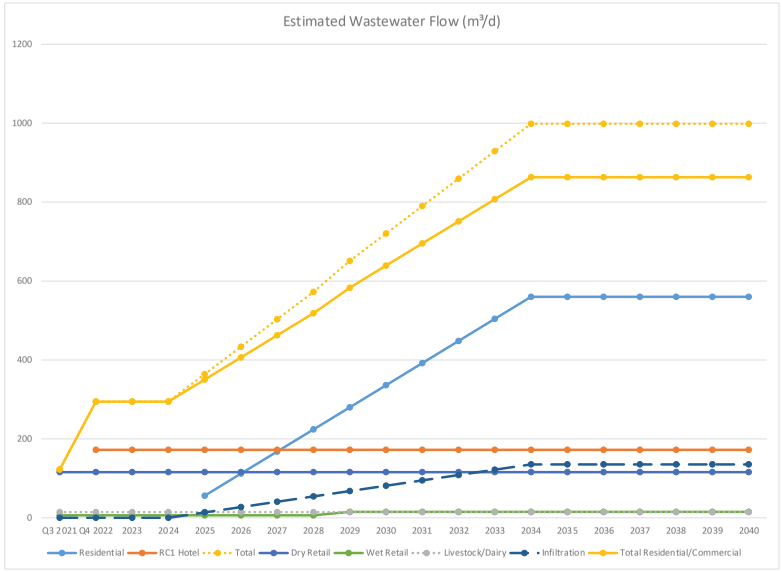
Wastewater Demand Estimate - Tata Valley and Havelock Village

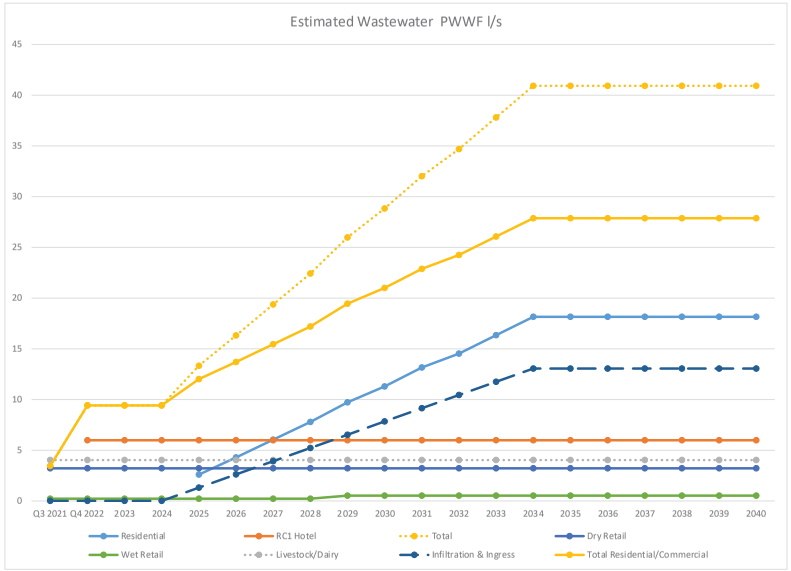
CLIENT: Tata Valley Limited
PROJECT: Tata Valley
OUTFALL: Wastewater demand growth - low estimate based on dry retail

DESIGNER: AJH
JOB NO: 2020
DATE: 16/09/2019
REV: 2

																							Notes
		second half Q3 2021	fourth quarter Q4 2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040 and onwards	
"Havelock Village" Residential		Build time	10 years		Start year	2024																	
Total Population	2800	Consumption	200 l/p/d		Peak Factor	4	3.3	3.1	3	3	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8		
Population						280	560	840	1120	1400	1680	1960	2240	2520	2800	2800	2800	2800	2800	2800	2800		
Daily Demand (m³)						56	112	168	224	280	336	392	448	504	560	560	560	560	560	560	560		
Peak flow rate (l/s)						3	4	6	8	10	11	13	15	16	18	18	18	18	18	18	18		
RC1 Hotel					Peak Factor	3																	
Daily Demand (m³)			172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172		
Peak flow rate (l/s)			6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
RC3																							
Dry retail with customer toilets				m²/person	15 l/p/d		65 Peak Factor		2.4														
	Area (m²)	Daily Demand (m³)																					
Shed 1	2551	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1		
Shed 2	3392	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7		
Shed 3	4518	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6		
Shed 4	4518	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6		
Shed 5	10677	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3	46.3		
Farm Show (Shed 7)	1048	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
Total	26704	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7		
Peak flow rate (l/s)		3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2		
Wet Retail				l/d/m²	15 Peak Factor		3																
	Area (m²)	Daily Demand (m³)																					
Café (Shed 6)	426	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4		
Winery	580									8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7		
Total	1006	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1		
Peak flow rate (l/s)		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
Livestock & Milking Shed (Shed 8)*				l/sheep/day	7.5 l/cow/day		70 Peak Factor		24														Based on half water use being for washdown
	No.	Daily Demand (m³)																					
Dairy Cows	100	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7		
Sheep	1000	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5		These flows are excluded from the town WW demand and are to be treated on site.
Total	1000	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15		
Peak flow rate (l/s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		
Infiltration & Ingress				Infiltration l/ha/day	2250		Ingress l/ha/day	16500															assumes a sealed system so no infiltration or ingress except for residential Havelock Village
	Total Area (m²)	Area (m²)																					
Residential Area	601400	0.0	0.0	0.0	0.0	60140.0	120280.0	180420.0	240560.0	300700.0	360840.0	420980.0	481120.0	541260.0	601400.0	601400.0	601400.0	601400.0	601400.0	601400.0	601400.0		
	Total Area (m²)	Daily Demand (m³)																					
Residential Infiltration		0.0	0.0	0.0	0.0	13.5	27.1	40.6	54.1	67.7	81.2	94.7	108.3	121.8	135.3	135.3	135.3	135.3	135.3	135.3	135.3		
Commercial Infiltration	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Infiltration (m³/day)	601400	0	0	0	0	14	27	41	54	68	81	95	108	122	135	135	135	135	135	135	135		
Total Ingress (m³/day)		0.0	0.0	0.0	0.0	99.2	198.5	297.7	396.9	496.2	595.4	694.6	793.8	893.1	992.3	992.3	992.3	992.3	992.3	992.3	992.3		
Total Infiltration & Ingress (l/s)		0.0	0.0	0.0	0.0	1.3	2.6	3.9	5.2	6.5	7.8	9.1	10.4	11.7	13.1	13.1	13.1	13.1	13.1	13.1	13.1		
Total Residential/Commercial (excluding I&I)																							
Daily Demand (m³)		122	294	294	294	350	406	462	518	583	639	695	751	807	863	863	863	863	863	863	863		
Peak flow rate (l/s)		3	9	9	9	12	14	15	17	19	21	23	24	26	28	28	28	28	28	28	28		
Total																							
Average Daily Flow (m³)		122	294	294	294	364	433	503	573	651	720	790	859	929	998	998	998	998	998	998	998		
Peak Wet Weather Flow (l/s)		3	9	9	9	13	16	19	22	26	29	32	35	38	41	41	41	41	41	41	41		

*Provisional; i.e. ideally this will be managed on site i.e. effluent irrigation


Estimated Wastewater Flow (m³/d)
1200
1000
800
600
400
200
0
Q3 2021 Q4 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Residential
RC1 Hotel
Total
Dry Retail
Wet Retail
Livestock/Dairy
Infiltration
Total Residential/Commercial


Estimated Wastewater PWWF l/s
45
40
35
30
25
20
15
10
5
0
Q3 2021 Q4 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Residential
RC1 Hotel
Total
Dry Retail
Wet Retail
Livestock/Dairy
Infiltration & Ingress
Total Residential/Commercial

Tata Valley RC1 Hotel Occupancy and Flows

CLIENT:	**Tata Valley Limited**	**DESIGNER:**	**AJH**
PROJECT:	**Tata Valley**	**JOB NO:**	**2020**
OUTFALL:	**Tata Valley RC1 Hotel Occupancy and Flows**	**DATE:**	**16/09/2019**
		REV:	**2**

Calculated hotel Wastewater flows based largely on TP58 flows
Assumes water reuse tank is empty.

Area	Occupancy	Flow l/p/d	l/d	m³/d	l/s	
Kids Club	30	220	6600	6.6	0.08	
Conference Rooms	200	30	6000	6	0.07	
Restaurant/bar/café	100	30	3000	3	0.03	
Hotel Guests (2.8 per room, 200 rooms), includes laundry	560	220	123200	123.2	1.43	
Hotel Day Guests (pools etc)	50	30	1500	1.5	0.02	
Hotel Day Staff	50	40	2000	2	0.02	
Pools Backwashing (with 30m3 backwash surge tank)				30	1.00	peak flow of 3l/s with surge tank
Totals	**990**	**570**	**142300**	**172.3**	**2.65**	**ADWF**
			Peaking Factor		**3.00**	
					7.94	**PWWF**

c.f. calculations based on Auckland IGC document

Basis	HUE	Demand l/d	Demand m³/d	Demand l/p/d	
childcare centre	1.25	750	0.75	25	
school	6.666667	4000	4	20	matches TP58 upper estimate for school
assume 2m³/day	3.333333	2000	2	20	c.f. 25-30 from TP58
hotel rooms with bathroom facilities but no kitchen	200	120000	120	214.2857	
school	1.666667	1000	1	20	
commercial	4.166667	2500	2.5	50	
Assume 30m³/day	50	30000	30		
		Total	160.25		

c.f. 1000*0.26=260 from WW Pipe sizing sheet; c.f. 1000*0.26*5=1300 original rjp version

Tata Valley Water Useage Estimates - Horticulture References

CLIENT:	**Tata Valley Limited**	**DESIGNER:**	**AJH**
PROJECT:	**Tata Valley**	**JOB NO:**	**2020**
OUTFALL:	**Tata Valley Water Useage Estimates - Horticulture References**	**DATE:**	**16/09/2019**
		REV:	**2**

https://www.irrigationnz.co.nz/KnowledgeResources/FAQ During the New Zealand summer plants use an average of 4-5mm of water a day. During peak growth they can use more than 8mm a day

Vineyard Irrigation

	Low estimate	High Estimate	
Area	4	4	Ha
Vines	3000	7400	vines/Ha
Water use	10	13	l/vine/day
Water use	120	384.8	m^3/d
Equivalent rainfall depth	3	9.62	mm

c.f. annual rainfall of 1200mm = 3.3 mm/day average

c.f. 200mm/yr for Marlborough. 200/3 = 67 days. 200/10=20 days. Looks like the bulk of Marlborough has annual rainfall between 800mm and 1200mm https://marlborough.maps.arcgis.com/apps/MapJournal/index.html?appid=98ac0ed6209d4256b3d44eaacbcb770b

Kiwifruit Irrigation

	Low estimate	High Estimate	
Area	10		Ha
Water use	29838.70968		l/hr/ha
Water use	7161.290323		m^3/d
Equivalent rainfall depth	71.61290323		mm

N.B. average kiwifruit farm is 4.8Ha http://www.hea.co.nz/2012-05-11-03-05-28/kiwifruit-trade. It seems a bit less than half the farms are irrigated, using information from https://www.irrigationnz.co.nz/PracticalResources/GMP/Attachment?Action=Download&Attachment_id=24 design flow rate from a case study on waterforce.co.nz

This is too much, so I guess they only run the system for a short time each day. If they ran it for 1hr it would be 3.3mm, so similar to the vineyard.

Potatos Irrigation for comparison

	Low estimate	High Estimate	
Area	10		Ha
Water use	0.773809524		l/s/ha
Water use	668.5714286		m^3/d
Equivalent rainfall depth	6.685714286		mm

design flow rate from a case study on waterforce.co.nz

Might be too much, maybe they only run the system for a short time each day. If they ran it for 1hr it would be 0.3mm

Total 120 m^3/d

Tata Valley Water Useage Estimates - RC3 Shed References

CLIENT:	**Tata Valley Limited**	**DESIGNER:**	**AJH**
PROJECT:	**Tata Valley**	**JOB NO:**	**2020**
OUTFALL:	**Tata Valley Water Useage Estimates - RC3 Shed References**	**DATE:**	**16/09/2019**
		REV:	**2**

Milking shed washdown (WRC)				
Cows	100	100	cows	
Water use	35	100	l/cow/day	
Water use	3.5	10	m³/d	
Assume no irrigation for dairying				
Drinking water for cows (US source)				
Water use	110	190	l/cow/day	
Water use	11	19	m³/d	
Total	14.5	29	m³/d	

Typical dairy farm usage (Shed 8)			
Water use	140	l/cow/day	https://www.dairynz.co.nz/environment/water-use/water-meters-and-monitoring/
Water use	14	m³/d	

Sheep	1000	sheep	
Water usage	10	l/sheep/day	from a canadian document
Wash down	10	l/sheep/day	refer David's calcs
Total	20	m³/d	

	Area	Category based on Watercare standard	m²/person	l/p/d	m³/d	
Shed 1	2551	Dry retail with customer toilets	15	65	11	I don't know what they'll be doing in these sheds, but I suspect this is very conservative apart from the agrodome
Shed 2	3392	Dry retail with customer toilets	15	65	15	
Shed 3	4518	Dry retail with customer toilets	15	65	20	
Shed 4	4518	Dry retail with customer toilets	15	65	20	
Shed 5	10677	Dry retail with customer toilets	15	65	46	
Farm Show (Shed 7)	1048	Dry retail with customer toilets	15	65	5	
Total	**26704**		**90**	**390**	**115.7173**	

		Category based on Watercare standard	l/d/m²	m³/d	
Café (Shed 6)	426	Wet retail	15	6.39	these might be high - the average Auckland restaurant uses 2m³/d
Winery	580	Wet retail	15	8.7	
Total RC3				165 m³/d	c.f. 780 from WW Pipe sizing sheet; c.f. 3900 original rjp version

RITS WW peaking factors

POPULATION EQUIVALENT FOR CATCHMENT OR SUB CATCHMENT AREA	WASTEWATER PEAKING FACTORS	
	RESIDENTIAL	COMMERCIAL
10	14	13
15	12	11
20	10	9.5
25	9.1	8.5
30	8.5	8
35	8	7.5
40	7.5	7.2
45	7	6.9
50	6.8	6.3
55	6.7	6
60	6.3	5.7
65	6.2	5.5
70	6	5.4
75	5.9	5.3
80	5.8	5.1
90	5.5	5
100	5.3	4.8
125	5	4.2
150	4.8	4
175	4.4	3.8
200	4.1	3.7
250	4	3.5
300	3.8	3.3
350	3.7	3.1
400	3.5	3
450	3.4	2.9
500	3.3	2.8
600	3.2	2.7
700	3.2	2.6
800	3.1	2.55
900	3	2.5
1000	3	2.4
1500	2.9	2.2
2000	2.8	2.1
2500	2.8	2
3000	2.7	1.9
3500	2.6	1.85