



Community Drinking-Water Supply Assessment in Horizons Region - 2018-19 Compliance Period

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Executive Summary

Horizons Regional Council (Horizons) has recognised the need to develop a central repository for information regarding drinking water supplies in the region so that they can be better managed. Currently, there are several organisations that hold information regarding the operation, safety or management of drinking water supplies. These include:

- ✧ Horizons Regional Council
- ✧ Territorial Authorities and Water Supply Managers
- ✧ Drinking Water Assessors

Currently, there is no forum for sharing this information between these organisations and the purpose of this overall project (of which this report forms a part) is to allow complete sharing of all information between the relevant organisations.

As a starting point to develop a more collaborative working system, PDP has previously been engaged to develop a database of the community water supplies within the region. The purpose of the database is to enable an ongoing evaluation of contamination risks to the water supplies and thereby to identify appropriate action to be initiated to address those risks.

The development of a database combining the information from the key organisations involved in the authorisation, implementation and monitoring of the water supply can also provide a focal point for regular communication between those organisations to facilitate a general improvement in the management of community drinking-water supplies.

This report provides an update to our previous report provided in September 2019, and is based on the most recent compliance reports from the Central North Island Drinking Water Assessment Unit and the Waikato Drinking Water Assessment Service from the 2018/2019 monitoring period.

The volume of water take capability for the major water supply operators in the region is summarised in Table 1 below.

Table 1: Total volume of water take capability per district or operator	
District or operator	Total volume capability (m ³ /day)
Horowhenua District Council	22,204
Manawatu District Council	12,150*
Palmerston North City Council	64,850
Rangitikei District Council	11,621

Table 1: Total volume of water take capability per district or operator

District or operator	Total volume capability (m ³ /day)
Ruapehu District Council	8,260
Tararua District Council	13,980
Whanganui District Council	39,000
Total	172,065
Notes: *Volume capability from Drinking Water Online. Where not available, consented quantity used where data is missing.	

The database provides a summary of the water source and water treatment system including the key components of various risks that may apply to each site. A preliminary assessment (based on currently available information) has been undertaken for each water source which considers the following:

- ✧ *E. coli* or protozoa detection or breach of any MAV;
- ✧ The treatment systems in place or lack of treatment;
- ✧ Whether the source is low risk as defined by the Drinking Water Standards for New Zealand 2005 (revised 2018) (groundwater sources only);
- ✧ The landuse activities surrounding the water intake;
- ✧ The flooding risk;
- ✧ The presence of an approved Water Safety Plan (WSP).

This assessment has been used to rank the water supplies in terms of the following priorities for action:

Priority 1: Action is required as soon as practicable to improve the management of the water supply.

Priority 2: A heightened standard of vigilance and conservative management is required.

Priority 3: Maintenance of current management practices is expected to minimise contamination risks.

A summary of these priority categories for water supplies in each district in the Horizons region are provided in Table 2 below.

Table 2: Priority categories for water sources per district/operator

District or operator	Priority assessment									
	Number of water supplies (>500 people)					Percentage of total water supplies				
	Total	Priority 3	Priority 2	Priority 1	Unknown	Total	Priority 3	Priority 2	Priority 1	Unknown
Horowhenua District Council	5	3	2	0	0	12%	7%	5%	0%	0%
Manawatu District Council	6	2	3	1	0	14%	5%	7%	2%	0%
Palmerston North City Council	10	3	7	0	0	24%	7%	17%	0%	0%
Rangitikei District Council	7	1	5	0	1	17%	2%	12%	0%	2%
Ruapehu District Council	5	2	3	0	0	12%	5%	7%	0%	0%
Tararua District Council	4	0	3	1	0	10%	0%	7%	2%	0%
Whanganui District Council	5	0	5	0	0	12%	0%	12%	0%	0%
Total	42	11	28	2	1	100.0%	26%	67%	5%	2%

A list of community supplies in each priority category is presented in Table 3 below.

Table 3: Priority categorisation of overall town water supplies			
Priority Status			
Priority 3	Priority 2	Priority 1	Unknown
Foxton	Levin	Dannevirke	-
Foxton Beach	Tokomaru	Feilding (surface water source)	
Himatangi Beach	Feilding (groundwater sources)		
Rongotea	Sanson		
Ashhurst	Palmerston North City		
Longburn	Marton		
Bunnythorpe	Bulls		
Ratana	Bulls - Supplementary		
Raetihi	Taihape		
Shannon	Ohakune		
	Pahiatua		
	Pahiatua - Supplementary		
	Woodville		
	Whanganui		
	Whanganui - Supplementary		
	Marton - Supplementary		
	Taumarunui		
	National Park		

The majority of surface water sources are classified as Priority 1 and 2 due to gaps in the treatment plant monitoring for surface waterways, whereas some deeper groundwater bores can achieve Priority 3 classification.

A review of Horizons groundwater monitoring information suggests that surface influences on groundwater quality are most prominent for shallower bores, down to a depth of around 50 m, although the information is not comprehensive around all drinking water sources from groundwater. The information also indicates that there are some areas of the region where naturally occurring conditions result in concentrations of iron, manganese and arsenic that are above the drinking water standards. As a result, groundwater drawn from bores in those areas may require treatment to reduce these chemical concentrations before it is used in the public supply network.

A site specific approach has been used for delineating the zone of contribution to surface water sources and groundwater sources, and is detailed in the individual reports for each Territorial Authority. Refinement of those zones, and decisions around management of discharges and potential landuse restrictions within the zones (including conditions on resource consents), should be undertaken as more information regarding each water supply source becomes available.

Table of Contents

SECTION	PAGE
Executive Summary	ii
1.0 Introduction	1
2.0 Information Sources and Responsibilities	1
2.1 Responsibilities	1
2.2 Information sources	3
3.0 National Environmental Standards for Sources of Human Drinking Water	4
4.0 Components of the Database	5
4.1 Supply Name	8
4.2 The Water Source	10
4.3 The Treatment Plant	12
4.4 Monitoring	12
4.5 Zone of Contribution	15
4.6 Overall Compliance	15
5.0 Horizons Groundwater Monitoring Data	17
5.1 Monitoring Well Locations in Proximity to Community Drinking-Water Supply Wells	17
5.2 Depth of Land Surface Influences on Groundwater Supplies	19
6.0 Consideration of Requirements for Improved Water Supply Management	19
6.1 Likelihood of Contamination Occurring	20
6.2 Zone of Contribution	22
6.3 Consequence of Contamination Occurring	22
6.4 Overall Priority Rankings	22
7.0 Conclusion	26
8.0 References	27

Table of Figures

Figure 1: Location map

Figure 2: Location of drinking water supply bores and Horizons groundwater monitoring bores

Figure 3: Groundwater zones and drinking water supply bore locations

Figure 4: Maximum concentration of arsenic in monitoring bores

Figure 5: Maximum concentration of iron in monitoring bores

Figure 6: Maximum concentration of manganese in monitoring bores

Figure 7 to 10: Concentrations of E.coli, chloride, electrical conductivity and nitrogen compared to bore depth

Figure 11: Drinking water supply sources and preliminary risk assessment

Table of Tables

Table 1: Total volume of water take capability per district or operator	ii
Table 2: Priority categories for water sources per district/operator	iv
Table 3: Priority categorisation of overall town water supplies	v
Table 4: Horizons Region drinking water supplies sources	5
Table 5: Drinking Water Sources by Population	9
Table 6: Number of drinking water supplies per district based on the estimated volume	10
Table 7: Drinking Water Supplies by Source of Water	11
Table 8: Treatment of Drinking Water Supply Sources	13
Table 9: Water Quality Monitoring Results	14
Table 10: Overall Compliance with DWSNZ	16
Table 11: Summary of Groundwater Environment	18
Table 12: Likelihood Score	21
Table 13: Priority Matrix	22
Table 14: Horizons Region drinking water supply priority assessment summary	23

Appendices

Appendix A: Figures
Appendix B: Priority Assessment Matrix
Appendix C: Schedule of Proposed Actions at High Priority Sites
Appendix D: List of all supplies by Territorial Authority area

1.0 Introduction

Horizons Regional Council (Horizons) is working to develop a collaborative approach between themselves, territorial authorities¹ and Health Board personnel to achieve the best management systems for drinking-water supplies in the region. This approach recognises that each of these organisations holds information and are responsible for managing different aspects of a safe drinking-water system, but that information is not readily shared between the organisations at present.

As a starting point to develop a more collaborative working system, Pattle Delamore Partners Ltd (PDP) has previously been engaged to develop a database of the community water supplies within the region. The database draws on information from territorial authorities, drinking-water assessors (DWAs) and Horizons own information.

The purpose of the database is to enable an ongoing evaluation of contamination risks to the water supplies and thereby to identify appropriate action to address the contamination threats that exist.

The development of a database combining the information from the key organisations involved in the authorisation and implementation of the water supply can also provide a focal point for regular communication between those organisations to facilitate a general improvement in the management of community drinking-water supplies.

The database provides information on the water source and the water treatment system which are the key components of variable risks that apply to the supply. It does not consider risks within the distribution network as these are a more straightforward aspect of engineering design and procedure, which are a focus primarily for the water supply managers.

This report provides an update to the previous report provided in September 2019 (and an earlier version provided in November 2017), and is based on the most recent Drinking Water Assessor (DWA) compliance reports from the 2018/2019 monitoring period.

2.0 Information Sources and Responsibilities

2.1 Responsibilities

There are a number of different organisations with responsibilities for managing and monitoring potable drinking water in New Zealand, including regional councils, district councils, and drinking water assessors. The following brief summary draws on the consideration of roles provided in the Havelock North Drinking Water Inquiry Report (Stage 1) to provide some context around the

¹ Other managers of larger water supplies will also be invited to participate in this water supply management system.

information held by different authorities involved in drinking water supply and their responsibilities. It does not represent an exhaustive review and the reader is directed to Appendix 4 of the Inquiry report, and the legislation that controls those organisations for additional details.

Responsibilities of Regional Councils

Regional councils have responsibilities pertaining to water quality in the regions under both the Resource Management Act (RMA) and also under NES Regulations. With respect to water quality under the RMA regional councils are responsible for:

the use of land for the purposes of maintaining and enhancing the water quality of water in water bodies;

the discharge of contaminants into or onto land, air or water and discharges of water into water.

Drinking water suppliers require a resource consent from the regional council to take water and as part of the determination of that consent, the regional council must have regard to the relevant provisions of national environmental standards. For drinking water supplies the key NES document is The Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007 (NES Regulations). This contains minimum requirements for protecting sources of human drinking water and imposes responsibilities primarily on regional councils. The NES came into force on 20 June 2008 and is discussed in Section 3 of this report.

Responsibilities of District Councils

The functions of district councils are narrower than those of regional councils', however they are responsible for creating and implementing district plans, which must not be inconsistent with regional plans. Therefore, their responsibilities overlap with part of the regional council's responsibilities. District Councils' also have responsibilities as consent holders for water take consents and must comply with the conditions of those consents.

District Councils' (and regional councils) also have responsibilities under the local government act (LGA), which includes annual reporting on the extent to which a drinking water supply complies with Part 4 and Part 5 of the Drinking Water Standards for New Zealand 2005 (revised 2018) (DWSNZ). It should be noted that the previous 2008 revision of the DWSNZ was replaced by the 2018 version, which came into effect during the second half of the compliance period (1 March 2019). The main change (among several changes) noted for the compliance reports is the requirement for protozoa compliance now having a default minimum 3-log removal under Section 5.2.1.2 of the DWSNZ.

In addition to responsibilities under the LGA, drinking water suppliers (primarily district and city councils) have responsibilities under the Health Act both as local authorities and as drinking water suppliers. A local authority is obliged to inspect its district to ensure that nuisance that may affect (i.e. make liable to

contamination) any source of supply that may be used for domestic purposes is removed. In addition, the local authority must enforce regulations for the protection of any water supply.

Responsibilities of a district council under the Health Act as a drinking water supplier include (note these responsibilities also extend to other drinking water suppliers other than district councils):

- ✧ take all practicable steps to ensure an adequate supply of drinking water, notify any risk to that supply, ensure that drinking water complies with the DWSNZ, and if the supplier becomes aware that water is not meeting the DWSNZ, carry out the remedial action set out in the DWSNZ, or all other practicable steps if no remedial action is specified;
- ✧ take reasonable steps to protect its source of raw water from contamination, protect all aspects of the drinking water supply system from pollution and ensure the drinking water supplied is wholesome;
- ✧ monitor the drinking water supplied to determine its compliance with the DWSNZ and detect and assess public health risks;
- ✧ prepare and implement a water safety plan.

Drinking Water Assessors

Under the Health Act drinking-water assessors (DWAs) have primary responsibility for monitoring drinking-water suppliers' compliance with their obligations to supply safe drinking-water, and designated officers are responsible for any necessary enforcement action.

The functions of DWAs are to:

- ✧ determine whether drinking-water suppliers are complying with the requirements in Part 2A Health Act (which deals with drinking water) and the DWSNZ and implementing their water safety plans;
- ✧ verify and, if appropriate, approve a drinking-water supplier's water safety plan;
- ✧ check whether drinking-water suppliers are recording and responding appropriately to complaints; and
- ✧ assess and authorise persons to undertake testing of water (if that testing is not undertaken by a recognised laboratory).

2.2 Information sources

Information on drinking water supplies and their contamination risks is held by several different organisations. The purpose of this report is to establish a single repository for the most relevant information. This is achieved by drawing information from the following sources:

- ✧ Drinking Water Assessors

- ✧ Territorial Authorities and Water Supply Managers
- ✧ Horizons Regional Council

In the past, information sharing between the above parties has been somewhat of a case by case process and in some instances relevant information has not been shared with all parties. For this project, a great effort has gone into combining all of the relevant information from different sources so that in the future, all relevant authorities have access to the information required to suitably manage public water supplies in the Horizons region. Information drawn from the Drinking Water Assessors compliance reports refers to the reports for 2018/2019.

During the previous two revisions of this report, compliance reports were not available for the Ruapehu District Council Taumarunui and National Park supplies. However, compliance reports for these supplies were available for the most recent 2018/2019 compliance period.

3.0 National Environmental Standards for Sources of Human Drinking Water

The National Environmental Standards for Sources of Human Drinking Water (NES for Drinking Water) were introduced by the Ministry for the Environment in 2008 as a regulation under the Resource Management Act (RMA). The NES for Drinking Water aims to reduce the risk of drinking water sources becoming contaminated due to activities being authorised by regional councils' in close proximity to drinking water supply points, whether it be surface water or groundwater sources.

The NES for Drinking Water requires regional councils to:

1. Decline water or discharge permits upstream of a drinking water abstraction point that are likely to deteriorate the quality of the supply;
2. Ensure that permitted activities in any regional plans will not have any detrimental effects on drinking water supplies; and
3. Place conditions on resource consents which may be subject to accidents such as spills, or may as a result of an event (i.e. rainfall) have an adverse effect on drinking water supply points, so that the drinking water supplier is notified in any of these instances.

For points 1 and 2 above, the NES regulations apply to activities that have the potential to affect a registered drinking water supply that provides no fewer than 501 people with drinking water for not less than 60 days each calendar year. In addition, for registered drinking-water supplies that provide for no fewer than 25 people for not less than 60 days each calendar year, point 3 above applies.

As the main regulations under the NES apply to drinking water supply points that supply more than 500 people, this has been used as a population threshold for

community drinking water supplies considered in the database. Some smaller supplies that have seasonal increases in population have also been included in the database.

4.0 Components of the Database

The database has focused on assessing 44 water supply sources within the Horizons region. That has been achieved by incorporating all supplies providing drinking-water to more than 500 people and other townships that may increase above that population limit at particular times of the year. Those criteria result in a list of 25 different communities and 44 separate intakes, as summarised in Table 4 and their locations are shown in Figure 1. Note that the water supply sources for Massey University, Fonterra, the Department of Corrections, and the Defence Force are not included in the list below. Additionally, we are aware that PNCC have recently registered three new water supply sources (Papaioea Park Bore 3, Railway Road Bore and Keith Street Bore 2). However, these bores are not yet (as per 2018/2019 compliance reports) connected and supplying water so have not been included in the following assessments.

Table 4: Horizons Region drinking water supplies sources			
Operator: Horowhenua District Council			
Community Name	Community Number	Population	Intake
Levin	LEV001	19431	Ohau River, Gladstone Road
Foxton	FOX002	2643	Foxton Bore No. 1, Foxton Bore No. 3, Foxton, Clyde St Bore
Foxton Beach	FOX003	1641	Foxton Beach Bore No. 3
Shannon	SHA001	1239	Mangaore Stream
Tokomaru	TOK002	552	Tokomara River, Horseshoe Bend
Operator: Manawatu District Council			
Community Name	Community Number	Population	Source
Feilding	FEI001	13371	Oroua River
Feilding	FEI001	13371	Campbells Road Bore
Feilding	FEI001	13371	Newbury Bore
Himatangi Beach	HIM001	429	Himatangi Bore

Table 4: Horizons Region drinking water supplies sources

Rongotea	RON002	594	Rongotea Community Bore
Sanson	SAN001	537	Rangitikei River for Sanson
Operator: Rangitikei District Council			
Community Name	Community Number	Population	Source
Marton	MAR001	4548	Tutaenui Stream
Marton - Supplementary	MAR002	4548	Calico Bore
Marton - Supplementary	MAR003	4548	Tutaenui Bore
Bulls	BUL001	1515	Rangitikei River
Bulls - Supplementary	BUL001	1515	Bulls Bore
Ratana	RAT001	327	Ratana bore
Taihape	TAI001	1509	Hautapu River
Operator: Palmerston North City Council			
Community Name	Community Number	Population	Source
Palmerston North City	PAL001	80082	Keith Street Bore
Palmerston North City	PAL001	80082	Papaioea Park Bore
Palmerston North City	PAL001	80082	Papaioea Park Bore 2
Palmerston North City	PAL001	80082	Roberts Line Bore
Palmerston North City	PAL001	80082	Roberts Line Bore 2
Palmerston North City	PAL001	80082	Takaro Bore
Palmerston North City	PAL001	80082	Turitea Dam
Ashhurst	ASH001	2778	Ashhurst Bore
Longburn	LON001	648	Longburn Bore
Bunnythorpe	BUN001	450	Raymond St New Bore
Operator: Ruapehu District Council			
Community Name	Community Number	Population	Source
Taumarunui	TAU003	4480	Whanganui River for Matapuna
Raetihi	RAE001	1033	Makotuku River

Table 4: Horizons Region drinking water supplies sources

Raetihi	RAE002	1033	Makara Stream
Ohakune	OHA001	1000	Serpentine Stream
National Park ¹	NAT001	>500	Mangahuia Stream
Operator: Tararua District Council			
Community Name	Community Number	Population	Source
Dannevirke	DAN001	5043	Tamaki River
Pahiatua	PAH001	2412	Mangatainoka River
Pahiatua - Supplementary	PAH001	2412	Pahiatua Bore (2011)
Woodville	WOO001	1401	Mangapapa Stream
Operator: Whanganui District Council			
Community Name	Community Number	Population	Source
Whanganui	WAN001	39990	Kai Iwi Bore 1
Whanganui	WAN001	39990	Kai Iwi Bore 2
Whanganui	WAN001	39990	Kai Iwi Bore 3
Whanganui - Supplementary	WAN001	39990	Heloise bore
Whanganui	WAN001	39990	Aromoho bore
Note 1: Population for National Park varies depending on visitor numbers. Has been included as it frequently exceeds 500 people.			

It is expected that other smaller water supplies that are operated by Territorial Authorities or have high seasonal populations or sensitive supplies (for example schools) could be added into the database over time. The information to be incorporated into the database falls under the following broad categories:

- ✧ Supply
- ✧ Water Source
- ✧ Treatment Plant
- ✧ Monitoring
- ✧ Zone of Contribution
- ✧ Overall Compliance

The details contained in the database under each of these categories are summarised in the following sections.

4.1 Supply Name

A summary of who operates the supply, the name of the supply and the population that is supplied, which is classified as follows:

- ✧ Large: Greater than 10,000 people
- ✧ Medium: Between 5,001 and 10,000 people (inclusive)
- ✧ Minor: Between 501 and 5,000 people (inclusive)
- ✧ Small: Between 101 and 500 people (inclusive)

It should be noted that four small supplies have been included in the current version of the database due to the expected variation in seasonal population (for example Ratana and National Park). Supplies for Himatangi Beach and Bunnythorpe are also included although their populations are slightly less than 500.

A summary of the drinking water supplies by population is provided in Table 5 below.

Table 5: Drinking Water Sources by Population										
District or Operator	Number of water sources					Percentage of water sources				
	Total	Small	Minor	Medium	Large	Total	Small	Minor	Medium	Large
Horowhenua District Council	7		6		1	16%		14%		2%
Manawatu District Council	6	1	2		3	14%	2%	5%		7%
Palmerston North City Council	10	1	2		7	23%	2%	5%		16%
Rangitikei District Council	7	1	6			16%	2%	14%		
Ruapehu District Council	5	1	4			11%	2%	9%		
Tararua District Council	4		3	1		9%		7%	2%	
Whanganui District Council	5				5	11%				11%
Total	44	4	23	1	16	100%	9%	52%	2%	36%
Notes: - Population sizes relate to the classification in Section 69G of the Health Act. - Small = Between 101 and 500 people (inclusive) - Minor = Between 501 and 5,000 people (inclusive) - Medium = Between 5,001 and 10,000 people - Large = Greater than 10,000 people										

The volume taken per supply source has also been estimated by scaling the quantity able to be taken from each source (as authorised by resource consent) so that the total estimated volume per supply is equal to the volume capability for that supply. A summary of the estimated volumes taken per source are provided in Table 6 below.

Table 6: Number of drinking water sources per district based on the estimated volume

District or operator	Less than 1,500 m ³ /day	Between 1,500 and 10,000 m ³ /day	More than 10,000 m ³ /d ay
Horowhenua District Council	3	1	1
Manawatu District Council	3	3	
Palmerston North City Council ¹	2	7	1
Rangitikei District Council	3	4	
Ruapehu District Council	4	1	
Tararua District Council	2	2	
Whanganui District Council		2	3
Total	17	20	5
Total percentage	40.5%	47.6%	11.9%
Note 1: New sources for Papaioea Park Bore 3, Railway Road Bore and Keith Street Bore 2 are not included in these totals because the 2018/2019 compliance reports state that they are not yet in use, or connected, for the supply of water.			

As the database develops further, it will be preferable to utilise metered data of actual water use in this classification table.

4.2 The Water Source

Different assessment criteria apply depending on whether the water is drawn from surface water or groundwater, so that is identified along with the source name, location and details of the consent that authorises its use. A summary of the drinking water supply sources for the different districts and operators is provided in Table 7 below.

Table 7: Drinking Water Supplies by Source of Water

District or Operator	Shallow groundwater source (top of screen $\leq$ 50 m bgl)	Deep groundwater source (top of screen > 50 m bgl)	Groundwater source of unknown depth	Total groundwater sources	Surface water sources	Total
Horowhenua District Council		4		4	3	7
Manawatu District Council		4		4	2	6
Palmerston North City Council ¹		8	1	9	1	10
Rangitikei District Council	1	2	1	4	3	7
Ruapehu District Council				0	5	5
Tararua District Council		1		1	3	4
Whanganui District Council		5		5		5
Total (number)	1	24	3	27	17	44
Total (percent)	2%	55%	7%	61%	39%	100%

Notes: Some sources are comprised of more than one bore/surface water intake.

1: New sources for Papaioea Park Bore 3, Railway Road Bore and Keith Street Bore 2 are not included in these totals because the 2018/2019 compliance reports state that they are not yet in use, or connected, for the supply of water

4.3 The Treatment Plant

The name of the treatment plant and the treatment process it uses are described, along with the log credit requirements for protozoa compliance specified in the NZ Drinking-Water Standards and the log credit removal that the treatment process can actually achieve.

4.4 Monitoring

The monitoring records, as reported by the DWAs for 2018/2019, are summarised to determine whether or not adequate monitoring is being undertaken and whether that monitoring has shown any detections that breach the NZ Drinking-Water Standards.

A summary of treatment and monitoring information for the various water supply sources are displayed in Tables 8 and 9 below:

Table 8: Treatment of Drinking Water Supply Sources

District or operator	Unknown	No treatment required (low risk bore water) ¹	Treatment required, but not in place	Treated but insufficient monitoring	Treated and fully monitored	Total treated sources
Horowhenua District Council		4			3	3
Manawatu District Council			1	3	2	6
Palmerston North City Council					10	10
Rangitikei District Council	1 ²			1	5	6
Ruapehu District Council				3	2	5
Tararua District Council					4	4
Whanganui District Council		5				
Total (number)	1	9	1	7	26	34
Total (percent)	2%	20%	2%	16%	59%	77%

Note: 1. Whilst water treatment is not required for low risk bore water, Mid Central Health note that all low risk bore water sources that they review are treated.

2. Calico treatment plant, Tutaenui Bore (Rangitikei District Council) not currently in use.

Table 9: Water Quality Monitoring Results

District or Operator	Unknown	Insufficient monitoring		Fully monitored		Number of sites with detections above MAV
		No detections above MAV	Detections above MAV	No detections above MAV	Detections above MAV	
Horowhenua District Council				6	1	1
Manawatu District Council		4		2		
Palmerston North City Council				10		
Rangitikei District Council	1 ¹		1	5		1
Ruapehu District Council			3	2		3
Tararua District Council		2	2			2
Whanganui District Council				5		
Total (number)	1	6	6	30	1	7
Total (percent)	2%	14%	14%	68%	2%	16%
Note: 1. Tutaenui Bore (Rangitikei District Council) not currently in use.						

4.5 Zone of Contribution

A detailed zone of contribution has been defined for each water supply source. The extent of those zones is detailed in individual reports for each Territorial Authority which records the land use within that zone in terms of potential contaminant sources. For groundwater sources consideration is given to the type of well head, its risk of flood water inundation and the results of any groundwater contamination risk assessment that has been undertaken.

4.6 Overall Compliance

Finally, there is consideration given to the completion and approval of the Water Safety Plan and overall compliance with NZ Drinking-Water Standards. This information is summarised in Table 10 below. The main reasons for non-compliance are insufficient monitoring data to demonstrate compliance with protozoa log credit requirements, or, in some cases, detections of E. Coli.

Table 10: Overall Compliance with DWSNZ

District or operator	Water Safety Plan			DWSNZ		Number of supplies with full compliance
	Not prepared	Completed but not approved	Completed with current approval	Compliant	Non-compliant	
Horowhenua District Council			7	6	1	6
Manawatu District Council			6	2	4	2
Palmerston North City Council			10	10		10
Rangitikei District Council ¹	1		5		6 ¹	
Ruapehu District Council	1		4	2	3	2
Tararua District Council		2	2		4	
Whanganui District Council			5	5		5
Total (number)	2	2	40	25	18	26
Total (percent)	5%	5%	91%	58%	42%	59%

Note ¹: Calico treatment plant Tutaenui bore is currently offline.

5.0 Horizons Groundwater Monitoring Data

As a separate, but related, exercise to the database development, a preliminary assessment of Horizons groundwater quality monitoring data has been carried out to evaluate:

- ∴ any evidence of poor groundwater quality in the vicinity of community drinking-water supply wells; and
- ∴ the depth to which wells show signs of land surface influences on their groundwater quality, as evidenced by the occurrence and variability in concentrations of *E. coli*, chloride, nitrate and electrical conductivity.

Figure 2 shows the location of the Horizons groundwater monitoring well network relative to the community drinking-water supply wells being considered in this report. The results of this evaluation are considered below.

5.1 Monitoring Well Locations in Proximity to Community Drinking-Water Supply Wells

The Horizons groundwater monitoring network has been developed to provide a general indication of groundwater quality in the main areas of groundwater use throughout the region. It does not specifically focus on community drinking-water supply areas and Figure 2 shows that none of the Horizons monitoring wells are in particularly close proximity to the water supply wells, or where they are close then they are much shallower than the supply wells so as not to provide an indication of water supply quality. However, the Horizons monitoring does show broad patterns of groundwater quality that may influence the drinking-water supply wells, as defined by the following broad zones of different groundwater quality characteristics that occur throughout the region.

Groundwater quality patterns can be characterised according to the following two major categories;

groundwater that occurs within a reducing environment; or

groundwater that occurs within an oxidising environment.

Reducing groundwater environments are characterised by elevated concentrations of ammonia- N, iron, manganese and in some cases, arsenic. Oxidising environments are characterised by low concentrations of those elements, but may have elevated concentrations of nitrate nitrogen.

Based on a review of the Horizons groundwater quality monitoring network carried out in 2013 (PDP, 2013), groundwater in the Horizons region can be classified into those two categories and a map showing the location of those zones together with the locations of the main drinking supply bores is provided in Figure 3, with the reducing zone characteristics typically occurring in deeper bores. A review of the more recent groundwater quality data indicates that the original classifications reported in 2013 have remained the same.

The elevated concentrations of iron, manganese and arsenic have continued to occur in a number of Horizons monitoring bores above the drinking water standards. Figures 4, 5, and 6 show the locations of those bores where concentrations of iron, manganese and arsenic have exceeded the drinking water standards in the Horizons monitoring bores, based on data collected since 2014. The locations of the drinking water supply bores are also shown on the same plots.

There are 27 groundwater takes for public water supply within the Horizons region of which:

- ✧ 23 bores are expected to be within a reducing environment;
- ✧ 1 bore is expected to be within an oxidising environment; and
- ✧ 9 bores have not yet been assessed in terms of their screened environment.

Table 11 below provides a summary of the groundwater supplies within the Horizons region and whether they are in an area that has previously been defined as likely being an oxidising or reducing environment.

Table 11: Summary of Groundwater Environment			
District or operator	Supplies likely to be within an oxidising environment	Supplies likely to be within a reducing environment	Supplies outside a defined area
Horowhenua District Council	None	Foxton and Foxton Beach	None
Manawatu District Council	None	Rongotea and Feilding ¹	Himatangi Beach
Palmerston North City Council	None	Palmerston North City ¹ , Ashhurst, Bunnythorpe and Longburn	None
Rangitikei District Council	None	Bulls - supplementary	Marton supplementary and Ratana
Ruapehu District Council	None	None	None
Tararua District Council	Pahiatua supplementary	None	None

Table 11: Summary of Groundwater Environment

District or operator	Supplies likely to be within an oxidising environment	Supplies likely to be within a reducing environment	Supplies outside a defined area
Whanganui District Council	None	Whanganui supplementary	Whanganui
Total (number)	1	19	7
Total (percent)	3.7 %	70.4 %	25.9 %
<i>Notes:</i> <i>Supply is sourced from both groundwater and surface water.</i>			

5.2 Depth of Land Surface Influences on Groundwater Supplies

Plots of *E. coli*, chloride, electrical conductivity and soluble inorganic nitrogen versus screen depth are shown in Figures 7 to 10. Elevated and/or variable concentrations in those parameters indicate that land surface activities can be having a reasonable degree of influences on groundwater quality.

The results show that the only parameter where there is a clear relationship between bore depths and concentrations is for soluble inorganic nitrogen. Note that soluble inorganic nitrogen includes all forms of inorganic nitrogen (i.e. nitrate and ammonia) and therefore accounts for circumstances where nitrate nitrogen is converted to ammonia via denitrification. Nitrogen concentrations are generally much less than 5 mg/L beyond a depth of around 50 m, implying that the effects of significant surface activities have not yet extended beyond that depth.

Note that one bore (312020, 116 m deep) shows high concentrations of chloride (Figure 8) and high levels of electrical conductivity (Figure 9). Those elevated levels appear to be an unusual localised pattern that does not represent general background groundwater quality in the area and so is not an indicator of general land surface effects on groundwater quality.

6.0 Consideration of Requirements for Improved Water Supply Management

The purpose of this project is to provide a common database of information on water supplies and to use it to prioritise management options to minimise the risk of contamination. A criteria to prioritise management actions can be implemented by considering the likelihood of contamination occurring and the consequences arising from that contamination.

6.1 Likelihood of Contamination Occurring

A range of information from within the database is used to evaluate the likelihood of contamination occurring. An over-riding criteria that indicates a high likelihood is if monitoring data shows the presence of contaminants in excess of the NZ Drinking-Water Standards, or if the treatment system is inadequate for the water source.

In addition to that over-riding criteria, a number of other factors are considered collectively to indicate the relative likelihood of contamination occurring. These are:

- ✧ whether the monitoring of the water source and/or the treatment plant meets the NZ Drinking-Water Standards;
- ✧ whether a groundwater source meets the risk criteria in the NZ Drinking-Water Standards;
- ✧ the land use (and contamination sources) that occur within the area that primarily contributes water into the supply;
- ✧ the likelihood of floodwaters inundating the well head of a groundwater supply;
- ✧ whether or not a Water Safety Plan² has been prepared and approved by the Drinking Water Assessor;

These combined criteria are given an individual score which is then combined into an overall likelihood score in accordance with Table 12:

² The Health (Drinking Water) Amendment Act 2007 does not require a Water Safety Plan to be prepared if a water scheme does not meet the population supply threshold of no fewer than 501 people for not less than 60 days per year. Despite this preparation of a Water Safety Plan is still included in the ranking system for all supplies in the database because such a plan is a useful document to lessen the risk of contamination.

Table 12: Likelihood Score

Criteria	Low (1)	Medium (2)	High (3)
<i>E. coli</i> or protozoa detection, or breach of any MAV	No detection from a fully compliant monitoring programme	No detections, but incomplete monitoring	Detections
Treatment	Yes and fully monitored	Yes with insufficient monitoring	No treatment
Risk of raw water contamination	Low risk bore water	Bore water	Surface water
Surrounding land use	Council controlled Yard	Other	Agricultural
Flood Hazard (groundwater takes only)	Outside 1 in 200 year inundation	1 in 200 year inundation	1 in 100 year inundation
Approved Water Safety Plan	Completed and approved	Completed but not approved	Not prepared
Likelihood Categories: Surface water or no flooding information	High = <i>E. coli</i> or protozoa detections & inadequate treatment; or a score of: 13 - 15		
	Medium = 10 - 12		
	Low = 5 - 9		
Likelihood Categories: Groundwater (includes flooding likelihood)	High = <i>E. coli</i> or protozoa detections & inadequate treatment; or a score of: 15 - 18		
	Medium = 11 - 14		
	Low = 6 - 10		

At the present time, some areas do not have flood maps available and in these situations the assessment has been scaled to exclude the flood hazards. It should be noted that 100 year flood maps are not available for most of the sites and hence, it is possible that sites assessed in the 200 year flood model may also be at risk during a 1 in 100 year flood. However, it is noted that there are currently no supplies within the 1 in 200 year flood with a total likelihood score of 14. Therefore, if they were also within the 1 in 100 year flood extent, the overall likelihood rating would remain the same.

The flood hazard category is not relevant for surface water sources and their scores have been scaled accordingly.

6.2 Zone of Contribution

The consideration of land use sources of contamination has been made within an area that primarily contributes water to the supply. These zones of contribution have been determined by the site-specific conditions that apply at each water source.

6.3 Consequence of Contamination Occurring

The consequence of contamination has been simply judged on the basis of the population that is supplied by the water source in accordance with the following criteria:

- ✧ High consequence: population greater than or equal to 5,001 people (Medium or Large supplies)
- ✧ Medium consequence: population between 501 and 5,000 people inclusive (Minor supplies)
- ✧ Low consequence: population between 101 and 500 people inclusive (Small supplies)

6.4 Overall Priority Rankings

Management priority rankings are assigned to each water supply according to the following schedule:

Priority 1: Action is required as soon as practicable to improve the management of the water supply.

Priority 2: A heightened standard of vigilance and conservative management is required.

Priority 3: Maintenance of current management practices is expected to minimise contamination risks.

The assessment of which priority classification should apply to each water supply is achieved by combining the individual classification of likelihood (from Section 6.1) and consequence (from Section 6.3) into Table 13.

Table 13: Priority Matrix				
		Likelihood		
		Low	Medium	High
Consequence	High	Priority 2	Priority 1	Priority 1
	Medium	Priority 3	Priority 2	Priority 1

Table 13: Priority Matrix

		Likelihood		
		Low	Medium	High
	Low	Priority 3	Priority 3	Priority 2

Limited information was available for several areas of the database so the following priority ratings should be taken as a preliminary assessment. The database is a living document that involves communication between the key parties that influence safe water supply management. Therefore, the priority rankings will be updated as more information becomes available, and updated in the database. The results from the assessment are summarised in Table 14. Where the classifications have changed since the previous compliance report provided in 2017, the previous numbers have been included in brackets and in green.

A more detailed break-down of the various likelihood components for each drinking water source are provided in Appendix B. Additionally, a comparison between the total likelihood scores during the 2017/2018 and 2018/2019 compliance periods is presented in Figures 11a through to 11d and generally show an improvement across the supplies during the 2018/2019 compliance period.

As shown, there are four supplies which have shown an increase in their likelihood scores and the reasons are briefly summarised below:

- ✧ Palmerston North City Council – Both the Papaioea Park and Roberts Line bores lost their secure status during the 2018/2019 compliance period due to the 5 yearly residence time re-sampling being overdue (last sample in March 2014).
- ✧ Rangitikei District Council – The Taihape, Hautapu River supply experienced turbidity and UV transgressions during the monitoring period.
- ✧ Ruapehu District Council – The Ohakune, Serpentine Stream supply had a significant transgression where untreated water passed through the treatment plant due to a power failure.

Table 14: Horizons Region drinking water supply priority assessment summary

Operator: Horowhenua District Council		Priority		
Community	Source	Consequence	Likelihood	Overall
Levin	Ohau River, Gladstone Road	H	L (M)	2 (1)

Table 14: Horizons Region drinking water supply priority assessment summary

Operator: Horowhenua District Council		Priority		
Community	Source	Consequence	Likelihood	Overall
Foxton	Foxton Bore No. 1, Foxton Bore No. 3, Foxton, Clyde St Bore	M	L	3
Foxton Beach	Foxton Beach Bore No. 3	M	L	3
Shannon	Mangaore Stream	M	L (M)	3 (2)
Tokomaru	Tokomara River, Horseshoe Bend	M	M	2
Operator: Manawatu District Council		Priority		
Community	Source	Consequence	Likelihood	Overall
Feilding	Oroua River	H	M	1
Feilding	Campbells Road Bore	H	L	2
Feilding	Newbury Bore	H	L	2
Himatangi Beach	Himatangi Bore	L	L	3
Rongotea	Rongotea Community Bore	M	L	3
Sanson	Rangitikei River for Sanson	M	M	2
Operator: Rangitikei District Council		Priority		
Community	Source	Consequence	Likelihood	Overall
Marton	Tutaenui Stream	M	M	2
Marton - Supplementary	Calico Bore ¹	M	M	2
Marton - Supplementary	Tutaenui Bore ¹	Offline		
Bulls	Rangitikei River	M	M	2
Bulls - Supplementary	Bulls Bore	M	M	2
Ratana	Ratana bore	L	M	3
Taihape	Hautapu River	M	M	2
Operator: Palmerston North City Council		Priority		
Community	Source	Consequence	Likelihood	Overall
Palmerston North City	Keith Street Bore	H	L	2
Palmerston North City	Papaioea Park Bore	H	L	2
Palmerston North City	Papaioea Park Bore 2	H	L	2

Table 14: Horizons Region drinking water supply priority assessment summary

Operator: Horowhenua District Council		Priority		
Community	Source	Consequence	Likelihood	Overall
Palmerston North City	Roberts Line Bore	H	L	2
Palmerston North City	Roberts Line Bore 2	H	L	2
Palmerston North City	Takaro Bore	H	L	2
Palmerston North City	Turitea Dam	H	L	2
Ashhurst	Ashhurst Bores	M	L	3
Longburn	Longburn Bore	M	L	3
Bunnythorpe	Raymond Street New Bore	L	L	3
Operator: Ruapehu District Council		Priority		
Community	Source	Consequence	Likelihood	Overall
Taumarunui ²	Whanganui River for Matapuna	M	M	2
Raetihi	Makotuku River	M	L (M)	3 (2)
Raetihi	Makara Stream	M	L (M)	3 (2)
Ohakune	Serpentine Stream	M	M (L)	2 (3)
National Park ²	Mangahua Stream	L	H	2
Operator: Tararua District Council		Priority		
Community Name	Source	Consequence	Likelihood	Overall
Dannevirke	Tamaki River	H	M	1
Pahiatua	Mangatainoka River	M	M	2
Pahiatua - Supplementary	Pahiatua Bore (2011)	M	M	2
Woodville	Mangapapa Stream	M	M	2
Operator: Whanganui District Council		Priority		
Community Name	Source	Consequence	Likelihood	Overall
Whanganui	Kai Iwi Bore 1	H	L	2
Whanganui	Kai Iwi Bore 2	H	L	2
Whanganui	Kai Iwi Bore 3	H	L	2
Whanganui - Supplementary	Heloise	H	L	2
Whanganui	Aromoho Bore	H	L	2

Note ¹: Tutaenui bore is currently offline, and the Calico bore was offline last year so has not previously been graded.

²: No previous reports were available for Taumarunui and National Park, so these supplies have not been previously graded.

Under the outlined criteria several water takes have been identified requiring actions to be taken as soon as practicable to improve the safety of the water supply. The two priority 1 ratings Dannevirke, Tamaki River source and Feilding, Oroua River source were a result of a high consequence rating (population greater than or equal to 5,001 people) combined with being a surface water supply and the following:

- ✧ Distribution bacterial compliance was not achieved for the Feilding distribution zone due to remedial action including E. coli monitoring not being undertaken if disinfectant level drops below 0.1 mg/L on numerous occasions.
- ✧ Turbidity and UV intensity transgressions on multiple occasions for the Dannevirke, Tamaki River source. Also, one month did not meet the continuous monitoring requirements, where a 132 minute gap in the monitoring was reported in November 2019.

Appendix C at the end of this report includes a specific schedule of actions to be undertaken by each of the water supply managers to address the issues arising from this assessment.

7.0 Conclusion

The report describes the main features of a database that holds information regarding drinking water supply sources in the Horizons Region. Those features include data regarding the supply name, the source(s) of water for each supply, the treatment used at each supply, the monitoring that occurs at each supply, information regarding landuse in the general zone of contribution around each supply and overall compliance.

Source protection zones based on site specific information have been identified for each of the supplies in this report and the potential hazards and risks to water quality within those zones have been identified as far as possible. Continued management of those risks (identified in the site-specific reports) should continue, for example identification of old and disused bore within the microbial protection zones to groundwater sources.

That information has been used to prioritise management actions to improve those supply sources. Figure 12 presents a map showing the location of each of the sources and the priority assigned to that source. Additionally, a comparison of the overall priority ratings between our previous 2017 and 2019 reports and the updated ratings in this report is presented in Figure 13. Compared to 2019, there are fewer sources with a Priority 1 classification, implying that the management of sources has continued to improve.

The majority of surface water sources are considered to require improved management actions as soon as practicable (Priority 1), or to be operating with a heightened standard of vigilance and conservative management (Priority 2). The

majority of groundwater sources can continue with their current management practices in place, based on the information currently available.

Horizons maintain a groundwater quality network around the region which is primarily designed to provide general information regarding groundwater quality in the region's aquifers. A review of that information suggests that surface influences on groundwater quality are most prominent in bores down to a depth of around 50 m, although the information is not comprehensive around all areas where drinking water sources are taken from groundwater. The information also indicates that there are some areas of the region where naturally occurring conditions result in concentrations of iron, manganese and arsenic that are above the drinking water standards. As a result, groundwater drawn from bores in those areas may require treatment to reduce these chemical concentrations before it is used in the public supply network.

8.0 References

- Central North Island Drinking Water Assessment Unit. (2017-2018). *Reports on Compliance with the Drinking-water Standards for New Zealand 2005 (Revised 2008) and duties under Health Act 1956*. Various locations.
- Ministry of Health. (2008). *Drinking-water Standards for New Zealand 2005 (Revised 2008)*. Wellington: Ministry of Health.
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- New Zealand Government. (2017). *Report of the Havelock North Drinking Water Enquiry: Stage 1*. Auckland.

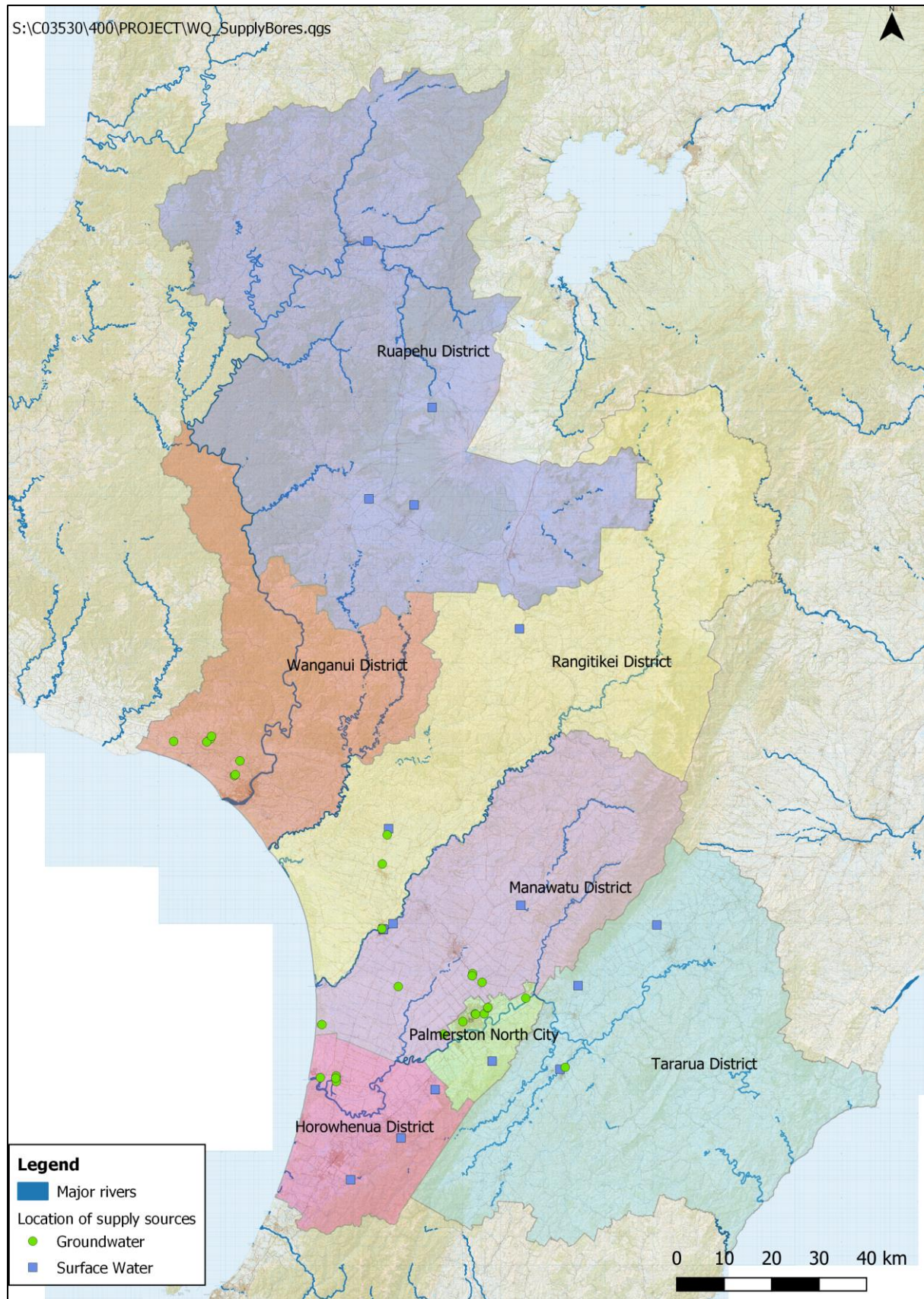


FIGURE 1: LOCATION OF DRINKING WATER SUPPLY SOURCES

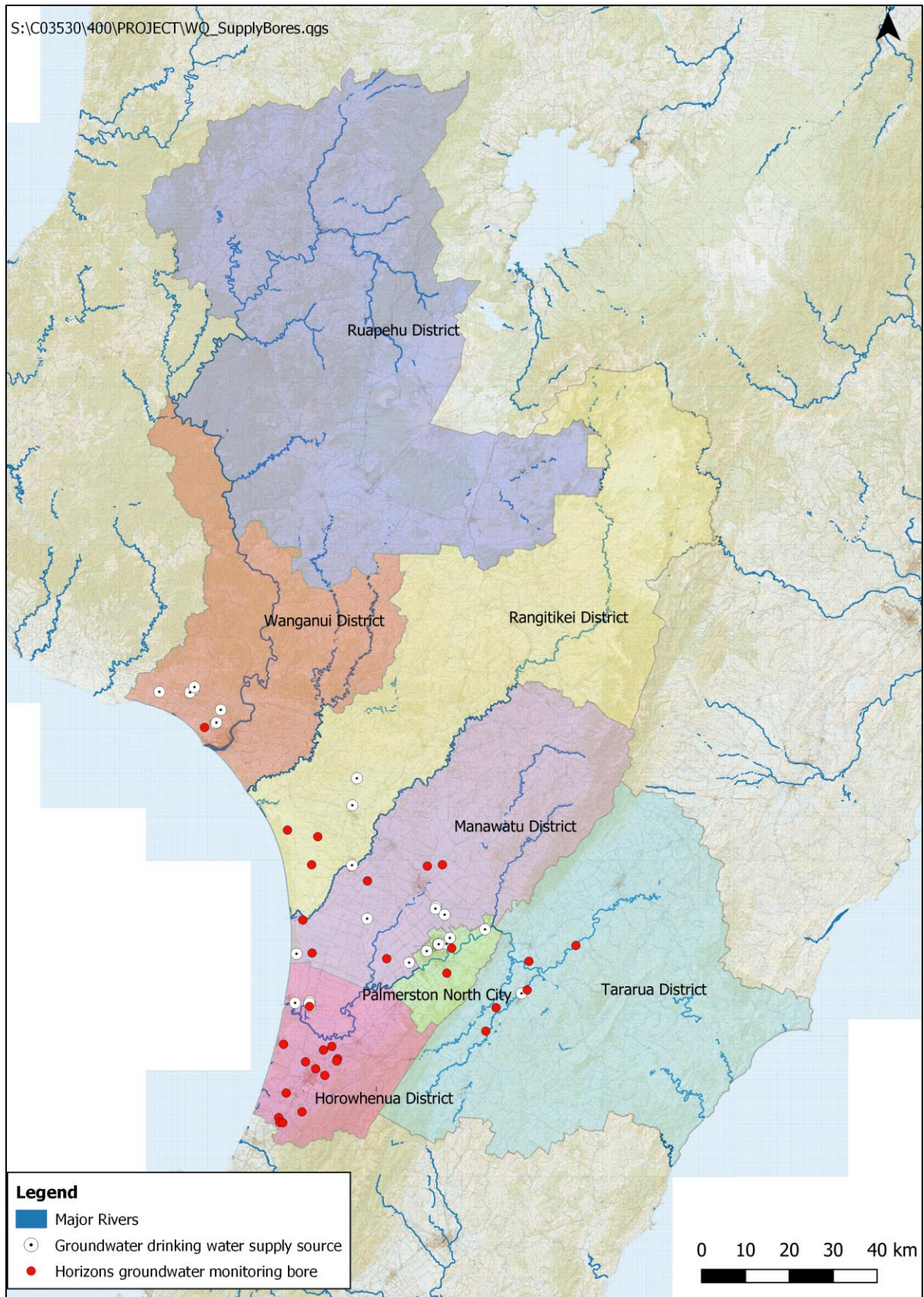


FIGURE 2: LOCATION OF DRINKING WATER SUPPLY GROUNDWATER SOURCES AND HORIZONS MONITORING BORES

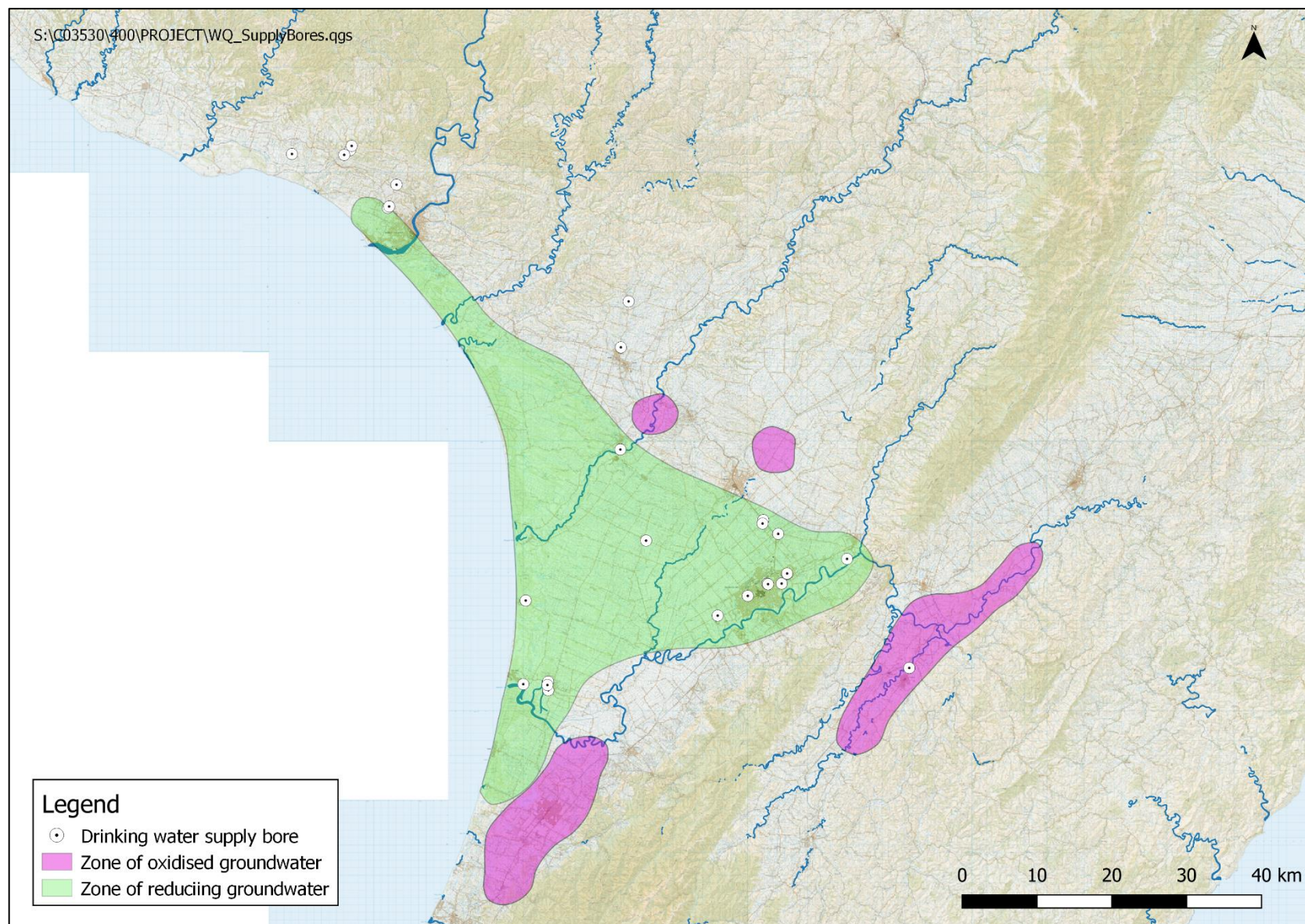


FIGURE 3: LOCATION OF DRINKING WATER SUPPLY BORES RELATIVE TO ZONES OF OXIDISING AND REDUCING GROUNDWATER

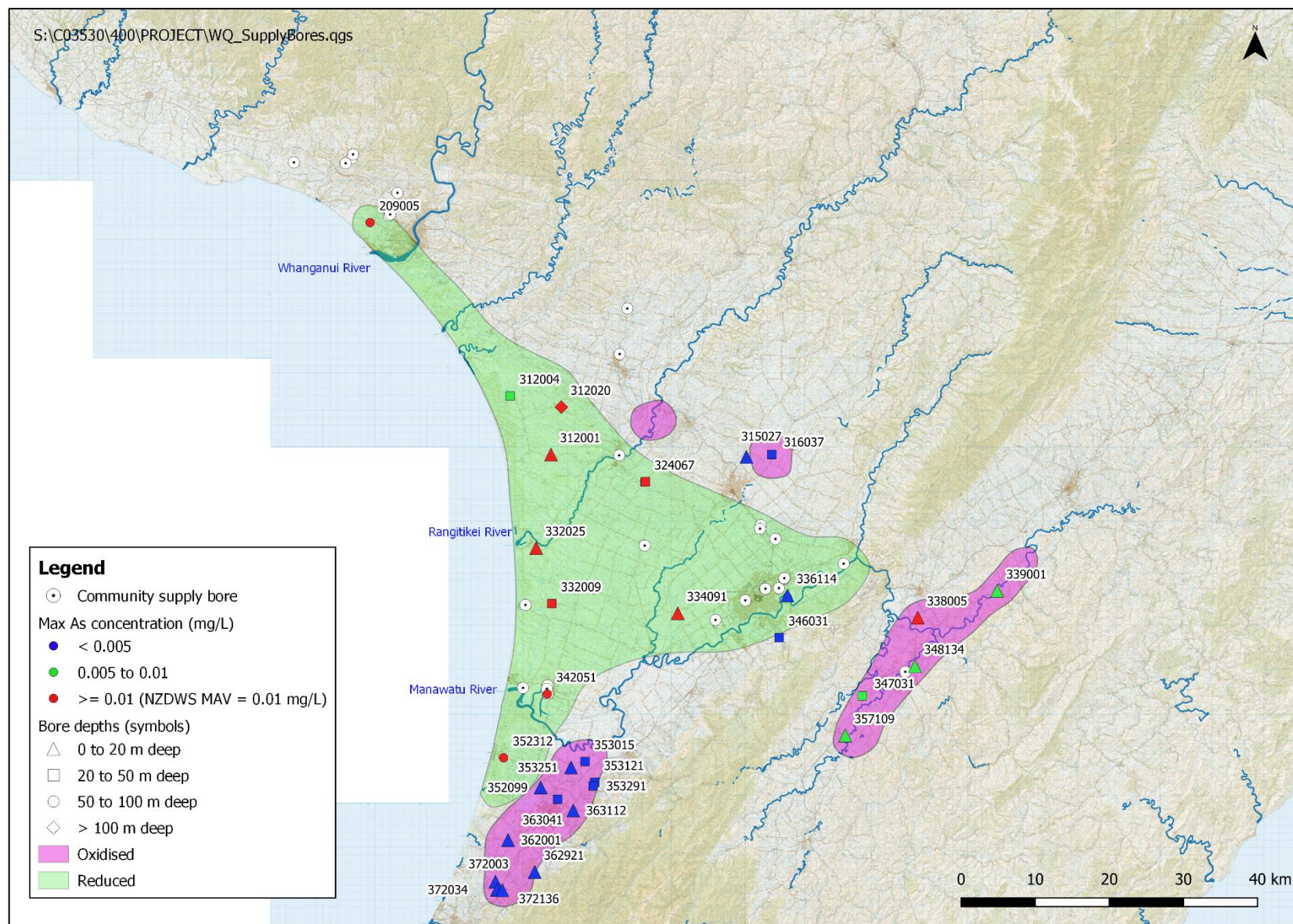


FIGURE 4: ARSENIC CONCENTRATIONS IN HORIZONS MONITORING BORES (BASED ON DATA COLLECTED BETWEEN 2014 AND 2017)

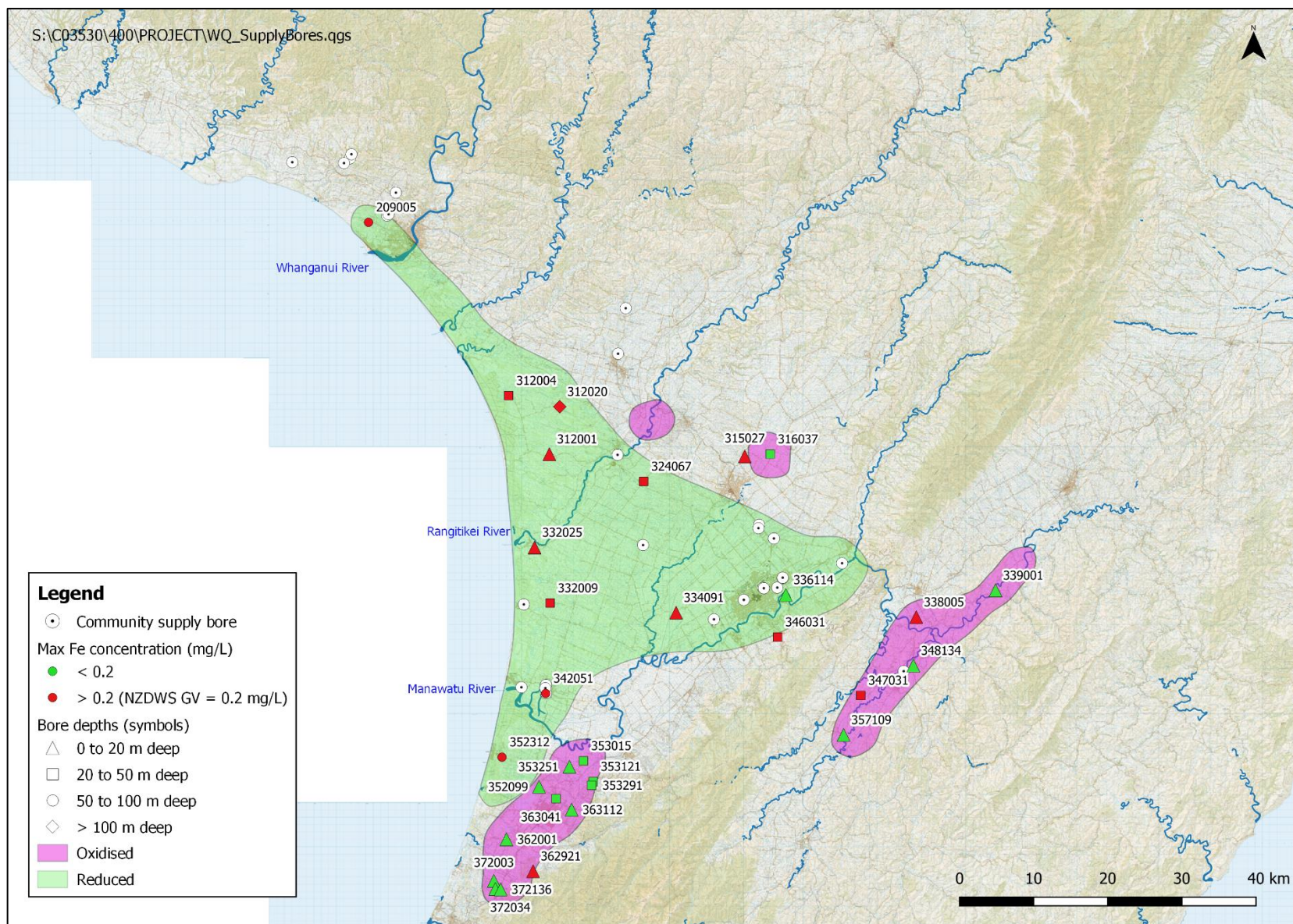


FIGURE 5: IRON CONCENTRATIONS IN HORIZONS MONITORING BORES (BASED ON DATA COLLECTED BETWEEN 2014 AND 2017)

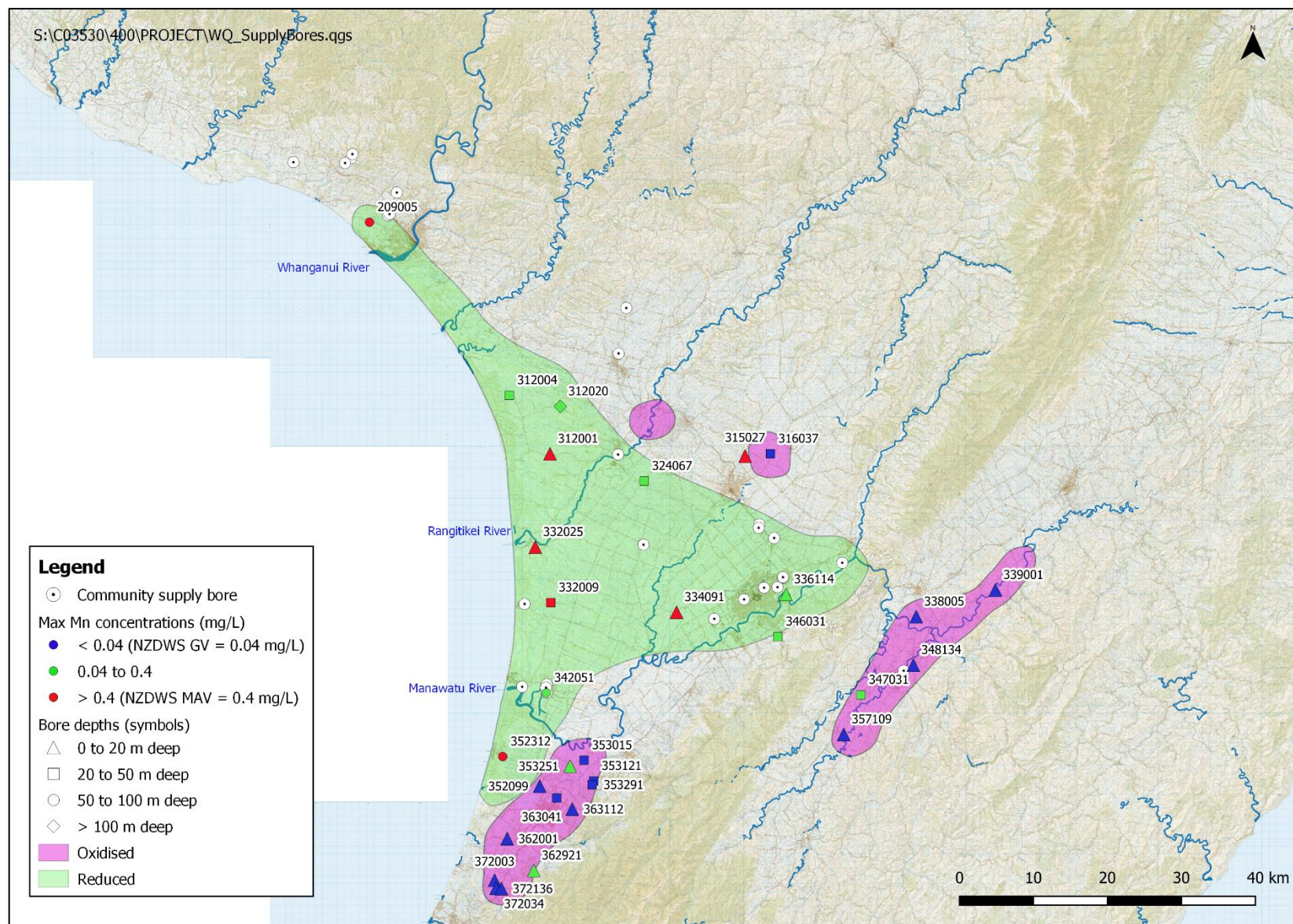


FIGURE 6: MANGANESE CONCENTRATIONS IN HORIZONS MONITORING BORES (BASED ON DATA COLLECTED BETWEEN 2014 AND 2017)

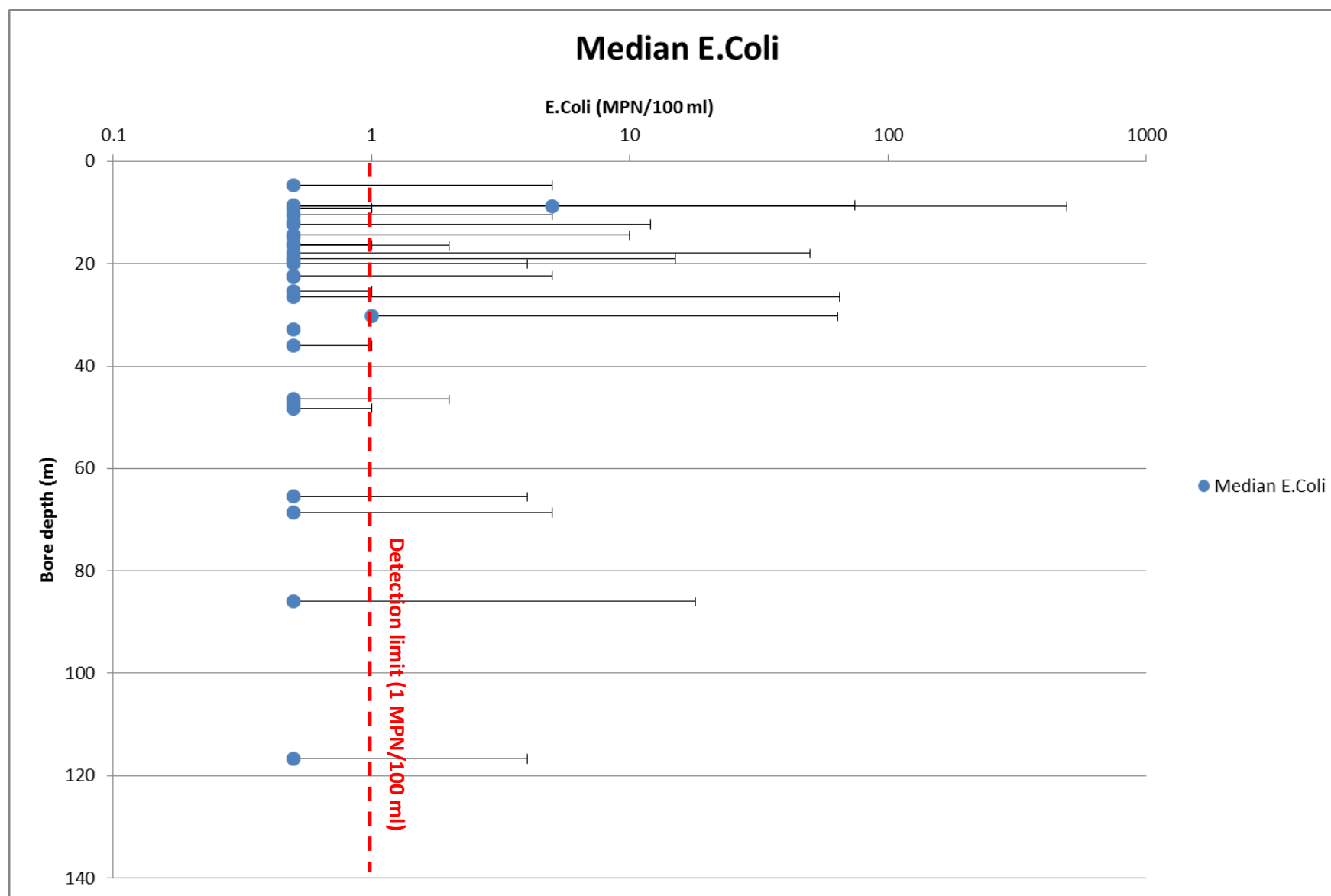


FIGURE 7: CONCENTRATION OF E.COLI WITH DEPTH OF SAMPLING BORE. CONCENTRATIONS OF LESS THAN 1 INDICATE NON DETECTION. BARS INDICATE RANGE OF CONCENTRATIONS

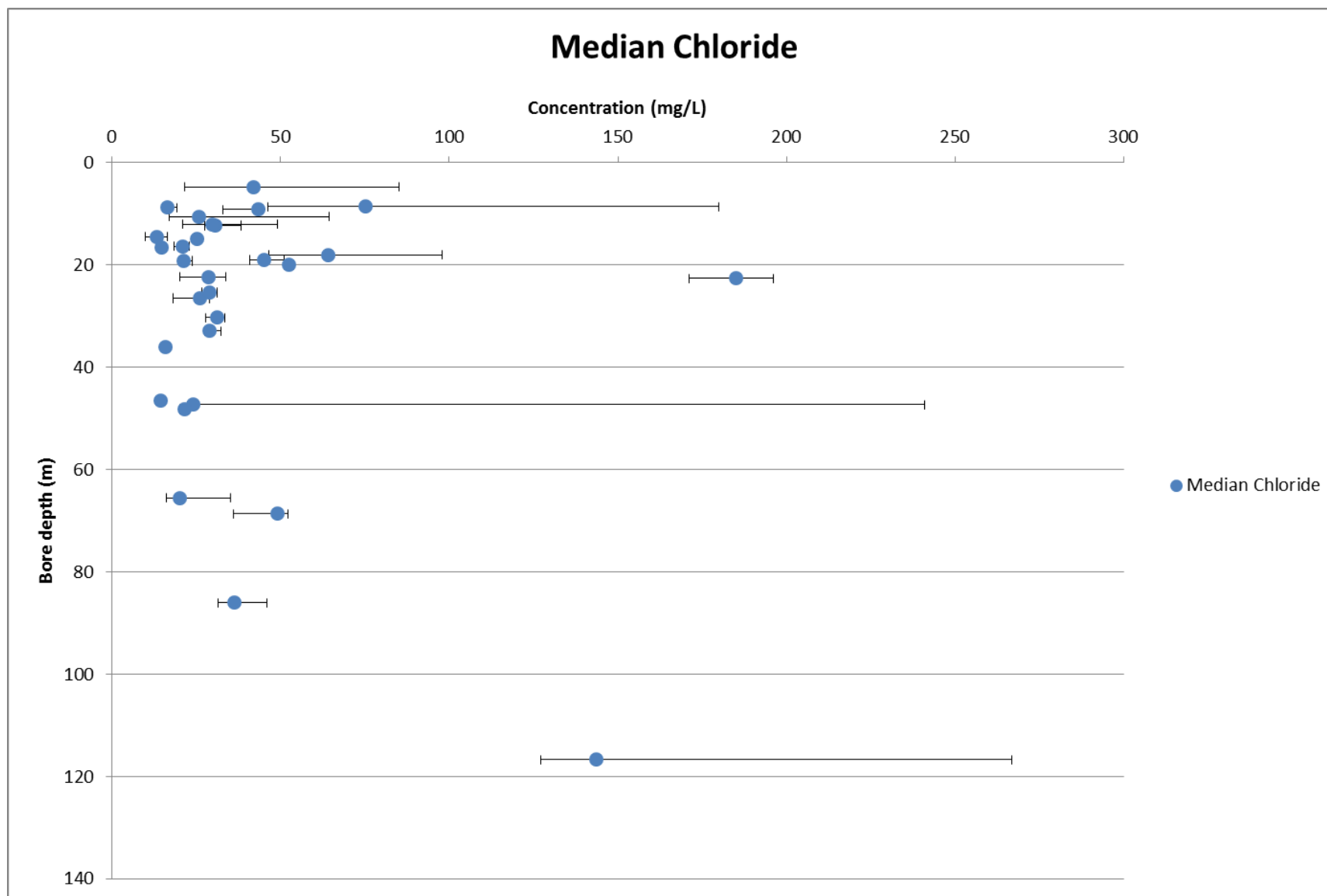


FIGURE 8: CONCENTRATION OF CHLORIDE WITH DEPTH OF SAMPLING BORE. BARS INDICATE RANGE OF CONCENTRATIONS

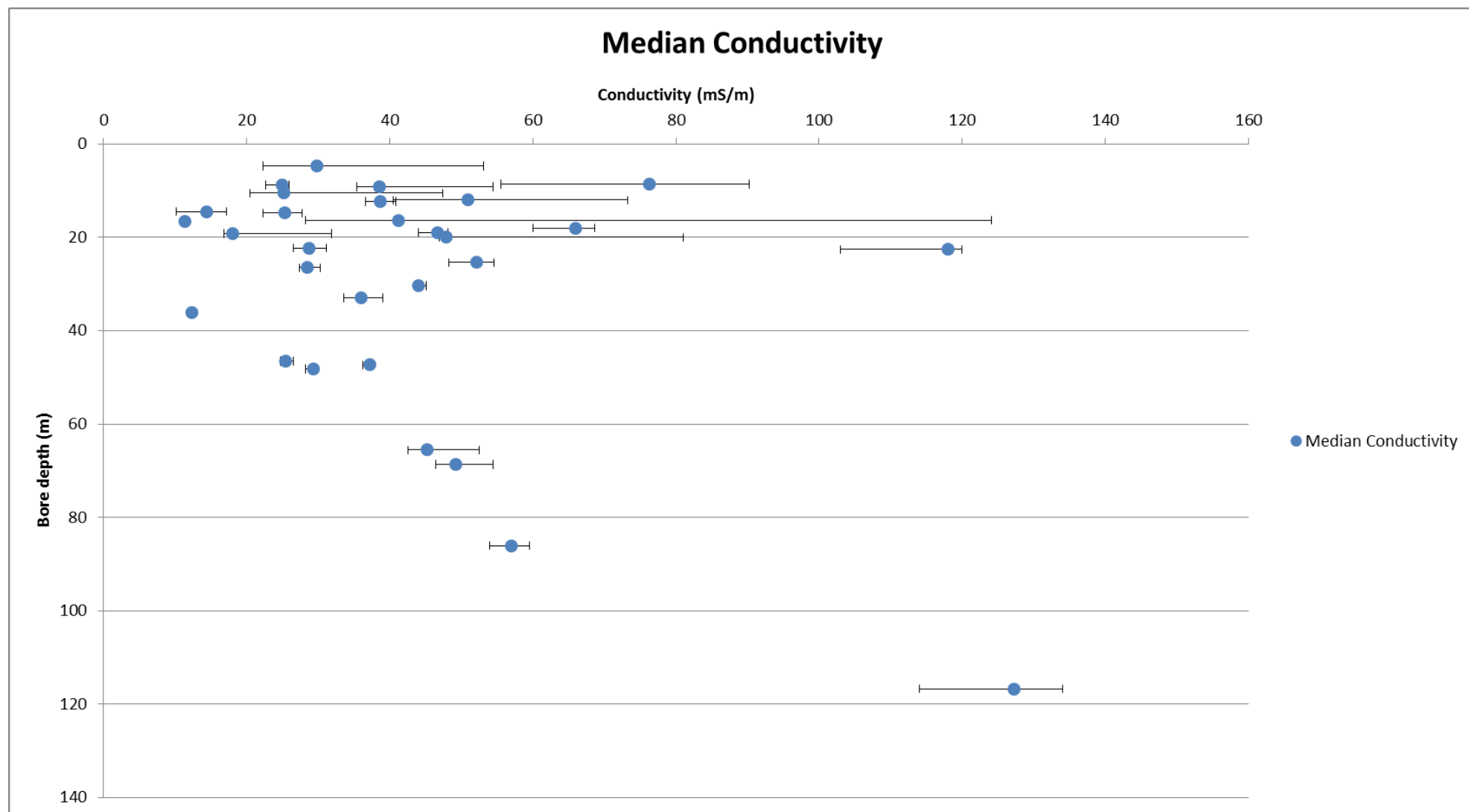


FIGURE 9: VARIATION OF ELECTRICAL CONDUCTIVITY WITH DEPTH OF SAMPLING BORE. BARS INDICATE RANGE OF CONCENTRATIONS

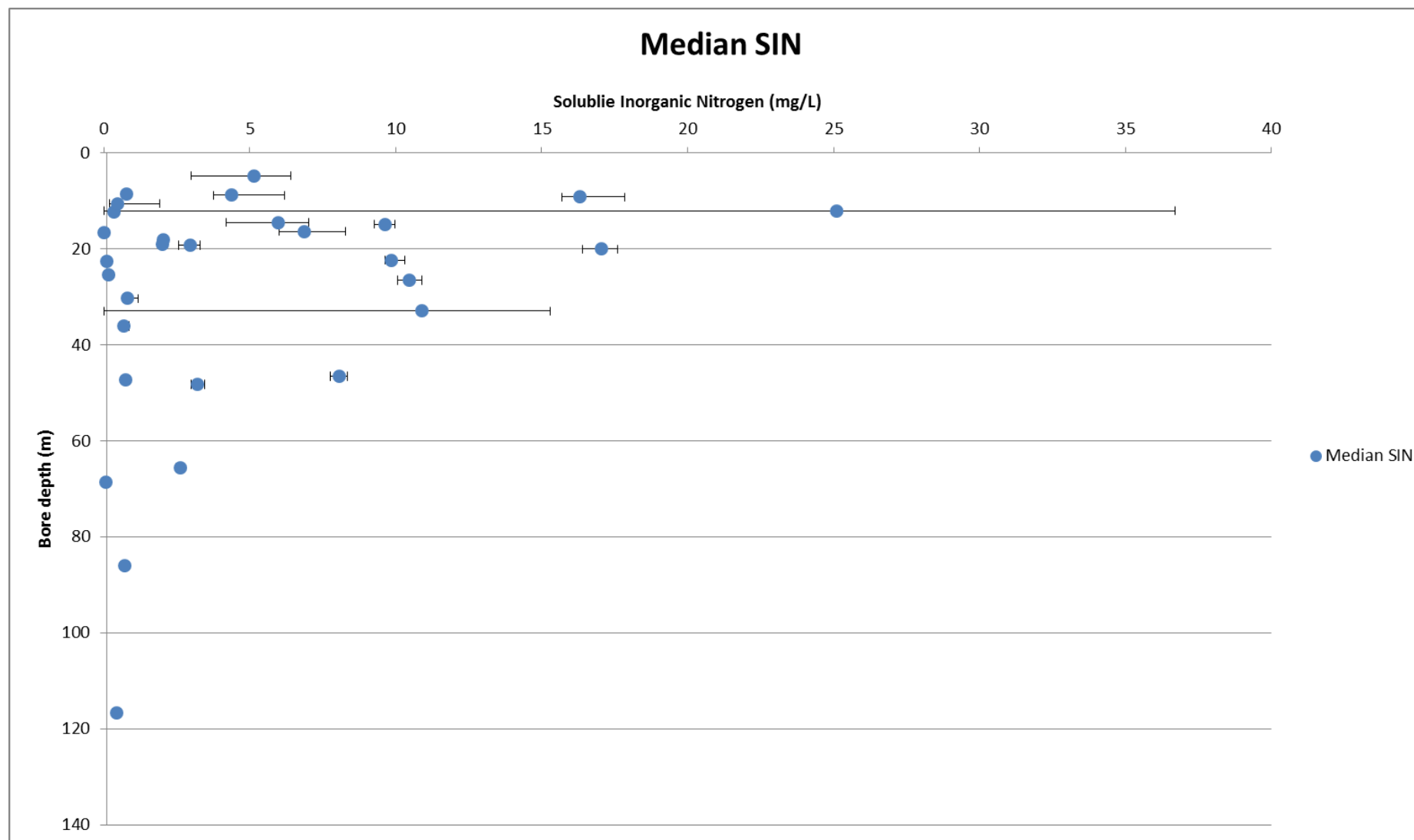


FIGURE 10: CONCENTRATION OF SOLUBLE INORGANIC NITROGEN WITH DEPTH OF SAMPLING BORE. BARS INDICATE RANGE OF CONCENTRATIONS

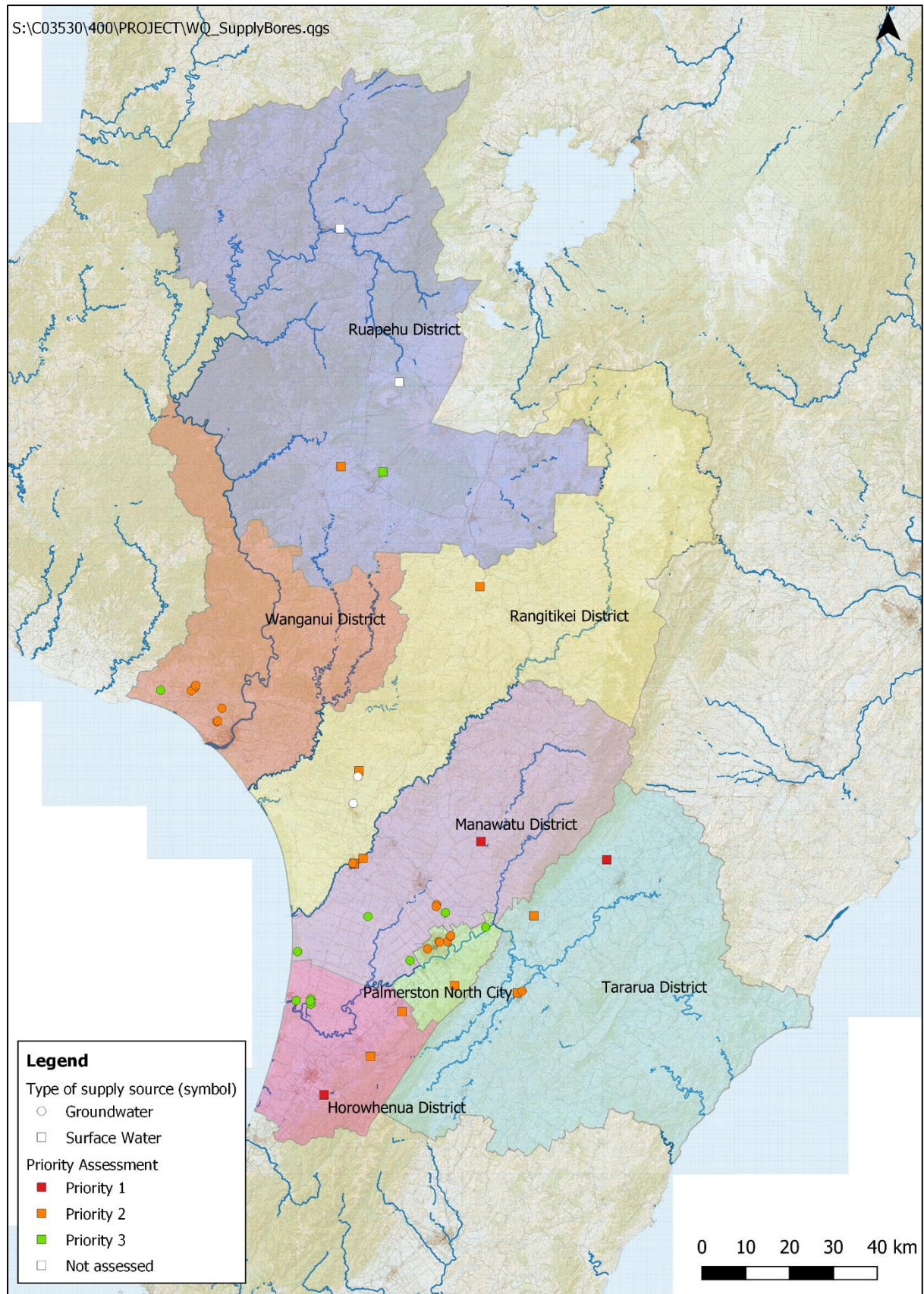


FIGURE 11: LOCATION OF DRINKING WATER SUPPLY SOURCES AND PRELIMINARY ASSESSMENT OF PRIORITIES

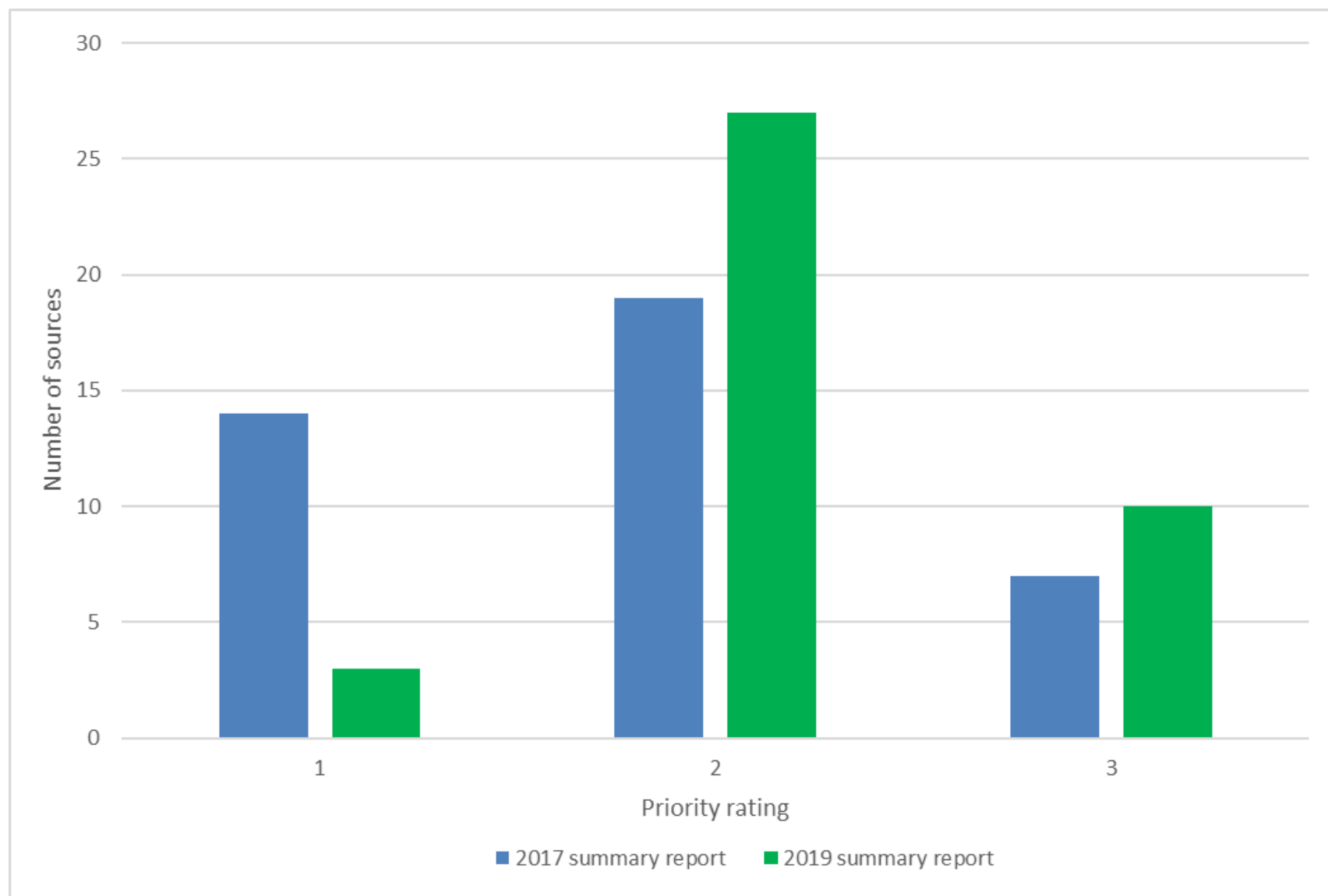


FIGURE 12: PRIORITY RATING COMPARISON BETWEEN THE 2017 AND 2019 COMPLIANCE REPORTS

Appendix B

Priority Assessment Matrix

Priority Assessment Matrix

The table below outlines the priority matrix for the relevant water supplies based on the most recent compliance reports from 2017/2018. Where the classifications have changed since the previous compliance report provided in 2017, the previous number s have been included in brackets and in green.

Summary of likelihood assessment for each drinking water supply source							
Community Name	Source	<i>E. coli</i> or protozoa detection, or breach of any MAV	Treatment	Contamination risk of water supply source	Surrounding land use	Flood hazard	Approved Water Safety Plan & Compliance with DWSNZ
Horowhenua District Council							
Levin	Ohau River, Gladstone Road	1 (3)	1 (2)	3	3	0	1
Foxton	Foxton Bore No. 1, Foxton Bore No. 3, Foxton, Clyde St Bore	1 (2)	1	1 (2)	1	1	1
Foxton Beach	Foxton Beach Bore No. 3	1	1	1	3	Unknown	1

Summary of likelihood assessment for each drinking water supply source							
Community Name	Source	<i>E. coli</i> or protozoa detection, or breach of any MAV	Treatment	Contamination risk of water supply source	Surrounding land use	Flood hazard	Approved Water Safety Plan & Compliance with DWSNZ
Shannon	Mangaore Stream	1 (2)	1 (2)	3	3	0	1
Tokomaru	Tokomaru River, Horseshoe Bend	3 (2)	1 (2)	3	3	0	1
Manawatu District Council							
Feilding	Oroua River	2	2	3	2	0	1
Feilding	Campbells Road Bore	2	2	1	3	1	1
Feilding	Newbury Bore	2	2	1	3	1	1
Himatangi Beach	Himatangi Bore	1	1	1	1	Unknown	1
Rongotea	Rongotea Community Bore	1	1	1	1	Unknown	1
Sanson	Rangitikei River for Sanson	1 (2)	3	3	3	0	1

Summary of likelihood assessment for each drinking water supply source							
Community Name	Source	<i>E. coli</i> or protozoa detection, or breach of any MAV	Treatment	Contamination risk of water supply source	Surrounding land use	Flood hazard	Approved Water Safety Plan & Compliance with DWSNZ
Palmerston North City Council							
Palmerston North City	Keith Street Bore	1	1	1	1	2	1
Palmerston North City	Papaioea Park Bore	1	1	2 (1)	1	2	1
Palmerston North City	Papaioea Park Bore 2	1	1	1	1	2	1
Palmerston North City	Roberts Line Bore	1	1	2 (1)	1	2	1
Palmerston North City	Roberts Line Bore 2	1	1	1	1	2	1

Summary of likelihood assessment for each drinking water supply source							
Community Name	Source	<i>E. coli</i> or protozoa detection, or breach of any MAV	Treatment	Contamination risk of water supply source	Surrounding land use	Flood hazard	Approved Water Safety Plan & Compliance with DWSNZ
Palmerston North City	Takaro Bore	1	1	1	1	2	1
Palmerston North City	Turitea Dam	1	1	3	2	0	1
Ashhurst	Ashhurst Bores	1 (3)	1	1	1	2	1
Longburn	Longburn Bore	1 (3)	1	1	2	1	1 (2)
Bunnythorpe	Raymond St bore	1	1	1	1	1	1
Rangitikei District Council							
Marton	Tutaenui Stream	3 (2)	1 (2)	3	3	0	1
Marton - Supplementary	Calico Bore	3	1	2	1	3	1

Summary of likelihood assessment for each drinking water supply source							
Community Name	Source	<i>E. coli</i> or protozoa detection, or breach of any MAV	Treatment	Contamination risk of water supply source	Surrounding land use	Flood hazard	Approved Water Safety Plan & Compliance with DWSNZ
Marton - Supplementary	Tutaenui Bore	Offline					
Bulls	Rangitikei River	3 (2)	1 (2)	3	3	0	1
Bulls - Supplementary	Bulls Bore	3 (2)	1 (2)	2	3	1	1
Ratana	Ratana bore	3 (2)	1 (2)	1 (2)	2	1	3
Taihape	Hautapu River	3 (2)	2	3	3	0	1
Ruapehu District Council							
Taumarunui	Whanganui River for Matapuna	3	2	3	3	0	1
Raetihi	Makotuku River	1	1 (2)	3	3	0	1 (3)
Raetihi	Makara Stream	1	1 (2)	3	3	0	1 (3)

Summary of likelihood assessment for each drinking water supply source							
Community Name	Source	<i>E. coli</i> or protozoa detection, or breach of any MAV	Treatment	Contamination risk of water supply source	Surrounding land use	Flood hazard	Approved Water Safety Plan & Compliance with DWSNZ
Ohakune	Serpentine Stream	3 (1)	2	3	2	0	1 (3)
National Park	Mangahuia Stream	3	2	3	2	0	3
Tararua District Council							
Dannevirke	Tamaki River	3 (2)	2 (3)	3	3	0	1 (2)
Pahiatua	Mangatainoka River	2	2	3	3	0	2
Pahiatua - Supplementary	Pahiatua Bore (2011)	2	2	2	1	3	2
Woodville	Mangapapa Stream	3 (2)	2	3	3	0	1 (2)
Whanganui District Council							
Whanganui	Kai Iwi Bore 1	1 (2)	1 (2)	1	1	Unknown	1
Whanganui	Kai Iwi Bore 2	1 (2)	1 (2)	1	1	Unknown	1

Summary of likelihood assessment for each drinking water supply source							
Community Name	Source	<i>E. coli</i> or protozoa detection, or breach of any MAV	Treatment	Contamination risk of water supply source	Surrounding land use	Flood hazard	Approved Water Safety Plan & Compliance with DWSNZ
Whanganui	Kai Iwi Bore 3	1 (2)	1 (2)	1	1	Unknown	1
Whanganui - Supplementary	Heloise	1 (2)	1 (2)	1	1	Unknown	1
Whanganui	Aromoho bore	1 (2)	1 (2)	1	1	0	1

Appendix C

Schedule of Proposed Actions at High
Priority Sites

Table C1: Schedule of Proposed Actions		
Supply	Cause of high priority rating	Action
Manawatu District Council - Feilding	Failed for bacterial compliance in the distribution zone because remedial action including E. coli monitoring was not undertaken when disinfectant levels dropped below 1 mg/L on numerous occasions.	Improved monitoring and sampling routine.
Tararua District Council - Dannevirke	Failed for protozoa compliance. Turbidity and UV intensity transgressions on multiple occasions. Also, one month did not meet the continuous monitoring requirements.	Improved monitoring routine.

Appendix D

List of all supplies by Territorial Authority
area

Communities shaded in grey are included in the priority assessment in this report. The list of supplies in Table D1 is sourced from the WINZ online database.

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Horowhenua District Council	Levin	20,000	LEV001
Horowhenua District Council	Foxton	2,700	FOX002
Horowhenua District Council	Foxton Beach	1,900	FOX003
Horowhenua District Council	Shannon	1,436	SHA001
Horowhenua District Council	Tokomaru	550	TOK002
Horowhenua District Council	Koputaroa School	170	KOP002
Horowhenua District Council	Poroutawhao School	150	POR006
Horowhenua District Council	Opiki School	140	OPI001
Horowhenua District Council	Tatum Park	106	TAT003
Horowhenua District Council	Ohau, Bishops Vineyard	100	OHA017
Horowhenua District Council	Poutu Marae	95	POU007
Horowhenua District Council	Shannon, Silver Fern Farms	85	SHA004
Horowhenua District Council	Himatangi Estate	70	HIM002
Horowhenua District Council	Kereru Marae	70	KER007

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Horowhenua District Council	Wehiwehi Marae	70	WEH001
Horowhenua District Council	Manakau School	55	MAN015
Horowhenua District Council	Lev -Country Educare Child Cen	38	LEV002
Horowhenua District Council	Kereru Children's' Learning Cent	33	KER004
Horowhenua District Council	Ngatokowaru Marae	30	NGA031
Horowhenua District Council	Ihakara Hall	25	IHA001
Horowhenua District Council	Kikopiri Marae	20	KIK001
Horowhenua District Council	Horowhenua, Webb	5	HOR008
Horowhenua District Council	Pescini Brothers	5	PES001
Manawatu District Council	Feilding	13,000	FEI001
Manawatu District Council	Ohakea	800	OHA002
Manawatu District Council	Sanson	492	SAN001
Manawatu District Council	Himatangi Beach	438	HIM001
Manawatu District Council	Halcombe-Stanway	430	HAL001
Manawatu District Council	Rongotea	300	RON002
Manawatu District Council	Kiwitea Rural	230	KIW003

Table D1: List of all supplies

Territorial Authority	Community name	Population served	Community code
Manawatu District Council	Waituna West	200	WAI022
Manawatu District Council	Newbury School	180	NEW003
Manawatu District Council	Colyton School	105	COL006
Manawatu District Council	Rongotea School	102	RON001
Manawatu District Council	Oroua Downs School	100	ORO003
Manawatu District Council	Mt Biggs Community	75	MTB001
Manawatu District Council	Te Rangimarie Marae	75	TER012
Manawatu District Council	Awahou School	70	AWA004
Manawatu District Council	Hiwinui School	70	HIW001
Manawatu District Council	Oroua No. 1	60	ORO001
Manawatu District Council	Glen Oroua School	52	GLE007
Manawatu District Council	Country Kindy	50	COU004
Manawatu District Council	Rangi Woods Camp	50	RAN019
Manawatu District Council	St Dominics Centre	50	STD001
Manawatu District Council	Bainesse School	47	BAI001
Manawatu District Council	Taonui School	46	TAO001

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Manawatu District Council	Kopane School	43	KOP001
Manawatu District Council	Highland Home Christian Camp	40	HIG001
Manawatu District Council	Feilding, Sec Garden Childcare	38	FEI002
Manawatu District Council	Poupatate Marae	30	POU006
Manawatu District Council	Rangiwahia School	30	RAN008
Manawatu District Council	Te Tikanga Marae	30	TET008
Manawatu District Council	Te Kawau Playcentre	27	TEK019
Manawatu District Council	Apiti School	26	API001
Manawatu District Council	Apiti Domain	25	API003
Manawatu District Council	Apiti Hall	25	API002
Manawatu District Council	Awahuri Hall	25	AWA011
Manawatu District Council	Beaconsfield Memorial Hall	25	BEA005
Manawatu District Council	Colyton Hall	25	COL010
Manawatu District Council	Glen Oroua Hall	25	GLE018
Manawatu District Council	Kauwhata Marae	25	KAU012
Manawatu District Council	Mt Lees Reserve	25	MTL002

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Manawatu District Council	Newbury Hall	25	NEW007
Manawatu District Council	Ohakea War Memorial Hall	25	OHA018
Manawatu District Council	Oroua Downs Hall	25	ORO009
Manawatu District Council	Pohangina Hall	25	POH004
Manawatu District Council	Pohangina School Reserve	25	POH005
Manawatu District Council	Rangiotu & Districts Hall	25	RAN026
Manawatu District Council	Rangiwahia Hall & Domain	25	RAN027
Manawatu District Council	Raumai Reserve	25	RAU011
Manawatu District Council	Tangimoana, McKelvie Hall	25	TAN015
Manawatu District Council	Totara Reserve Regional Park	25	TOT007
Manawatu District Council	Vinegar Hill	25	VIN002
Manawatu District Council	Tangimoana School	12	TAN002
Manawatu District Council	Rongotea, Wheeler	1	RON003
Palmerston North City Council	Palmerston North City	67,653	PAL001
Palmerston North City Council	Massey University	9,000	MAS001
Palmerston North City Council	Linton	4,500	LIN001

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Palmerston North City Council	Ashhurst	2,800	ASH001
Palmerston North City Council	Fonterra Research Centre	701	FON001
Palmerston North City Council	Bunnythorpe	450	BUN001
Palmerston North City Council	Whakarongo School	350	WHA021
Palmerston North City Council	Longburn Adventist College	300	LON002
Palmerston North City Council	Longburn	240	LON001
Palmerston North City Council	Kairanga School	180	KAI017
Palmerston North City Council	Longburn, Brandlines	150	LON006
Palmerston North City Council	Longburn, Fonterra	100	LON007
Palmerston North City Council	Aokautere School	90	AOK001
Palmerston North City Council	Palm Nth, Sec Garden Childcare	75	PAL005
Palmerston North City Council	Massey Uni. Sheep & Beef Farm	70	MAS003
Palmerston North City Council	Longburn, Mainland Meats	50	LON003
Palmerston North City Council	Linton School	40	LIN004
Palmerston North City Council	Kairanga Hall	25	KAI059
Palmerston North City Council	Icepak Logistics, Longburn	5	ICE001

Table D1: List of all supplies

Territorial Authority	Community name	Population served	Community code
Rangitikei District Council	Marton	3,750	MAR001
Rangitikei District Council	Taihape	2,200	TAI001
Rangitikei District Council	Bulls	1,800	BUL001
Rangitikei District Council	Ratana	450	RAT001
Rangitikei District Council	Huntermville	400	HUN001
Rangitikei District Council	Mangaweka	180	MAN001
Rangitikei District Council	South Makirikiri School	141	SOU004
Rangitikei District Council	Turakina School	70	TUR002
Rangitikei District Council	Mataroa School	68	MAT013
Rangitikei District Council	Moawhango	65	MOA005
Rangitikei District Council	Moawhango School	45	MOA004
Rangitikei District Council	Rangiwaia School	40	RAN010
Rangitikei District Council	Taoroa School	35	TAO002
Rangitikei District Council	Parewanui	25	PAR023
Rangitikei District Council	Whangaehu School	25	WHA025
Rangitikei District Council	Ngamatea School	15	NGA008

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Rangitikei District Council	Pukeokahu School	10	PUK010
Rangitikei District Council	Papanui Junction School	7	PAP010
Ruapehu District Council	Taumarunui	4,480	TAU003
Ruapehu District Council	Turoa Skifield	4,500	TUR003
Ruapehu District Council	Whakapapa Skifield	3,000	WHA058
Ruapehu District Council	Waiouru	2,800	WAI002
Ruapehu District Council	Ohakune	1,000	OHA001
Ruapehu District Council	Raetihi	1033	RAE001
Ruapehu District Council	National Park	180	NAT001
Ruapehu District Council	Owhango	170	OWH001
Ruapehu District Council	Whakapapa Village	200	WHA015
Ruapehu District Council	Ohura	130	OHU001
Ruapehu District Council	Karioi Pulp Mill	130	KAR013
Ruapehu District Council	Ngakonui School	120	NGA025
Ruapehu District Council	Piriaka	120	PIR001
Ruapehu District Council	Tangiwai Sawmill	120	TAN008

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Ruapehu District Council	Maniaiti Marae	90	MAN047
Ruapehu District Council	Kakahi	78	KAK002
Ruapehu District Council	Ngapuke School	70	NGA028
Ruapehu District Council	Mana - Ariki	50	MAN049
Ruapehu District Council	Raurimu	40	RAU001
Ruapehu District Council	Hia Kaitupeka Marae	37	HIA001
Ruapehu District Council	Matiere School	36	MAT036
Ruapehu District Council	Pipiriki, DOC Field Centre	25	PIP001
Ruapehu District Council	Takaputiraha Marae	25	TAK008
Ruapehu District Council	Ongarue School	20	ONG001
Ruapehu District Council	Orautoha School	13	ORA005
Ruapehu District Council	Kaitieke School	12	KAI037
Ruapehu District Council	Tokirima School	10	TOK011
Tararua District Council	Dannevirke	6,000	DAN001
Tararua District Council	Pahiatua	2,700	PAH001
Tararua District Council	Woodville	1,500	WOO001

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Tararua District Council	Eketahuna	456	EKE001
Tararua District Council	Kaitoki Marae	300	KAI049
Tararua District Council	Norsewood	200	NOR002
Tararua District Council	Pleckville	200	PLE002
Tararua District Council	Pongaroa	200	PON001
Tararua District Council	Ruahine School	180	RUA005
Tararua District Council	Kaitoki Shearing School	111	KAI050
Tararua District Council	Te Hika o Papauma Marae	111	TEH014
Tararua District Council	Fonterra Pahiatua	100	FON002
Tararua District Council	Weber School	65	WEB001
Tararua District Council	Mangamaire School	60	MAN018
Tararua District Council	Mangatainoka School	50	MAN016
Tararua District Council	Kumeroa-Hopelands School	46	KUM002
Tararua District Council	Kaitoki Kohanga Reo	35	KAI048
Tararua District Council	Norsewood, Country Kids ECE	35	NOR015
Tararua District Council	Ballance School	30	BAL002

Table D1: List of all supplies

Territorial Authority	Community name	Population served	Community code
Tararua District Council	Papatawa School	30	PAP003
Tararua District Council	Akitio	25	AKI001
Tararua District Council	Kaitoki Flats	25	KAI047
Tararua District Council	Tiraumea School	25	TIR005
Tararua District Council	Makuri School	16	MAK004
Tararua District Council	Norsewood Heritage	5	NOR016
Whanganui District Council	Whanganui	39,025	WAN001
Whanganui District Council	Kaitoke	650	KAI002
Whanganui District Council	Brunswick-Westmere	450	BRU001
Whanganui District Council	Fordell	350	FOR001
Whanganui District Council	Mowhanau Beach	300	MOW001
Whanganui District Council	Maxwell	200	MAX001
Whanganui District Council	Mosston School	150	MOS003
Whanganui District Council	Kaitoke School	110	KAI023
Whanganui District Council	Kaiwhaiki Pa	90	KAI001
Whanganui District Council	Raukawa Adventure Centre YMCA	80	RAU002

Table D1: List of all supplies			
Territorial Authority	Community name	Population served	Community code
Whanganui District Council	Matahiwi Marae	50	MAT047
Whanganui District Council	Ranana	50	RAN012
Whanganui District Council	Ranana, Whanganui Awa School	50	RAN011
Whanganui District Council	Okoia School	49	OKO001
Whanganui District Council	Green Pastures, Rapanui	40	GRE003
Whanganui District Council	Upokongaro School	40	UPO001
Whanganui District Council	Atene Marae Maori Reservation	30	ATE001
Whanganui District Council	Koriniti Kohanga Reo Marae	30	KOR004
Whanganui District Council	Aberfeldy School	26	ABE002
Whanganui District Council	Otumaire Camp	25	OTU003
Whanganui District Council	Patiarero Marae	25	PAT014
Whanganui District Council	Pungarehu Marae	25	PUN008
Whanganui District Council	Okoia	24	OKO002
Whanganui District Council	Mangamahu School	17	MAN019
Whanganui District Council	Jerusalem	15	JER001
Whanganui District Council	Kakatahi School	12	KAK003

Table D1: List of all supplies

Territorial Authority	Community name	Population served	Community code
Whanganui District Council	Scoutlands, Whanganui	6	SCO001
Whanganui District Council	Whanganui, Crystal Valley	5	WAN005
Whanganui District Council	Water 2U, Whanganui	5	WAT004



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