

Report

# Tuakau Structure Plan: Water and Wastewater Technical Assessment

**Prepared for Waikato District Council (Client)**

**By Beca Ltd (Beca)**

29 August 2014

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## Revision History

Revision N°	Prepared By	Description	Date
A	Gareth Hall/Lana Davison	Draft	30 June 2014
B	Gareth Hall/Lana Davison	Final Draft	29 July 2014
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## Document Acceptance

Action	Name	Signed	Date
Prepared by	Gareth Hall/ Lana Davison		29/8/14
Reviewed by	Paul Armstrong		29/8/14
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on behalf of	Beca Ltd		

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## 1 Introduction

A structure plan is currently being developed to facilitate and plan for growth in Tuakau over the next 30 years. This plan outlines the layout of land uses and sets out the key transportation links throughout the community. Within the location of proposed growth areas, an assessment of the water and wastewater infrastructure has been undertaken.

## 2 Existing Networks

The Tuakau water and wastewater networks were assessed by review of previous modelling reports and a workshop held with WDC operations staff on 21 February 2014. The following sections provide a summary of the existing infrastructure limitations based on these reports and operator input.

### 2.1 Water Supply

A hydraulic network model was built and run for the Tuakau water network (MWH, 2006). While the accompanying report is now out of date, the current observations of WDC operations staff suggest not much has changed. The required level of service supply pressure of 20m is currently met in all areas, but no modelling allowing for future development was undertaken.

The Tuakau water network is very “spider like” with numerous dead ends, and many of the bulk supply mains are only 100mm diameter. Not surprisingly the 2006 modelling showed compliance with the then 1992 fire code flows and pressure is not achieved in the extremities of the network, particularly around McEvoy Place and Whangarata Road.

Operator observations suggest that when hydrants are opened, the pressure is adequate but the flow is limited to meet fire fighting requirements. Establishing a minimum water supply main (excludes rider mains) size of 150mm and creating loops in the network to improve hydraulic performance is needed to achieve compliance with SNZ PAS 4509:2008 fire flows and pressures, notwithstanding catering for large scale development where boost pumping may be required in some areas.

### 2.2 Wastewater

A hydraulic network model was built and run for the Tuakau wastewater network (AWT, 2010). This showed adequate capacity in the Tuakau reticulation network to the Watercare trunk main for all but future wet weather flows. However since that time Pokeno wastewater has been reticulated and is pumped into the Tuakau reticulation system via a dedicated rising then falling main. The downstream (western) end of the Tuakau network now experiences periodic overflows during storm events.

To mitigate wastewater overflow issues in Tuakau, the wastewater main from Pokeno will be diverted to a new pump station next to the existing Matipo pump station (which will be decommissioned). The wastewater will then be pumped via a dedicated rising main to a new connection to Watercare’s Pukekohe sewer interceptor at Buckland Road. Based on AWT 2010, this will free up capacity in the existing Tuakau network to allow for development.

The new pump station and rising main have been designed and are scheduled to be constructed in 2014.

There are no further unknown problems in the existing wastewater system for Tuakau.

### 3 Population and Demand Projections

The current and future populations for Tuakau have been based from the 'Strategic Water Supply Options Assessment for Pokeno and Tuakau' letter report by MWH. The current population for Tuakau as shown in Table 3-1 is 4,429 people and is expected to increase to 7,236 people by 2031.

**Table 3-1: Current and Future Populations for Tuakau**

	2014	2016	2021	2026	2031
	4429	4,719	5,470	6,260	7,236

Population estimates for Pokeno have been included for the wastewater assessment. Pokeno population is currently 1288 people and is expected to increase to 6753 people by 2031. The combined population of Tuakau and Pokeno is expected to be 13989 people by 2031.

**Table 3-2: Current and Future Populations for Tuakau and Pokeno**

	2014	2016	2021	2026	2031
Tuakau	4,429	4,719	5,470	6,260	7,236
Pokeno	1,288	2,049	3,848	5,576	6,753
Total	5,717	6,768	9,318	11,836	13,989

The future growth areas for Tuakau to the year 2031 were supplied by the council and anticipated developing approximately 723 hectares of land additional to the existing developed area. This will be developed in stages and include commercial, industrial and a range of residential areas. The water and wastewater for Tuakau has been assessed on the final stage at year 2031 and does not include staging. The location and associated land use for the Tuakau development areas is illustrated in Appendix A.

There is currently no wastewater flow data available for Tuakau however payment to Watercare is based on 0.49m<sup>3</sup>/day per household equivalent unit (HEU) with 2.59 people per HEU.

## 4 Structure Plan Areas

### 4.1 Methodology

The future development areas for Tuakau were evaluated and divided into sub catchments to align with the existing terrain. From there, the proposed network was positioned along existing and proposed roads where practicable to connect with the existing infrastructure. The water and wastewater flows for each sub catchment were calculated based on the Hamilton City Council Development Manual. Using the flows from each sub-catchment, pipes sizes were determined using a minimum pipe diameter of 150mm (excluding rider mains). The proposed pipes have been sized as per the HCC Development Manual, and grades assumed by the difference in existing ground levels.

The original brief required layout plans and costs for water and wastewater infrastructure in the proposed development areas. The position of pipes is generally dependent on the proposed road layout and therefore pipes have not been placed where the road layout is unknown. It was assumed that the water and wastewater network in these areas will be the responsibility of the

developer. Wastewater pump stations and rising mains outside the development areas have not been included. However upon request from WDC, new service reservoirs, and watermain upgrades in the existing urban area required to meet levels of service have been considered and costs allowed for.

## 4.2 Water Supply

The water supply network has been assessed based on the “*Strategic Water Supply Options Assessment for Pokeno and Tuakau*” report by MWH. This uses a water demand of 260 litres/person/day and a factor of five times this figure for peak flow.

It is noted that the current network has fire hydrants predominantly supplied by 100mm diameter pipes and in accordance with the Hamilton City Development Manual guidance these may all eventually need to be on 150mm diameter pipes. For the purposes of this report the upgrade of the 100mm diameter mains has focussed upon those mains which, will be upgraded in response to the proposed planned development, or where dead ends would remain in the existing network.

The water demand for industrial purposes, and used to determine the pipe size of the network, was confirmed by WDC to be 1200m<sup>3</sup> per day. To size the pipes it was assumed that the peak demand for industrial use would not coincide with the peak demand for the residential supply based upon the industry operating on an 8hr day and the residential peaks occurring pre and post working hours.

The average demand for the year 2031 and population of 7,236 persons equates to a flow rate of 21.8 l/s and thus peak flow of 108 l/s.

For the industrial demand of 1200m<sup>3</sup> per day results in an average flow of 13.8 l/s and peak flow of 69.4l/s.

Based upon, the residential and industrial peaks not occurring simultaneously and a maximum velocity less than 3.5m/s, the primary supply pipes from the service reservoir need to be a minimum of 200mm diameter. A 200mm diameter pipe then results in a velocity of 0.69m/s for average demand conditions. This is considered to be suitable to ensure the quality of the water supply is maintained.

The proposed layout for the future water supply network of Tuakau is shown in Appendix B.

It has been proposed to install water supply pipes along the roads within development areas. These have been positioned to create loops where possible to improve the quality and pressure of the supply. The size of these pipes is at a minimum of 150mm diameter in the residential zones and 200mm diameter in the industrial zones. Two boost pump stations are proposed to provide level of service supply and fire pressures to elevated areas. The water supply layout does not show rider mains. However, these have been included in the cost estimates.

There is one known proposed water demand in the industrial area. Brinks poultry processing factory was previously reported to require 250m<sup>3</sup> per day but was subsequently confirmed by WDC, that for the purposes of this report, an industrial demand of 1200m<sup>3</sup>/day should be used. The potential business type for the remainder of industrial area is unknown. Therefore it is difficult at this stage to calculate the water demand in this area. At this early pre development stage, it has been assumed that a 200mm pipe will be suitable. Once industry types are known, this will need to be reassessed where the considered 1200m<sup>3</sup> per day demand requirement will be exceeded or the working hours overlap with residential peak demands.

The existing water supply network has approximately 15km of pipe that is 100mm diameter. Some areas of the network may need to be upgraded / duplicated with 150mm diameter mains to future proof fire flows and pressure. An initial indication of this is shown in the water supply layout plan in

Appendix B. The priority for any pipes to be replaced should be based on the age and condition of pipes where no other requirements take precedence.

The existing reservoir currently stores over 48 hour supply with a capacity of 2,405m<sup>3</sup>. The current daily demand is 1,130m<sup>3</sup>/day which is expected to increase to 1,883m<sup>3</sup>/day by 2031. For storage of 48 hour supply this would require the service reservoir to be increased to a capacity of 6,166m<sup>3</sup>, or an additional storage of 3,761m<sup>3</sup> to be provided.

On the assumption that WDC will continue to require 48 hour storage, it has been proposed that two additional reservoirs of the same size as the existing will be required. To assist in assuring water quality and turnover in the reservoirs it has been assumed that their supply is fixed for average demand needs and the level in the reservoir fluctuates in line with the network daily demand cycle.

#### Key Assumptions of the Water Supply Network

- That WDC persists with 48 hour storage for the water supply of Tuakau
- The water supply pipes in development areas where roads are undefined will be subject to the developer.
- Supply is from Watercare and that the bulk supply has the capacity to provide the water demand needs for Tuakau.
- The existing sources will only be used in periods where Watercare cannot provide supply due to unplanned interruptions in their system.
- Supply to the service reservoirs from existing sources would use the current approach whereby the reservoirs are filled over night via the supply network.
- The existing boost pumps at the corner of Ryders Road and Harrisville Road provide adequate supply pressure to elevated dwellings towards the service reservoir (the proposed boost pump on Dominion Road will provide a backup for this, as well as boosting up Dominion Road feeding the loop round to the industrial area).
- Where the condition and age of the existing 100mm pipes are suitable for the design horizon of year 2031 then they may be retained in use for residential supply.
- The 300mm diameter main from the proposed bulk supply point to the service reservoirs will meet peak demand, should by-pass of the reservoir be required.

### **4.3 Wastewater**

As per the HCC Development manual, calculations for wastewater flows have been based on a water consumption of 200 litres per person per day. Occupancy rates for Tuakau were predicted at 2.59 persons per household from the MWH letter report. Table 4-1 sets out the population per hectare for each future zone. The country living zone was not included for the wastewater assessment as this area will not be serviced by the Council system.

The industrial and commercial zones were calculated based on the recommended equivalent population density as specified in the HCC Development Manual. These were 45 persons per hectare and 30 persons per hectare, respectively. The two known wet industries for Tuakau were Lowe Corporation and Brinks Poultry Processing Factory. It has been assumed that there are no other wet industries in this area. The predicted wastewater flows for Lowe Corporation were unknown at this stage and therefore included with the remainder of industrial area. The predicted water demand for Brinks poultry processing factory was 1200m<sup>3</sup>/day; It has been assumed that the wastewater flow is 80 per cent of water demand.

**Table 4-1: Description of Development Zones**

Residential	Lot Size (m <sup>2</sup> )	Population per Hectare
Country Living	Greater than 3000	<i>Private on site wastewater system</i>
Large Lot	1000 - 3000	13 persons per hectare
Low Density	600 - 1000	32.4 persons per hectare
Medium Density	400 - 600	51.8 persons per hectare
Commercial	<i>varies</i>	30 persons per hectare
Industrial	<i>varies</i>	45 persons per hectare

The proposed layout for the future wastewater network of Tuakau is shown in Appendix C. The network follows the proposed road layout where appropriate or alternatively runs adjacent to boundary lines and in open spaces. Some growth areas propose to connect directly to the existing network while other areas flow into proposed pump stations.

Pump stations have been placed at low points in the sub catchment areas allowing wastewater to flow via a gravity system. The wastewater may then be pumped via a rising main to the existing pump stations of Dominion, Geraghtys and the New Pump Station next to Matipo (to be decommissioned). These eventually pump into Watercare’s Pukekohe interceptor.

The predicted wastewater flows for the proposed pump stations included the areas of development where there was no proposed road layout. However, pipes in these areas were not proposed and will be the responsibility of the developer. The wastewater flows will need to be reassessed once the road layout is known.

The wastewater flows for each sub catchment proposed a total of:

- 17,800m of 150mm diameter pipe;
- 1,351m of 225mm diameter pipe;
- 3,090m of rising main assumed at 150-300mm diameter; and
- Six pump stations.

A summary of the proposed pump stations and the design peak wet weather flow is shown below.

**Table 4-2: Wastewater Pump Station Overview**

Pump Station	Pumps to	Catchment Area (ha)	PWWF (l/s)
PPS1	Ex. Dominion PS	21.9	4
PPS2	New PS	69.1	28
PPS3	PPS4	62.5	11
PPS4 (includes PPS3)	Ex. Geraghtys PS	129.3	26
PPS5	Ex. Geraghtys PS	63.4	16
PPS6	Existing Bypass	60.5	15

### Key Assumptions for the Wastewater Network

- The wastewater flows from Pokeno have not been included in the wastewater assessment. It has been assumed that the new pump station and rising main constructed in 2014 has capacity for future development in the area. This includes the Yashili dairy factory.
- It has been assumed that the new pump station and connection to Watercare's Pukekohe sewer interceptor at Buckland Road has capacity for some future development of Tuakau. This will need to be assessed closer to development.
- The existing pump stations of Dominion and Geraghtys have been assumed to have capacity for future development flows. These will need to be assessed prior to development and may need upgrading.
- It has been assumed that 150mm pipe diameters will be sufficient for the wastewater flows in the industrial area based on HCC Development Manual. This will need to be reassessed when industry types are known.
- The development area next to Tuakau town has existing wastewater infrastructure. These have been assumed to be of the required capacity for this area.
- Relatively flat areas within the development have been assumed to fall in the direction of the existing wastewater network.
- The wastewater layout in areas that fall away from proposed roads will be subject to the developer. Pump stations have been positioned in these areas however may be relocated once layout of development is known.
- The North West development has been assumed to flow directly into the existing network. It has been assumed that the existing network has capacity for these areas and will need to be reassessed prior to development.
- At this early stage, all proposed rising mains have been assumed at 150 – 300mm pipe diameter and will need to be reassessed prior to development.

The impact of the development areas and associated flow in terms of the reduction of the level of service has not been assessed at this stage. It is suggested that this impact be evaluated using a revised, "future" version of the model used to assess current capacity. This includes assessment of the available capacity of the Pukekohe interceptor.

## **5 Cost Estimates**

Cost estimates for the water supply and wastewater network have been based on Watercare Services Limited (Watercare) Unit Rate Model 2011 and other unit cost information which has been derived from recent construction tenders. An allowance for inflation of 10 per cent has been made to translate the Watercare 2011 rate to present day unit rates.

The water supply assessment has shown that the proposed infrastructure to facilitate the development of Tuakau will be a total cost of \$29.95 million. This price includes a contingency of 40 per cent. A summary of the total cost for water supply is shown in Table 5-1.

**Table 5-1: Summary of Cost Estimate for Water Supply**

ITEM	DESCRIPTION	UNIT	RATE (\$)	QUANTITY	COST (\$)
Pipe					
	150mm dia (New) <sup>(1)</sup>	m	444.1	17,700	7.86M
	150mm dia (Upgrade)	m	365.5	7,015	2.56M
	200mm dia	m	546.5	9,550	5.22M
	300mm dia	m	760.0	2,330	1.78M
Reservoir					
	2 x 2400m <sup>3</sup>	m <sup>3</sup>	581	4,800	2.79M
Pump Stations					
		ea	593,000	2	1.19M
<b>Total</b>					<b>21.39M</b>
	<b>Contingency of 40%</b>				<b>8.56M</b>
<b>Total</b>					<b>29.95M</b>

(1) Rate includes 50mm id (65mm od) ridermains

The Watercare Unit Rate Model provided a per metre rate for the network based on various gravity pipeline sizes. The wastewater pump stations were costed on the basis of installed capacity from the peak wastewater inflow.

The rising main cost estimates have been based on the following;

- Assumed material of PE80 MDPE SDR17;
- Average pipe depth of 1.5m;
- The rate taken from an average pipe rate for the size range of 150 – 300mm diameter.

The wastewater assessment has shown that the proposed infrastructure to facilitate the development of Tuakau will be a total cost of \$37 million. This price includes a contingency of 40 per cent. A summary of the total cost for wastewater is shown in Table 5-2.

**Table 5-2: Summary of Cost Estimate for Wastewater**

Item	Description	Unit	Rate (\$)	Quantity	Cost (\$)
Gravity Pipe					
	150 dia pipe	m	808.5	18413	14.9M
	225 dia pipe	m	894.3	2530	2.3M
Riser Main					
	150 - 300 dia pipe	m	540	4018	2.2M
Pump Station					
	5 l/s	ea	1.06M	1	1.1M
	10 l/s	ea	1.11M	1	1.1M
	15 l/s	ea	1.16M	2	2.3M
	20 l/s	ea	1.21M	0	0
	25 l/s	ea	1.27M	1	1.3M
	30 l/s	ea	1.32M	1	1.3M
<b>Total</b>					<b>26.4M</b>
	<b>Contingency of 40%</b>				<b>10.6M</b>
<b>Total</b>					<b>37.0M</b>

## **6 Conclusions & Recommendations**

### **6.1 Conclusions**

To support the development of a structure plan for Tuakau, an assessment of the future water and wastewater demand associated with development areas, mostly in periphery of the town, has been made.

The water network suffers from some localised low pressure issues and further development may require the installation of booster pumps in the network.

A conceptual level water network to service the future development areas as well as upgrade of the existing network to meet level of service flows and pressures has been designed. A high level cost estimate of \$29.95M for this network has been made.

Further water network modelling is necessary to confirm the extent of the proposed upgrades required.

An assessment has been made of the available capacity in the current wastewater network and concluded that for the most part there is sufficient capacity to cope with current flows.

A conceptual level wastewater network to service the future development areas has been designed comprising gravity networks and associate pumping stations. A high level cost estimate of \$37M for this network has been made.

With the scope of the work done to date it is not possible to determine, definitely whether the existing wastewater network and associated pumping stations has sufficient capacity to accommodate future flows.

### **6.2 Recommendations**

It is recommended to:

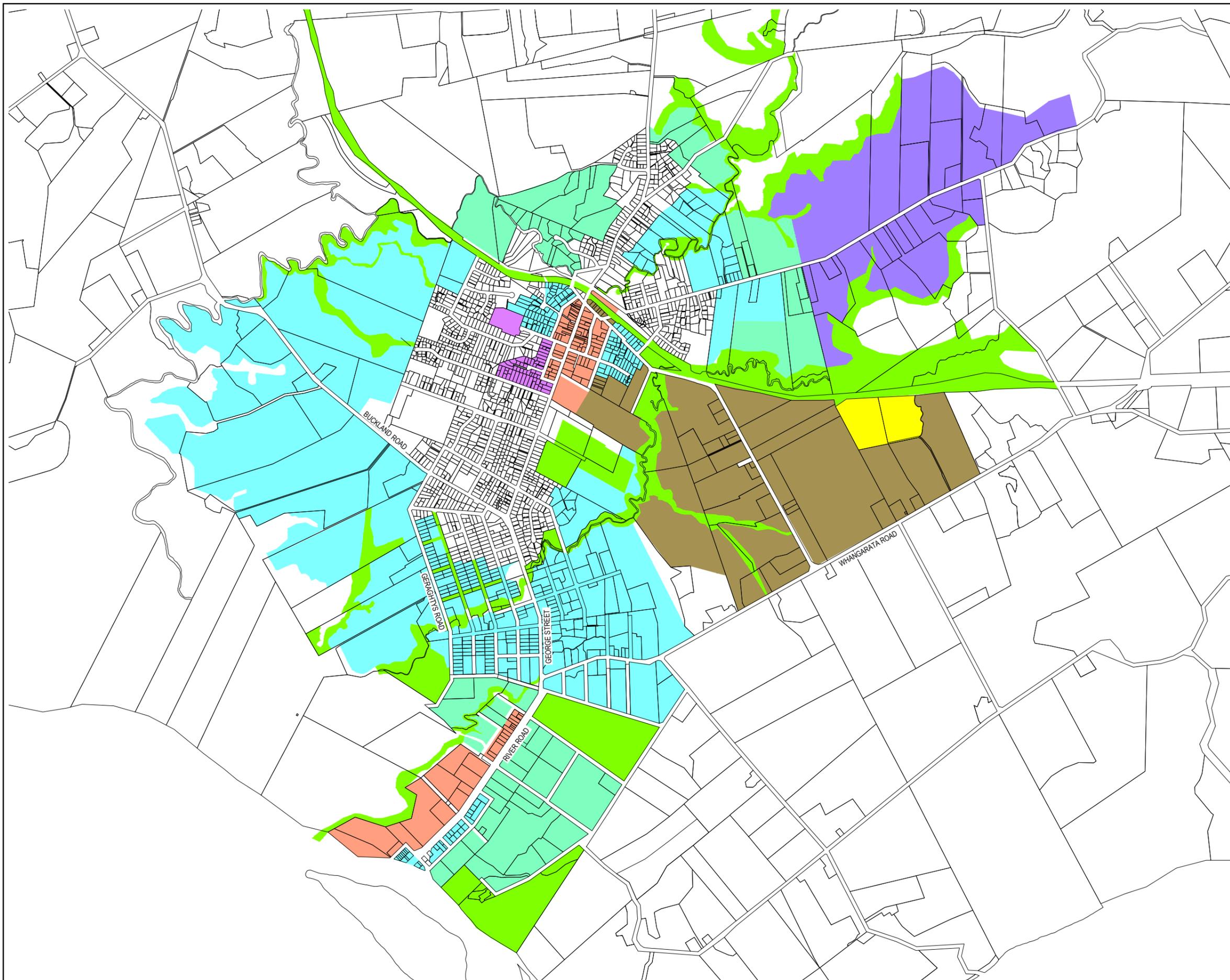
Update the existing, or develop a new model of the water network system including the future flows to determine/confirm the extent of the existing network to be upgraded, so that the proposed improvements can be prioritised to ensure flows and pressures meet the required levels of service.

Develop a model of the wastewater system with future flows to determine whether the existing network has sufficient capacity to cope with these flows.

## 7 References

1. "Strategic Water Supply Options Assessment for Pokeno and Tuakau", *MWH*. October 2013.
2. "Tuakau Model Build and Sewerage System Performance", *AWT*. February 2010.
3. "Tuakau Water Supply Model", *MWH*. May 2006.
4. "Update of Unit Rate Cost Models", *Aecom*. July 2011

**Appendix A: Tuakau Growth Areas**



**LEGEND:**

EXISTING URBAN

FUTURE LAND USE ZONES

- COMMERCIAL
- DRY INDUSTRIAL
- WET INDUSTRIAL (BRINKS)
- LARGE LOT
- LOW DENSITY RESIDENTIAL
- MED DENSITY RESIDENTIAL
- COUNTRY LIVING
- OPEN SPACE

ORIGINAL DRAWING  
IN COLOUR

**FOR INFORMATION  
NOT FOR CONSTRUCTION**

No.	Revision	By	Chk	Appd	Date
A	FOR INFORMATION	AF	PA	GH	29.07.14

Drawing Originator:

Original Scale (A1)	Design	LD	29.07.14	Approved For Construction*
1:10000	Drawn	LD	29.07.14	Date
Reduced Scale (A3)	Dwg Verifier			
1:20000	Dwg Check			

\* Refer to Revision 1 for Original Signature

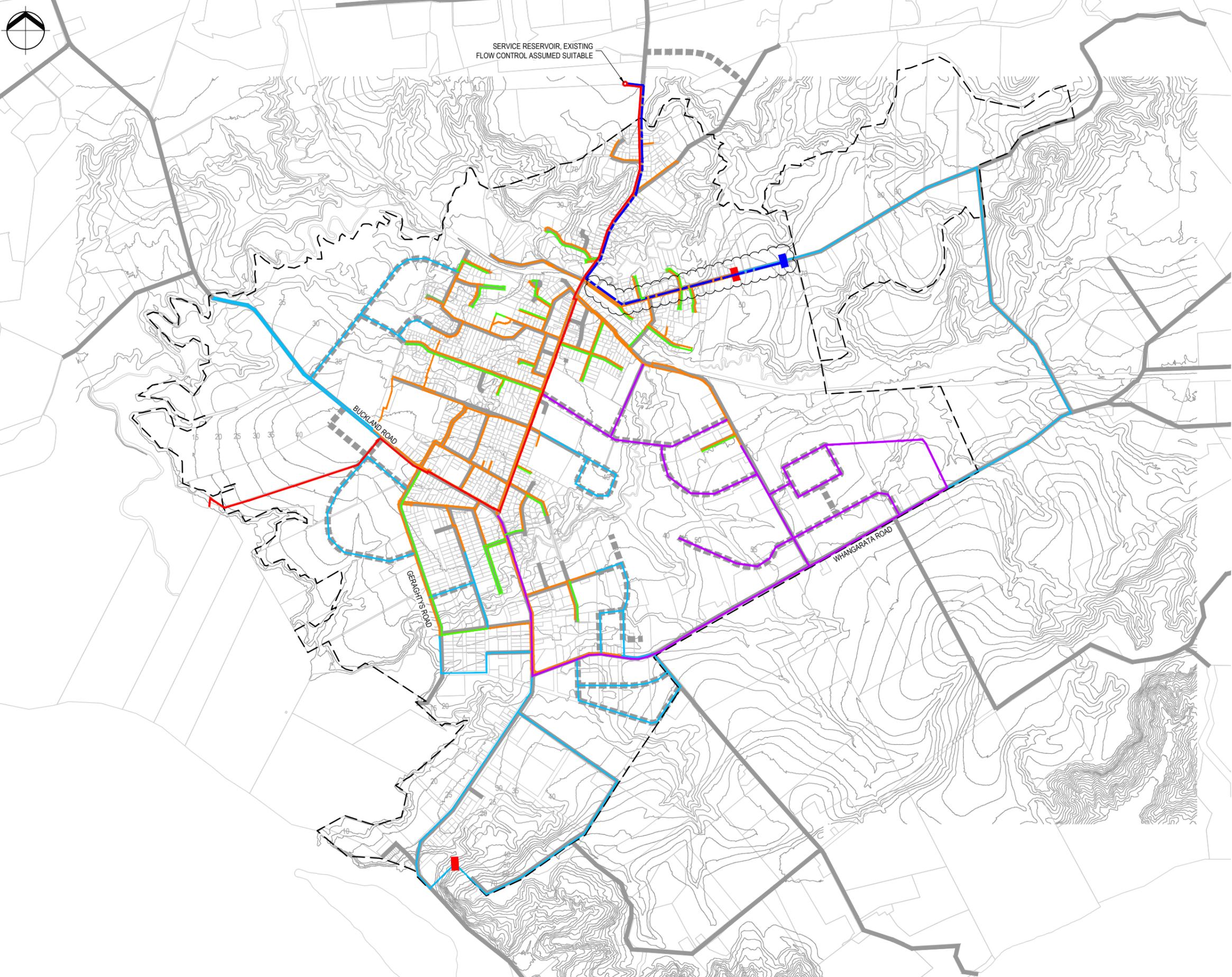
Client:

Project: WDC STRUCTURE PLANS

Title: TUAKAU DEVELOPMENT AREAS

Discipline	CIVIL
Drawing No.	3411575-CK-103
Rev.	A

**Appendix B: Proposed Draft of Water Network**



**LEGEND:**

- EXISTING WATER SUPPLY PIPE
- EXISTING WATER MAIN TO REMAIN IN USE
- PROPOSED 150mm WATER SUPPLY PIPE
- PROPOSED 200mm WATER SUPPLY PIPE
- PROPOSED 300mm WATER SUPPLY PIPE
- UPGRADE/DUPLICATION OF EXISTING SUPPLY
- PROPOSED PRESSURE BOOST PUMPING STATION
- BULK SUPPLY POINT
- SERVICE RESERVOIR
- EXISTING ROAD
- PROPOSED ROAD
- TUAKAU DEVELOPMENT AREA

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No.	Revision						
B	FOR INFORMATION - BULK SUPPLY POINT RELOCATED	AF	GH	IG	25.08.14		
A	FOR INFORMATION	AF	PA	GH	29.07.14		

Drawing Originator:

Original Scale (A1)	Design	LD	29.07.14	Approved For Construction*
1:10000	Drawn	LD	29.07.14	Date
Reduced Scale (A3)	Dwg Verifier			
1:20000	Dwg Check			

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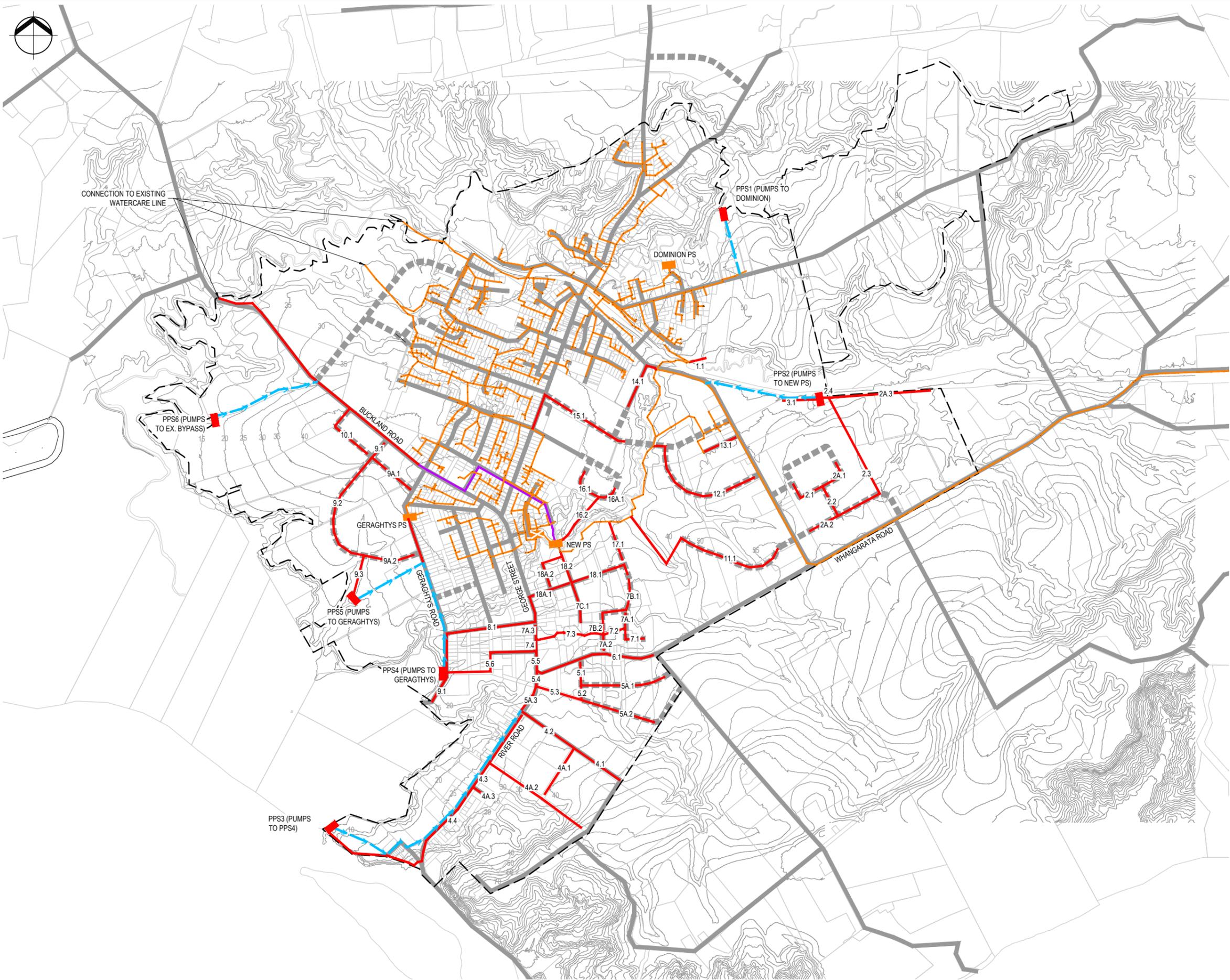
Project: **WDC STRUCTURE PLANS**

Title: **TUAKAU PROPOSED WATER SUPPLY NETWORK**

Discipline	Rev.
CIVIL	
Drawing No.	
3411575-CK-101	B

Document No. 3411575-CK-101.DWG

**Appendix C: Proposed Draft of Wastewater Network**



**LEGEND:**

- EXISTING WASTEWATER PIPE
- ASSUMED RISING MAIN
- EXISTING PUMP STATION
- PUMP STATION TO BE DECOMMISSIONED
- PROPOSED WASTEWATER PIPE - GRAVITY
- PROPOSED WASTEWATER PIPE - PRESSURE
- PROPOSED PUMP STATION
- EXISTING ROAD
- PROPOSED ROAD
- TUAKAU DEVELOPMENT AREA

**NOTES:**

1. NEW PS CURRENTLY UNDER CONSTRUCTION

ORIGINAL DRAWING  
IN COLOUR

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No.	Revision	By	Chk	Appd	Date
A	FOR INFORMATION	AF	PA	GH	29.07.14

Drawing Originator:

Original Scale (A1)	Design	LD	29.07.14	Approved For Construction*
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Reduced Scale (A3)	Design Checker			
1:20000	Dwg Check			

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Client:

Project: **WDC STRUCTURE PLANS**

Title: **TUAKAU PROPOSED WASTEWATER DRAFT LAYOUT PLAN**

Discipline	CIVIL
Drawing No.	3411575-CK-100
Rev.	A