

Report

Ngaruawahia Structure Plan: Water and Wastewater Technical Assessment

Prepared for Waikato District Council (Client)

By Beca Ltd (Beca)

21 August 2014

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Revision History

Revision N°	Prepared By	Description	Date
A	Gareth Hall/Lana Davison	Draft	28 July 2014
B	Gareth Hall	Final - minor edits from Client Review	21 August 2014

Document Acceptance

Action	Name	Signed	Date
Prepared by	Gareth Hall		21 August 2014
Reviewed by	Paul Armstrong		21 August 2014
Approved by	Ian Garside		21 August 2014
on behalf of	Beca Ltd		

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1 Introduction

Structure plans are currently being developed to facilitate and plan for growth in and around Ngaruawahia over the next 30 years. The map in Appendix A shows the towns in the structure plan study area. The structure plans outline the layout of proposed residential and industrial land use, and key transportation links throughout the community. This report provides an assessment of the water and wastewater infrastructure needs for Ngaruawahia.

2 Existing Networks

The Ngaruawahia water and wastewater networks were assessed by review of previous modelling reports and a workshop held with Waikato District Council (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

A hydraulic network model has been built and operated for the Ngaruawahia/ Horotiu water supply (AWT, 2013). Based on current water demands, only 2.3% of nodes in the model present a supply pressure less than the required level of service of 20m. These areas are situated in the south east end of the supply zone around Paterson Rd, Osborne Rd and Kay Rd.

According to the model, hydrants in Horotiu and the outskirts of Ngaruawahia cannot meet the SNZ PAS 4509:2008 fire flow requirements (25 l/s) under current peak day water demand conditions.

Due to increased Horotiu industrial demand to 2031, higher head losses will result in pressures in the south of the supply zone dropping to below 20m. Correspondingly the fire flow and pressures will be further compromised.

WDC are currently in the process of securing a site for a new service reservoir and associated boost pump station which along with reticulation upgrades as recommended in AWT2013, will be designed to overcome the low supply pressures and non compliant fire supply to Horotiu and southern Ngaruawahia.

The Ngaruawahia Water Treatment Plant (WTP) is sometimes under capacity compared to current demands. This issue is being addressed as part of a separate district wide water supply strategy.

2.2 Wastewater

The Ngaruawahia wastewater network includes Horotiu and Taupiri. Wastewater from Horotiu is pumped via a dedicated rising main into the reticulation at the southern end of Ngaruawahia. Wastewater from Taupiri is pumped directly to the Ngaruawahia Wastewater Treatment Plant (WWTP), which is located between those two towns. No hydraulic modelling has been completed for the Ngaruawahia wastewater network.

There are no reported capacity issues with Ngaruawahia's wastewater network that lead to overflows. The main overflow risk is from powercuts due to the reliance on 14 pump stations to convey wastewater through Ngaruawahia to the WWTP. To mitigate this risk, emergency overflow storage is currently assessed for construction at the two most critical wastewater pump stations, being Thomas Street and Regent Street

Six hours emergency storage is the level of service to be adopted, consistent with the HCC Development Manual.

Wastewater generated from proposed development in Horotiu, industrial in particular, will result in network capacity issues in Ngaruawahia in the future. Therefore it is proposed to pump Horotiu's wastewater via a new dedicated rising main across Horotiu Bridge Road and along River Road directly to the Ngaruawahia WWTP. More details of this concept are provided in Section 4.3.

2.3 Ngaruawahia Surrounds

The Taupiri / Hopuhopu water reticulation is supplied by the Hopuhopu reservoir adjacent to the old State Highway 1. As the gravity feed from the reservoir is only at an R.L of approximately 37m supply pressures to customers are moderate. The reticulation pressure is boosted to a degree when the Hopuhopu Water Treatment Plant pumps are feeding the reservoir. Complaints of low water supply pressure are sometimes received from Taupiri Primary School on Greenlane Road. An option to pump directly into Taupiri from the WTP pumps to improve supply pressure when the reservoir is not being filled warrants further investigation.

Fire flow and pressure requirements to SNZ PAS 4509:2008 are not met. This is mainly due to the Hopuhopu reservoir being at an R.L of 37m and Taupiri town being around R.L 15m, so there is insufficient available head to meet fire fighting demands. A boost pump in the main water supply line to Taupiri would be needed to achieve compliance.

Te Kowhai and Glen Massey are not serviced by a public water supply. The former has approximately 21 wastewater connections to a WDC operated WWTP. The wastewater drainage reticulation is adequately sized for the current number of connections. Any future subdivision development should be straight forward to cater for. The current restriction is the adequacy and suitability of Te Kowhai's wastewater treatment and disposal, which is not part of the structure plan assessment.

3 Population and Demand Projections

The current and future populations for Ngaruawahia and surrounds have been taken from the "Population and Household Table" pdf document provided by WDC in February 2014 for the structure plan assessments, and are reproduced in Tables 3.1 and 3.2.

Table 3.1 - Current and Future Population Projections for Ngaruawahia

Town	2014	2021	2031
Ngaruawahia	5,319	5,573	6,034
Horotiu	870	954	1,100
Taupiri	453	466	490
Ngaruawahia Water ⁽¹⁾	6,189	6,527	7,134
Ngaruawahia Wastewater ⁽²⁾	6,642	6,993	7,624

(1) includes Horotiu.

(2) includes Horotiu and Taupiri.

Table 3.2 - Current and Future Populations for Satellite Towns

Town	2014	2021	2031
Te Kowhai (urban)	1,010	1,163	1,425
Glen Massey	279	313	322

The population figures used in AWT (2013) for Ngaruawahia water demand projections are consistent with table 3.1. Industrial water demand predictions were also made as per Table 3.3, based on the proposed Horotiu industrial development in the following Stages:

- Stage 1 : 56.2 ha released before 2021
- Stage 2 : 76.9 ha released before 2031

Table 3.3 - Ngaruawahia Peak Day Water Demand Projections

Demand (m ³ /d)	2013	2021	2031
Residential ⁽³⁾	3,356	3,618	3,829
Industrial	0	378	878
Total	3,356	3,996	4,707

(3) includes large users and night flow (AWT, 2013)

Average and peak daily wastewater flows for the previous three years (July to June) have been calculated from WDC Ngaruawahia WWTP inflow flowmeter records and are presented in Table 3.4.

Table 3.4 - Ngaruawahia WWTP Inflows

Year	Average (m ³ /d)	Maximum (m ³ /d)
2011/12	1,563	4,612
2012/13	1,600	6,190
2013/14	1,435	4,750

It is worth noting that the 2013/14 average wastewater flow is equivalent to 216l/capita/d. This is only slightly more than HCC Development Code calculation of 200l/capita/d so confirms the HCC code is an appropriate basis for Ngaruawahia wastewater flow estimates. The ratio of peak to average wastewater flow is between 3.0 and 3.9, which is normal for most New Zealand towns. The contribution of Inflow and infiltration (I&I) into the existing wastewater network requires more assessment with respect to the available capacity to cater for wastewater from new development.

4 Structure Plan Areas

4.1 Methodology

The preceding urban design assessment for Ngaruawahia and surrounds (Beca, 2014) identified proposed development areas. These are shown in the maps contained in Appendix B. Due to the size and location of the development areas, the transport assessment (Aecom, 2014) concluded no new link roads would be necessary for the Ngaruawahia structure plan.

New roads in the development areas would be the responsibility of the developer through the subdivision process. The same applies to water and wastewater infrastructure, which typically follows the road access. Therefore an assessment of water and wastewater infrastructure within the development areas has not been undertaken.

However current proposals to improve the existing water and wastewater networks, which will benefit the proposed development areas so they can comply with the Hamilton City Council development manual have been reviewed and summarised in the following sub-sections along with the associated costs in Section 5.

To future proof compliance with the required minimum water supply pressure of 20m and SNZ PAS 4509:2008, a minimum watermain size of 150mm (excluding rider mains) is recommended for future development.

4.2 Ngaruawahia Water

AWT (2013) provides a number of water infrastructure improvement options for the Ngaruawahia/Horotiu water supply system. The first stage which is required as a minimum is to improve levels of service (excluding Horotiu industrial), specifies a number of pipe upgrades to reduce head losses through the system and installation of a fire pump to meet residential fire fighting requirements in Horotiu.

Other enhanced improvement options are:

- 1) Improve security of supply in Horotiu (excluding industrial) – new 1,000m³ reservoir and boost pump station
- 2) Improve level of service (including Horotiu industrial) – new dedicated 250mm main from existing reservoirs and boost pump station (with additional downstream pipes)
- 3) Improve level of service and security of supply (including Horotiu industrial) – new dedicated 200mm main, 1,700m³ reservoir and boost pump station (with additional downstream pipes).

For full details, refer to AWT (2013).

The third of the enhanced options is recommended to meet all requirements. A plan of this option including the first stage pipe upgrades is included in Appendix C.

It must be noted that the reservoir storage of 1,700m³ is based on 24h storage in 2031, where as WDC are adopting a level of service of 48h storage. A reservoir storage volume of 3,400m³ is therefore required. WDC are already in the process of securing land for this reservoir.

The Horotiu industrial developer has provided a water supply plan (refer Appendix D) to service the industrial area which is consistent with the AWT recommendations, as well as costs which are discussed in Section 5.

4.3 Ngaruawahia Wastewater

With limited residential population growth, the main capacity issue for the Ngaruawahia wastewater network will be increased industrial flows from Horotiu. As previously described pumping these flows directly to the Ngaruawahia WWTP, will resolve this issue by freeing up capacity within the existing reticulation network.

Concept plans for new gravity sewers and pump stations with associated rising mains to service the industrial area are contained in Appendix D.

4.4 Ngaruawahia Surrounds

As shown in Tables 3.1 and 3.2, there is minimal population growth expected in Taupiri and Glen Massey. Te Kowhai has significant (in terms of percentage) growth predicted by 2031, but the overall scale of development would be small. No new link roads have been recommended by the structure plan transport assessment. Any proposed development with associated water and wastewater infrastructure in these townships is likely to be developer led and funded, so assessed on a case by case basis. As such no further analysis of these small water and wastewater networks (where present) has been undertaken.

5 Cost Estimates

Cost estimates for the Ngaruawahia water supply and wastewater network upgrades have taken from AWT (2013) and cost information provided by the Horotiu industrial developer. These are summarised in Table 5.1 with breakdowns shown in Appendix E.

Table 5.1 - Summary of Water and Wastewater Cost Estimates

Item	Source	Cost (\$)
Stage 1 Water Supply	AWT	2,788,000
Stage 2 Water Supply	AWT	7,052,000
Water Supply Total		9,840,000
Wastewater	Developer	4,757,000

It should be noted that the industrial developer water supply costs are covered within the above AWT amount for water supply, so should not be added to the AWT cost estimate. The breakdown of the developer water costs is still included in Appendix E for completeness.

The AWT costs include \$1,634,000 for a 1,700 m³ concrete reservoir. This cost estimate is considered conservative but is appropriate for WDC budgeting purposes at this time. As explained in Section 4.2, 3,400m³ is required to provide 48h storage for the 2031 water demands. Due to economies of scale for reservoir construction, a single 3,400m³ reservoir will be significantly cheaper than two 1,700m³ tanks. A detailed NPV analysis (and operational flexibility considerations) will be required to determine the optimum reservoir strategy. WDC is currently in the process of securing land for the reservoir site with sufficient area to accommodate either option.

6 Conclusion & Recommendations

The impact of population growth in and around Ngaruawahia on the existing water and wastewater networks is minimal. The proposed Horotiu industrial development will have a significant impact on water demands from the Ngaruawahia supply, and consequently increased wastewater flows. Some of the proposed works to meet this demand and achieve the stated levels of service have commenced, at least in the planning stage.

The Ngaruawahia water hydraulic model provides a useful tool for assessing proposed upgrades to the water network. Wastewater network analysis, such as determining timing for the diversion of the industrial wastewater flows directly to the WWTP currently can't be undertaken with the same level of confidence.

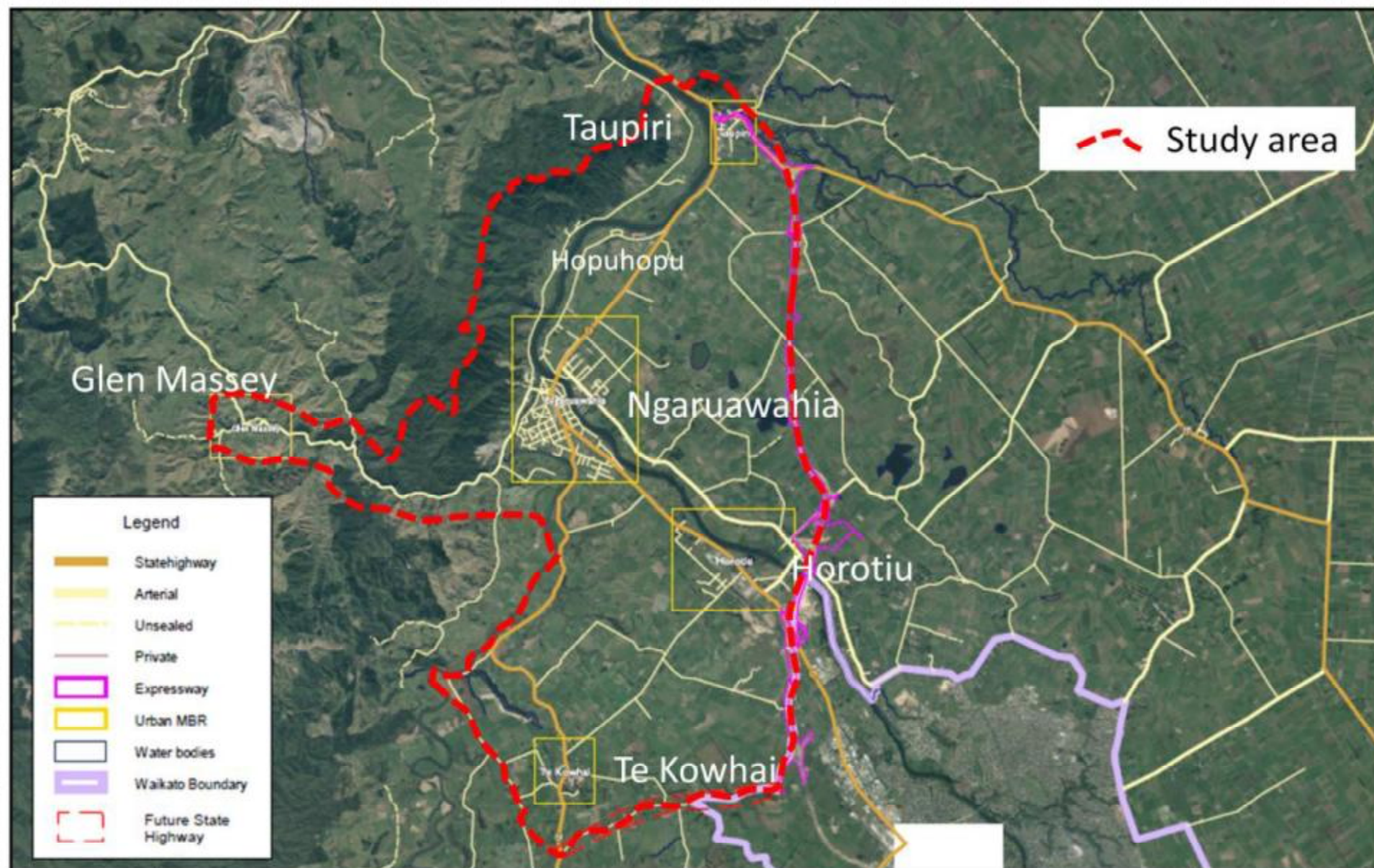
It is therefore recommended that:

- WDC work closely with the industrial developer to determine the timing of development and corresponding quantification of future water demand and wastewater flows.
- Further analysis be undertaken to determine whether future water reservoir storage be provided by one or two reservoirs.
- A model of the wastewater system be developed with future flows, including industrial and I&I inputs, to optimise capital expenditure.

7 References

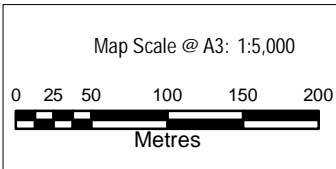
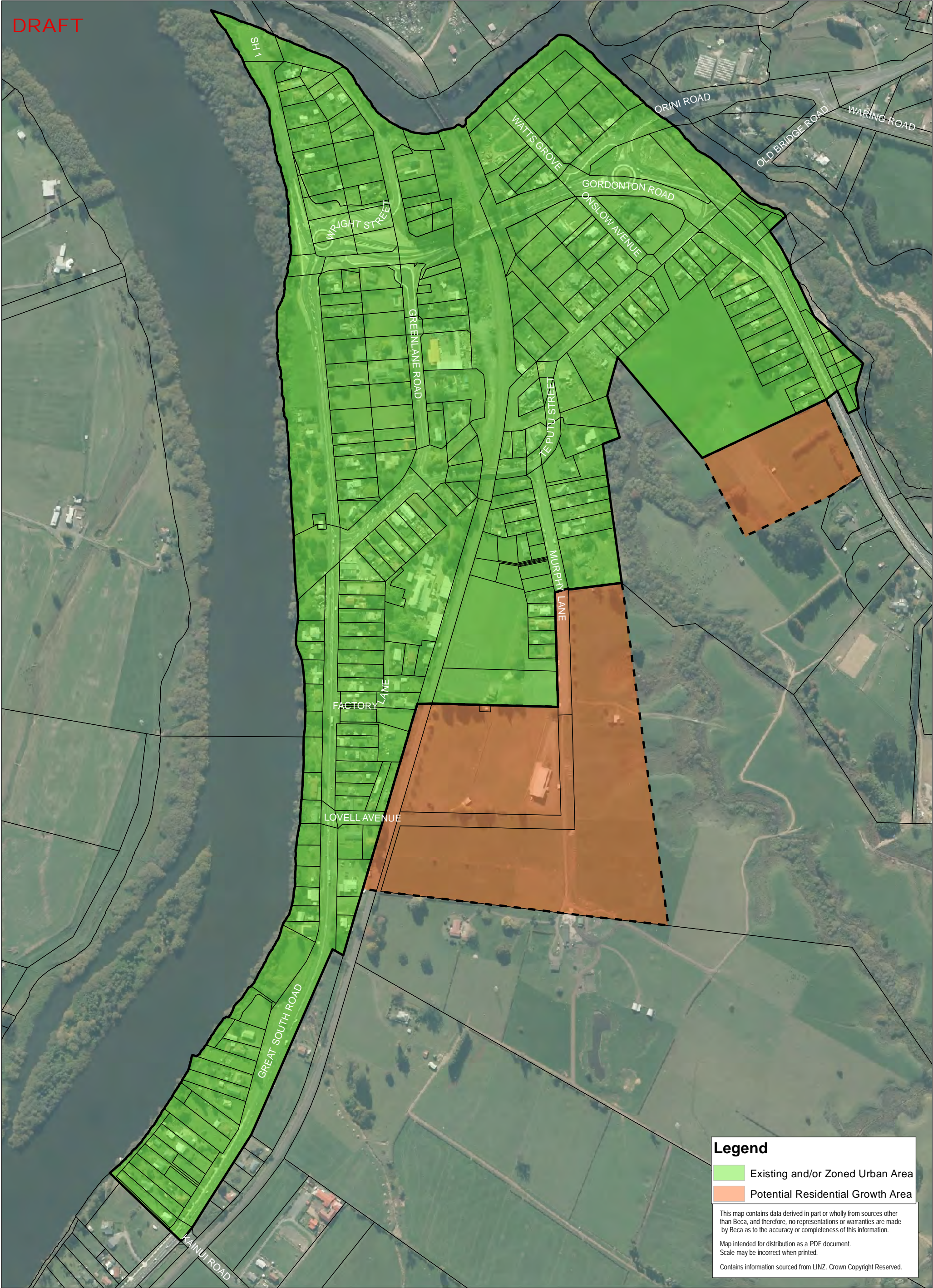
1. "Ngaruawahia and Environs Structure Plan Preliminary Urban Design Assessment", *Beca*. 25 July 2014.
2. "Ngaruawahia Water Supply Zone Management Plan", *AWT*. September 2013.
3. "Horotiu Industrial Proposed Water and Wastewater Upgrades", *supplied by Waikato DC*. (Draft) May 2011.

Appendix A: Structure Plan Study Area



Appendix B: Proposed Development Areas

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Revision	Author	Verified	Approved	Date
1	AYF	DRAFT	DRAFT	22/04/14

FOR INTERNAL PURPOSES ONLY. YET TO BE VERIFIED.

Taupiri
Potential Growth Areas

Client:	Waikato District Council
Project:	WDC Structures

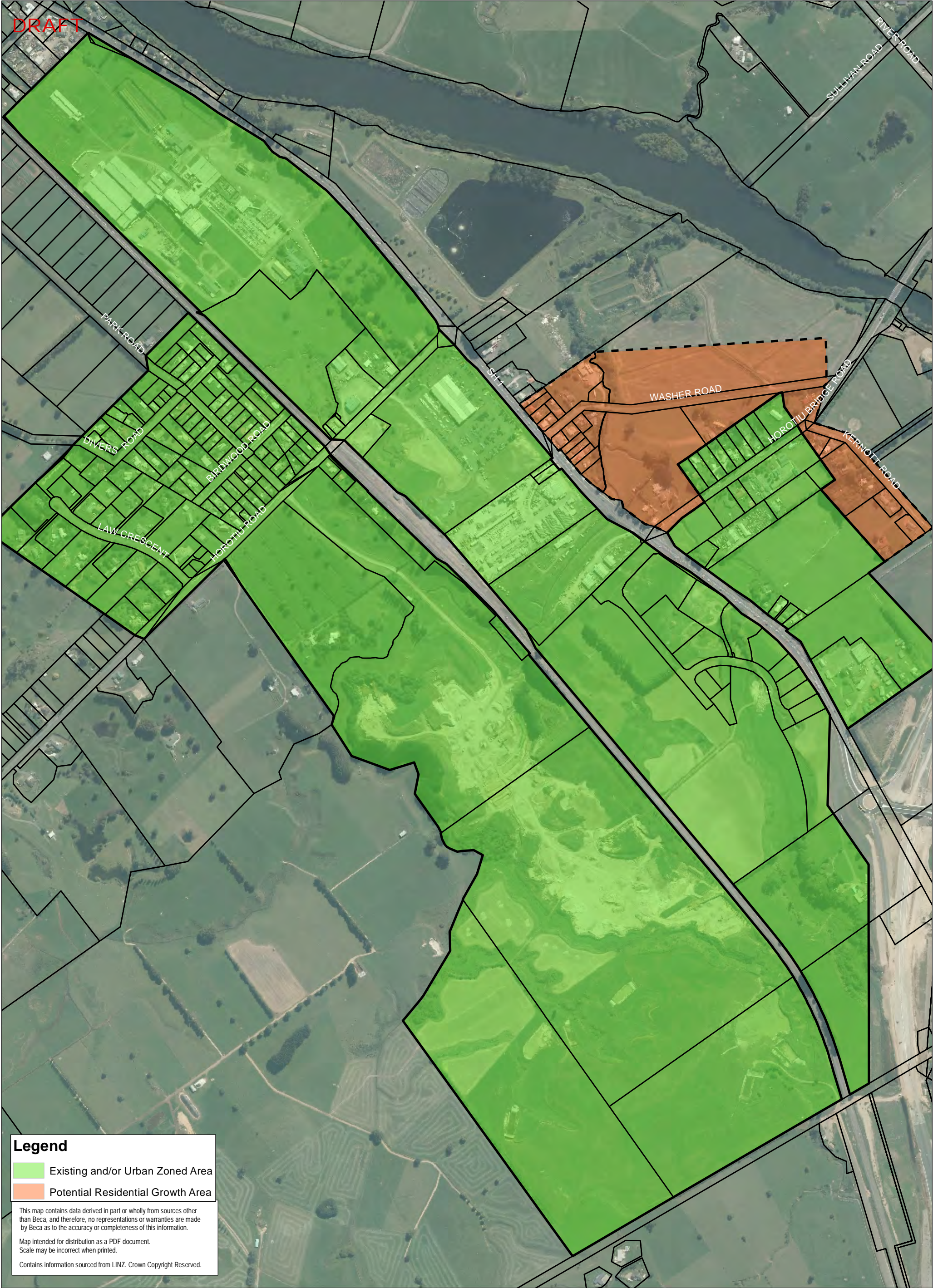
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Discipline:	GIS
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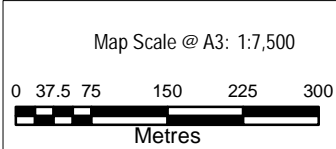
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Legend

- Existing and/or Urban Zoned Area
- Potential Residential Growth Area

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Revision	Author	Verified	Approved	Date
1	AYF	DRAFT	DRAFT	22/04/14

Title:

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Horotiu - Te Rapa
Potential Growth Areas

Client:
Waikato District Council

Project:
WDC Structures

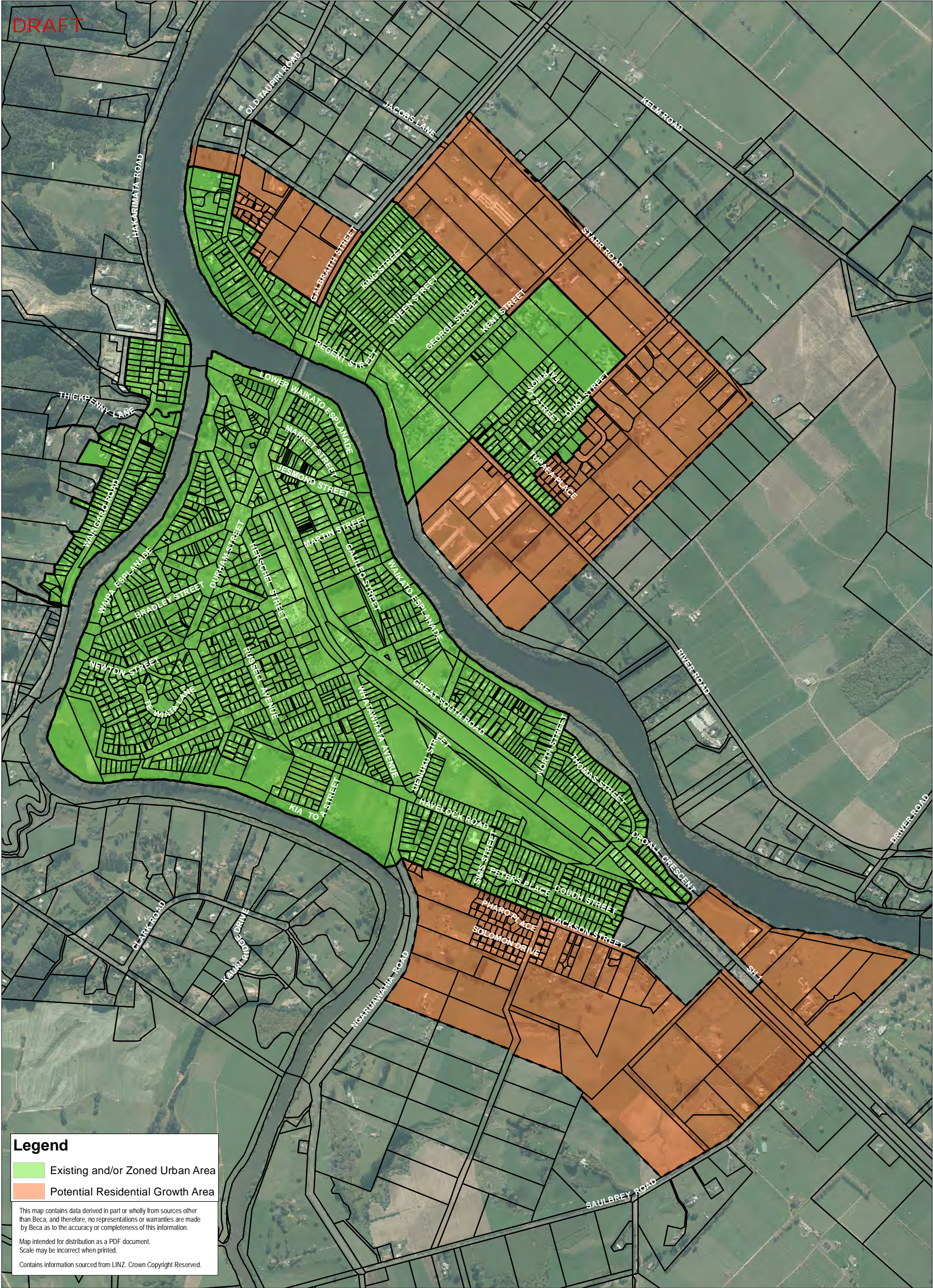


Discipline:
GIS

Drawing No:
GIS-3411575-002

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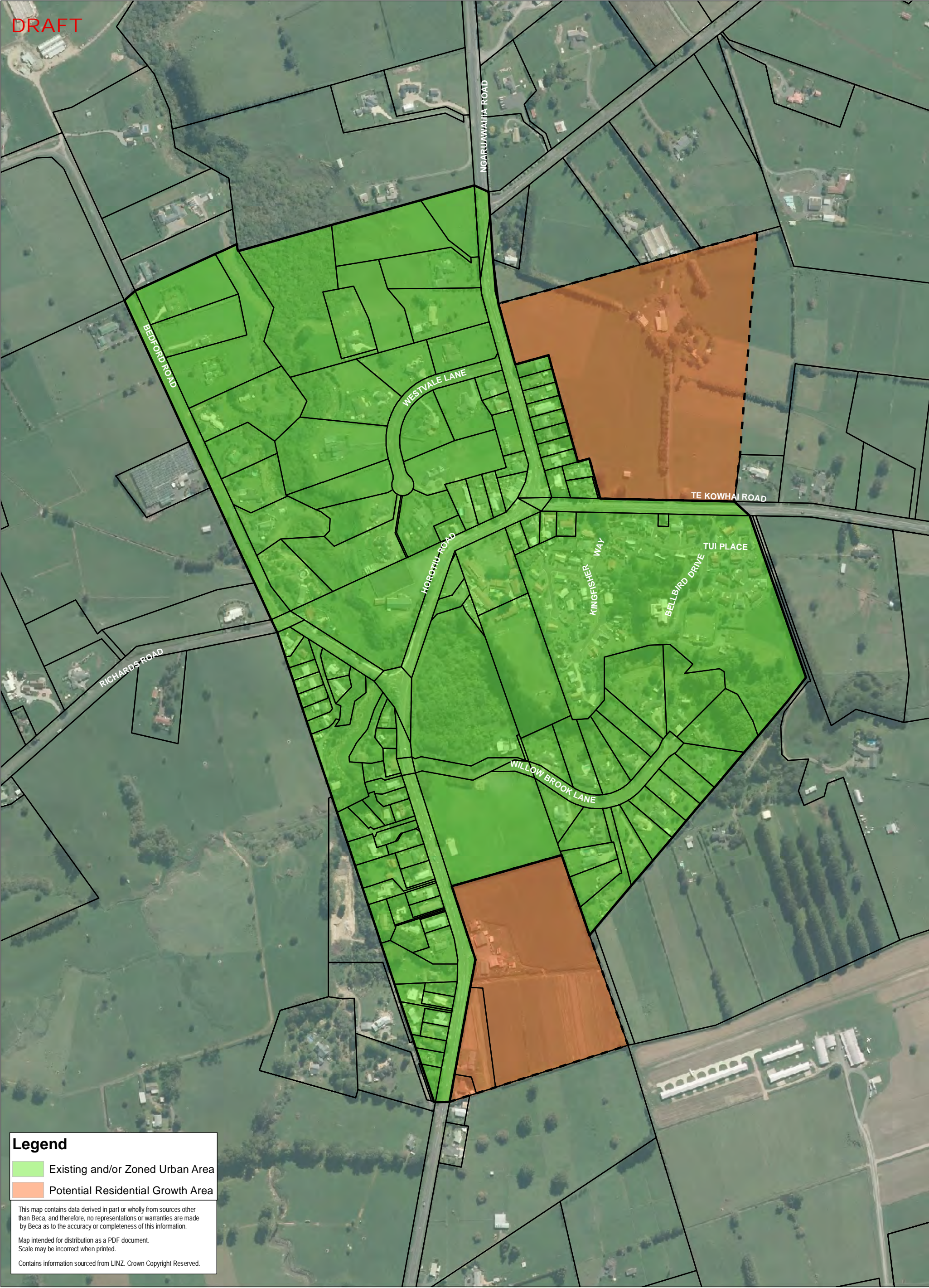
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Metres										
		1		AYF	DRAFT	DRAFT	22/04/14		Project: WDC Structures	Beca
									Drawing No: GIS-3411575-003	

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Legend

- Existing and/or Zoned Urban Area
- Potential Residential Growth Area

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Map Scale @ A3: 1:5,000

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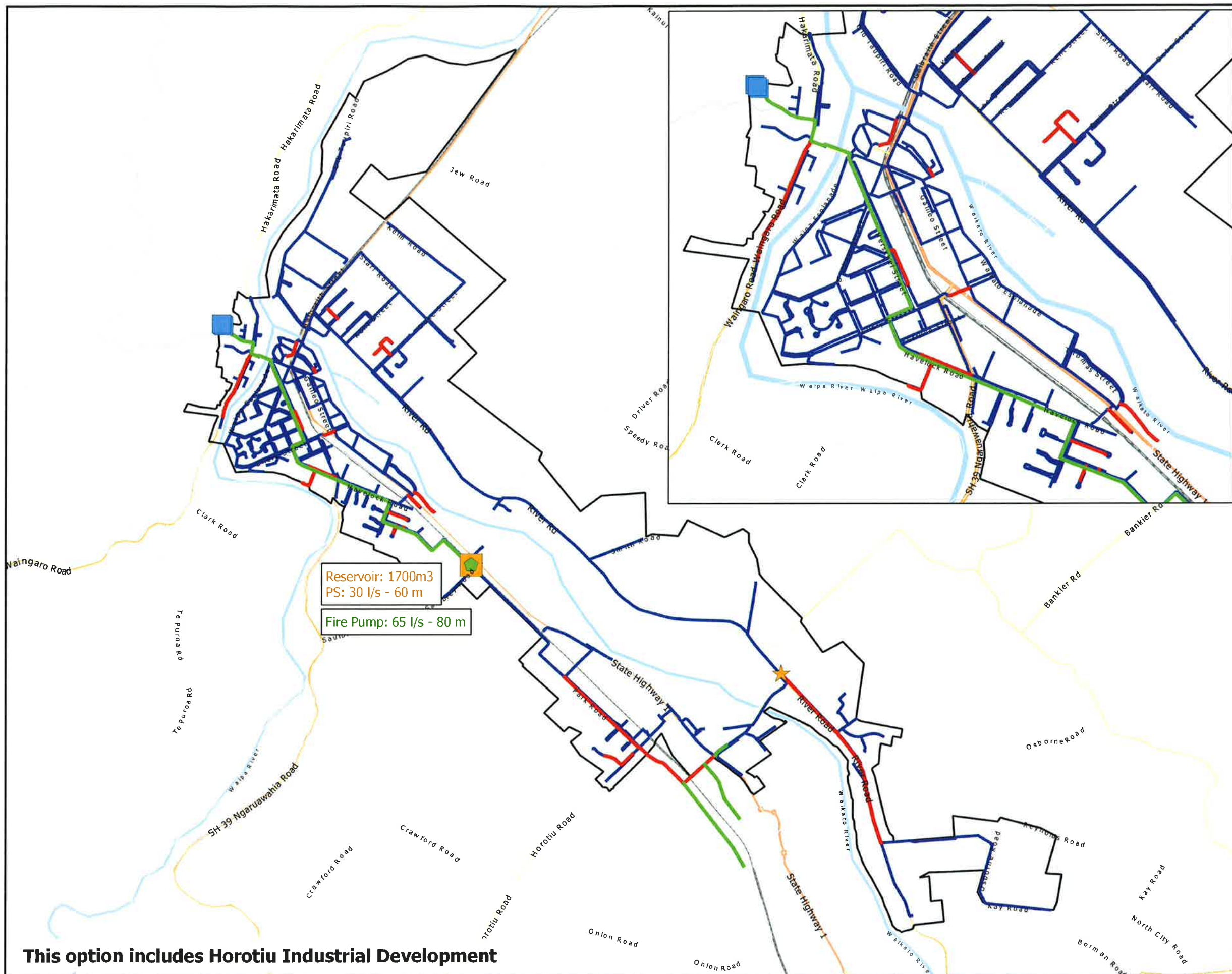
Metres

Revision	Author	Verified	Approved	Date	Title:
					Te Kowhai Potential Growth Areas
1	AYF	DRAFT	DRAFT	22/04/14	

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YET TO BE VERIFIED.

Client: Waikato District Council		Discipline: GIS
Project: WDC Structures		Drawing No: GIS-3411575-004

Appendix C: Proposed Water Upgrades (AWT)



Legend

Existing Network

- Reservoir
- Pipes

Stage 1 Upgrades

- ◆ Fire Pump
- Pipes

Stage 2 Upgrades - Option C

- Reservoir and PS
- ★ Closed Valve
- Pipes
- Model Extent

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REV	AMENDMENT	ENG	APPD	DATE

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AWT WATER LIMITED,
AWT HOUSE, 131 NEW NORTH RD.,
EDEN TERRACE, AUCKLAND, N.Z.
TEL: +64 9 374 1599
FAX: +64 9 309 3209

PROJECT: **NGARUAWAHIA
WATER SUPPLY MODEL**

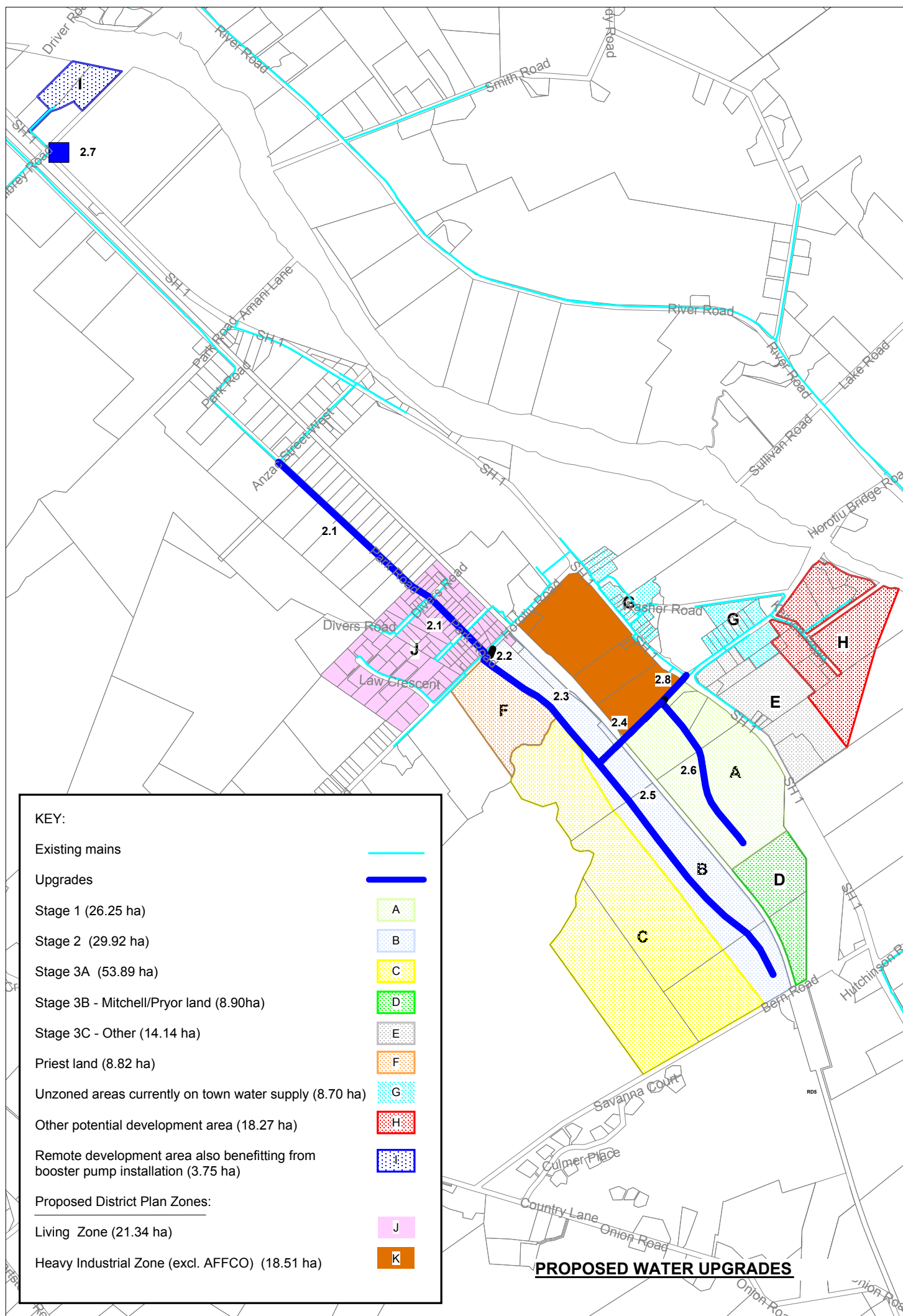
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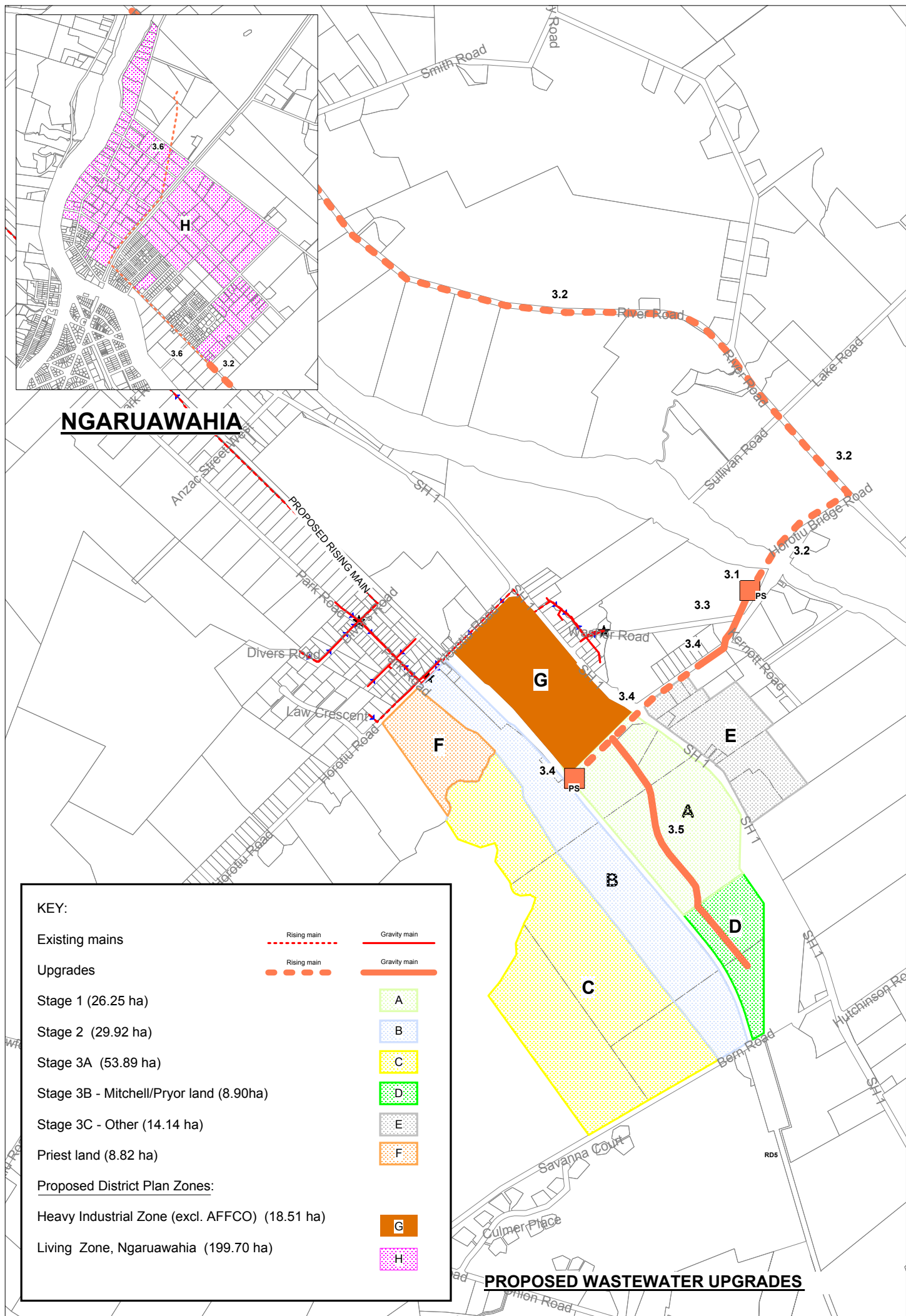
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PROJECT No: **1210** FIGURE No: **7** REV: **0**

Appendix D: Horotiu Industrial Water/Wastewater Plans





Appendix E: Cost Estimates

Option	Cost
Stage 1: Improve Level of Service - without industrial development	\$ 2,788,800
Pipework	\$ 1,915,000
One fire pump operating at 30 l/s and 40m head	\$ 25,000
Pump Station basic building	\$ 30,000
Electrical and control (assuming enough power available at site)	\$ 22,000
Contingency (30%) and design	\$ 796,800
Stage 2 - Option A: Improve Security of supply - without industrial development	\$ 1,906,800
Three pumps on VSD (2 duty /1 standby) operating at 13l/s and 40m head	\$ 50,000
Pump Station basic building	\$ 40,000
Pipework modifications	\$ 20,000
Electrical and Control (assuming enough power available at site)	\$ 44,000
New Concrete reservoir (1,000m ³)	\$ 1,159,000
PSV	\$ 49,000
Contingency (30%) and design	\$ 544,800
Stage 2 - Option B: Improve Level of Service - with industrial development	\$ 5,396,000
Pipework (including 250mm dedicated main)	\$ 3,630,000
Three pumps on VSD (2 duty /1 standby) operating at 30l/s and 20m head	\$ 70,000
Two fire pumps operating at 65 l/s and 50m head	\$ 50,000
Pump station basic building	\$ 40,000
Electrical and control (assuming enough power available at site)	\$ 64,000
Contingency (30%) and design	\$ 1,542,000
Stage 2 - Option C: Improve Level of Service and Security of Supply - with industrial development	\$ 7,051,600
Pipework (including 200mm dedicated main)	\$ 3,040,000
Three pumps on VSD (2 duty /1 standby) operating at 30l/s and 60m head	\$ 90,000
Two fire pumps operating at 65 l/s and 80m head	\$ 80,000
Pump station basic building	\$ 40,000
New Concrete reservoir (1,700m ³)	\$ 1,634,000
Flow Control Device	\$ 49,000
Electrical and control (assuming enough power available at site)	\$ 103,600
Contingency (30%) and design	\$ 2,015,000

2.0 WATER

HOROTIU INDUSTRIAL

2.1	<u>Upgrade Park Rd 150mm & 100mm to 200mm from Anzac St West to Horotiu Rd</u>			
		Rate \$	Unit	Estimated Cost \$
	a) 200mm oPVC PN12	1150	\$160.00 m	\$184,000.00
	b) Traffic Management & driveway reinstatement	1	\$20,000.00 Sum	\$20,000.00
				<u>\$204,000.00</u>
	Contingencies	10.0%		\$20,400.00
	Design and supervision	7.5%		\$16,830.00
		Sub Total =		<u>\$241,230.00</u>

2.2	<u>Park Road to RD3/Horotiu Intersection</u> (Incl. New main and pipe thrusting)			
	a) Pipe thrust under Horotiu Road	20	\$1,000.00 m	\$20,000.00
	b) 200mm oPVC PN12 Horotiu Road	60	\$125.00 m	\$7,500.00
				<u>\$27,500.00</u>
	Contingencies	10.0%		\$2,750.00
	Design and supervision	7.5%		\$2,268.75
		Sub Total =		<u>\$32,518.75</u>

2.3	<u>RD3 from Horotiu Rd to RD1</u> (New main)			
	a) 200mm oPVC PN12 Horotiu Road to RD1	580	\$160.00 m	\$92,800.00
				<u>\$92,800.00</u>
	Contingencies	10.0%		\$9,280.00
	Design and supervision	7.5%		\$7,656.00
		Sub Total =		<u>\$109,736.00</u>

2.4	<u>RD1 between RD3 & RD4</u> (New main)			
	a) 200mm oPVC PN12 Along RD1B & RD1A	350	\$160.00 m	\$56,000.00
				<u>\$56,000.00</u>
	Contingencies	10.0%		\$5,600.00
	Design and supervision	7.5%		\$4,620.00
		Sub Total =		<u>\$66,220.00</u>

2.5	<u>RD2 from RD1 to 100m from Bern Rd Boundary</u> (New main)			
	a) 200mm oPVC RD2 from RD1 to 100m from Bern Rd Boundary	1100	\$160.00 m	\$176,000.00
				<u>\$176,000.00</u>
	Contingencies	10.0%		\$17,600.00
	Design and supervision	7.5%		\$14,520.00
		Sub Total =		<u>\$208,120.00</u>

2.6	<u>RD 4A from RD 1A to service adjacent land (Mitchell)</u> (New main)			
	a) 200mm oPVC RD4A	660	\$160.00 m	\$105,600.00

				<u>\$105,600.00</u>
Contingenies		10.0%		\$10,560.00
Design and supervision		7.5%		\$8,712.00
		Sub Total =		<u>\$124,872.00</u>

2.7	<u>Booster PS for Fire Fighting - Saulbrey Road</u>			
	a) Booster PS for Fire Fighting - Park Road	1	\$150,000.00 m	<u>\$150,000.00</u>
				\$150,000.00
	Contingenies		10.0%	\$15,000.00
	Design and supervision		7.5%	\$12,375.00
			Sub Total =	<u>\$177,375.00</u>

2.8	<u>From RD 4A to Connect to Existing main on SH1</u> <u>(Incl. New main and pipe thrusting)</u>			
	a) 200mm oPVC RD2 from RD1A to SH1	125	\$160.00 m	\$20,000.00
	b) Pipe thrust under SH1	25	\$500.00	\$12,500.00
				<u>\$32,500.00</u>
	Contingenies		10.0%	\$3,250.00
	Design and supervision		7.5%	\$2,681.25
			Sub Total =	<u>\$38,431.25</u>

Grand Total =	<u>\$998,503.00</u>
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3.0 WASTEWATER

HOROTIU INDUSTRIAL

3.1

New Pump Station on Washer Road

(Incl. PS, Storage, Rising Main, Bridge Crossing)

	Qty	Rate \$	Unit	Estimated Cost \$
a) 50 l/sec pump station	1	\$250,000	sum	\$250,000
b) Horotiu bridge crossing	1	\$100,000	sum	\$100,000
c) Storage 6-hours ADWF	1	\$100,000	sum	\$100,000
				<u>\$450,000.00</u>
Contingencies		20.0%		\$90,000.00
Design and supervision		10.0%		\$54,000.00
				<u>Sub Total =</u>
				<u>\$594,000.00</u>

3.2

RM to Ngaruawahia Living Zone Boundary

	Qty	Rate \$	Unit	Estimated Cost \$
a) 300mm rising main to Ngaruawahia Living Zone Boundary	5967	\$250	m	\$1,491,750
				<u>\$1,491,750.00</u>
Contingencies		20.0%		\$298,350.00
Design and supervision		10.0%		\$179,010.00
				<u>Sub Total =</u>
				<u>\$1,969,110.00</u>

3.3

Land Purchase for P/S (1,000m2)

Sub Total = \$35,000.00

3.4

New Pump Station nr Rail Underpass

(Incl. PS, Storage, Rising Main, Gravity Main, SH1 Thrusting)

	Qty	Rate \$	Unit	Estimated Cost \$
a) 40 l/sec pump station	1	\$200,000	sum	\$200,000
b) 225mm rising main to gravity main	636	\$170	m	\$108,120
c) 300mm gravity main to main PS	337	\$295	sum	\$99,415
d) Storage 6-hours ADWF	1	\$120,000	sum	\$120,000
e) Thrusting under SH1	50	\$1,000		\$50,000
				<u>\$577,535.00</u>
Contingencies		20.0%		\$115,507.00
Design and supervision		10.0%		\$69,304.20
				<u>Sub Total =</u>
				<u>\$762,346.20</u>

3.5

Trunk Sewer To Ajaent Land (Mitchell/Prior)

	Qty	Rate \$	Unit	Estimated Cost \$
a) 225mm trunk sewer	1100	\$235	sum	\$258,500
				<u>\$258,500.00</u>
Contingencies		10.0%		\$25,850.00
Design and supervision		10.0%		\$28,435.00
				<u>Sub Total =</u>
				<u>\$312,785.00</u>

3.6

RM from Ngaruawahia Living Zone Boundary to Treatment Plant

	Qty	Rate \$	Unit	Estimated Cost \$
a) 300mm rising main to Ngaruawahia Living Zone Boundary	3285	\$250	m	\$821,250
				<u>\$821,250.00</u>
Contingencies		20.0%		\$164,250.00
Design and supervision		10.0%		\$98,550.00
				<u>Sub Total =</u>
				<u>\$1,084,050.00</u>

Grand Total = \$4,757,291.20