CENTRAL PLAINS

WATER

Central Plains Water Limited

Annual Ground and Surface Water Monitoring Report

2016/2017

Central Plains Water Limited

	Name	Position on Project	Signature	Date
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Ground and Surface Water Expert Review Panel Members for the 2016-17 Period

John Sunckell (Chairman), John Bright, Peter Callander, Kyle Nelson, Ned Norton, Matthew Smith

Table of Contents

List of Tables

List of Figures

1. Purpose

The purpose of this report is to present all monitoring data collected by Central Plains Water Limited (CPWL) between 1 July 2016 and 30 June 2017, and to provide an interpretation of background conditions and impacts arising from consented activities. This report is prepared to comply with condition 25(a) of Schedule 2: Administrative Conditions of Resource Consent CRC165080. The condition require that:

> *The consent holder shall prepare a report describing the results of the environmental monitoring outlined in the Ground and Surface Water Plan, for the period from 1 July to the following 30 June for each year.*

CPWL are required to measure a suite of parameters for river and stream water quality; lake water quality; and groundwater quality and quantity and report the results in this Ground and Surface Water Monitoring Report for the Period 1 July to the following 30 June each year. This report is required to include all the monitoring data and an interpretation of background conditions and impacts arising from the consented activities.

CPWL have developed a Ground and Surface Water Monitoring Plan (GSWP) (as required by Condition 18 of CRC165680), which is in two parts:

- Part I: includes an outline of CPWLs monitoring programme; and
- Part II: specifies (amongst other matters) trigger levels for monitored parameters.

The results from the monitoring programme are included in this report and are compared to applicable trigger levels.

2. Executive Summary

Alpine sourced CPWL irrigation water has been supplied to the Stage 1 area for two seasons.

The effects of this irrigation water on surface water and groundwater flows, levels and quality are being monitored at multiple locations within and downstream of the CPWL supply area.

A range of environmental trigger values are, or will be in future, used by CPWL to draw attention to changes in the state of water flows, levels and quality in the Selwyn Waihora catchment that *may* be attributed to the operation of the CPWL scheme.

After three dry years with little groundwater recharge in the Lowland Central Plains area, it is not surprising that groundwater levels in the lowland monitoring bores did not exceed their respective trigger levels. We will have to wait for further years of alpine water use and the associated reduction in groundwater abstraction, in order to be able to determine if groundwater levels are rising and flows in the lowland streams are recovering due to the influence of the Scheme.

Some stream and lake water quality triggers were exceeded but the results were found to be consistent with those from previous years (prior to the CPWL Scheme operating) so any elevated levels should not be attributed to operation of the CPWL Scheme.

E. coli were detected in four bores from within the operational Stage 1 area of the Scheme. Three of these bores reported concentrations of 1-2 MPN/100ml and one at 201MPN/100ml. Although elevated concentrations of nitrate were detected in some Stage 1 bores, they were found to be consistent with results or trends from previous years (prior to the CPWL Scheme operating) and therefore should not be attributed to effects of the CPWL Scheme.

In general the monitoring results obtained during the last two years (when Stage 1 was operating) are not sufficient to enable any positive or negative effects of the Scheme on water quality to be explained. This is particularly the case when CPWL monitoring results are compared against existing elevated, or increasing contaminant level trends, caused by historic land uses and practices whose effects are time-lagged. Additional years of water quality monitoring will be necessary, together with on-going assessment of CPWL facilitated, and other, land use change patterns in the catchment, to determine whether any significant change to existing elevated nitrate concentrations or increasing trends, can be attributable to CPWL, previous land use changes and/or to improving practices through time.

With CPWL irrigation expected to commence in Sheffield in 2017 and Stage 2 in 2018, further monitoring of the effects of the scheme will take place and future Ground and Surface Water Monitoring Reports will be able to present this information.

CPWL did not receive any complaints during 2016-17 concerning adverse environmental effects of the Scheme on groundwater or surface water, including more specifically, impacts on land drainage, or on-site wastewater systems.

3. Background

The CPWL Irrigation Scheme (the Scheme) is located in the Selwyn Waihora Zone, within the Selwyn District (Figure 1).

The Scheme is being developed in a staged manner. Once completed the Scheme will provide water to up to 60,000ha situated between the Rakaia and Waimakariri Rivers, the Foothills and State Highway 1.

The 23,000ha Stage 1 section of the Scheme was constructed during early 2014 – mid 2015, with first irrigation water supplied on 1 September 2015. Stage 2 and Sheffield areas are currently under construction. Stage 2 will provide irrigation to 20,000ha and Sheffield around 4,300ha with first irrigation water forecast for September 2018 for Stage 2 and October 2017 for Sheffield (see Figure 2).

The limit/target for nitrogen losses in Selwyn Waihora is 5,044.4 tonnes/year by 2037 (Table 11(i) of the Canterbury Land and Water Regional Plan (CLWRP)). A total of 358 tonnes/year (7% of the total) has been allocated to CPWL to allow for the conversion of dryland into irrigated land. This allocation is in addition to the assessed dryland nitrogen baseline of 621 tonnes (giving a total of 979 tonnes, as specified in Table 11(j) of the CLWRP).

The regulatory environment planning framework has changed since CPWL's original Take and Use Water permit was granted in 2010.

The Selwyn Waihora Zone Implementation Plan (ZIP, and ZIP Addendum) was developed by the Selwyn Waihora Zone Committee as a result of a two-year collaborative process, which commenced in December 2011. The ZIP identified a number of priority outcomes sought for the Zone which is considered to be over-allocated in terms of consented groundwater takes and nitrogen contamination in groundwater.

Variation 1 to the Land and Water Plan was therefore developed based on the recommendations in the Selwyn Waihora ZIP.

The original Central Plains Water Trust (CPWT) consent decision recognised the trade-off between benefits associated with increased baseflows in the lowland streams resulting from operation of the Scheme with the potential negative effects on land drainage and wastewater infrastructure in the lowland Central Plains area due to groundwater mounding.

While Variation 1 to the Land and Water Regional Plan (LWRP) has provided explicit recognition of the positive benefits associated with increased baseflows in lowland streams, it does not provide equivalent guidance in terms of thresholds for adverse effects on land drainage and wastewater infrastructure. It remained the task of CPWL to operate in accordance with the consent conditions to ensure appropriate management of environmental effects resulting from operation of the Scheme.

For a detailed summary of the background to CPWL and the Schemes' water use and nitrogen discharge consents please refer to Appendix 6.2: Central Plains Water Limited Annual Compliance Report 2015/2016 Irrigation Season; Section 4.

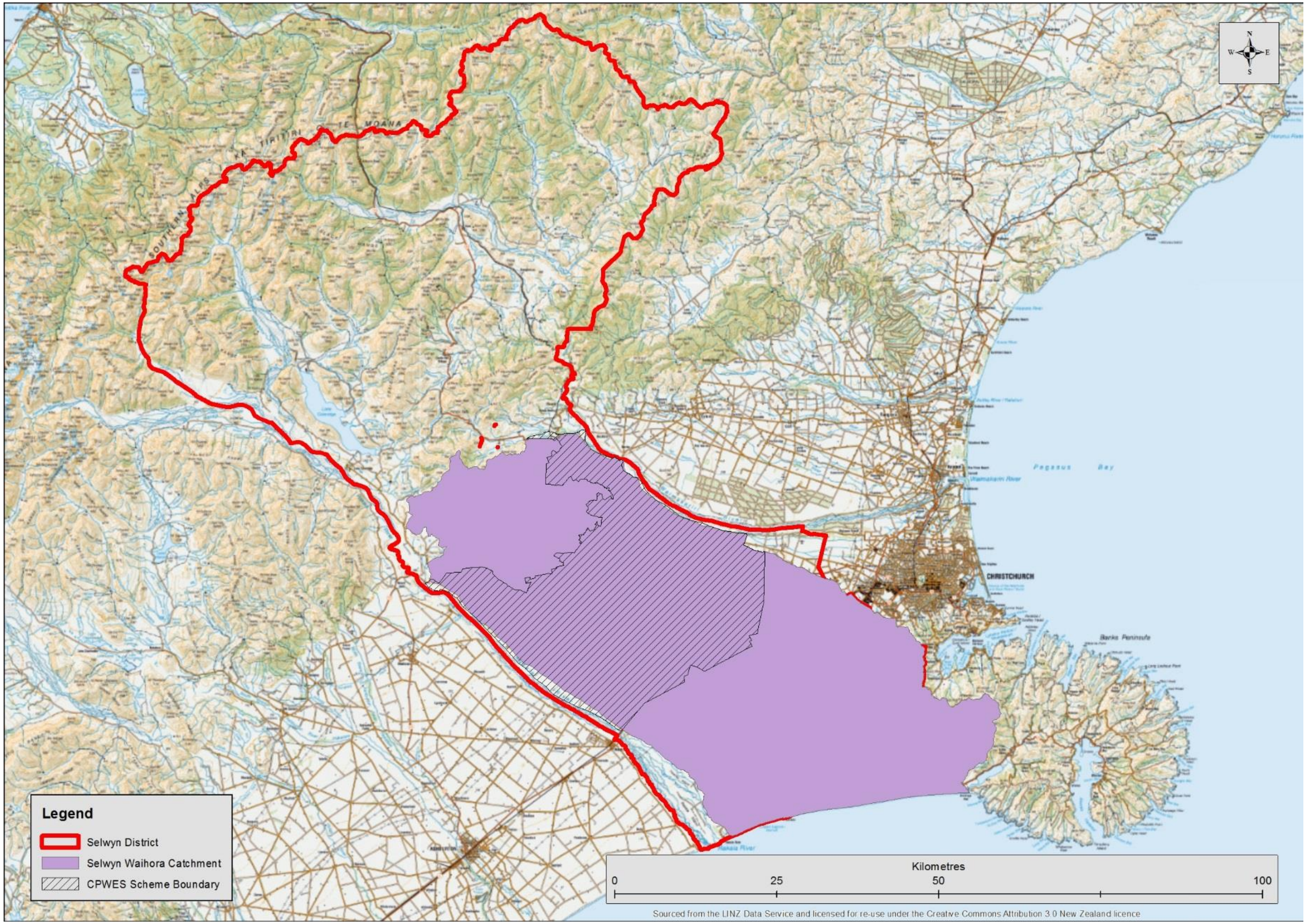


Figure 1. CPWL Scheme with the Selwyn Waihora Catchment

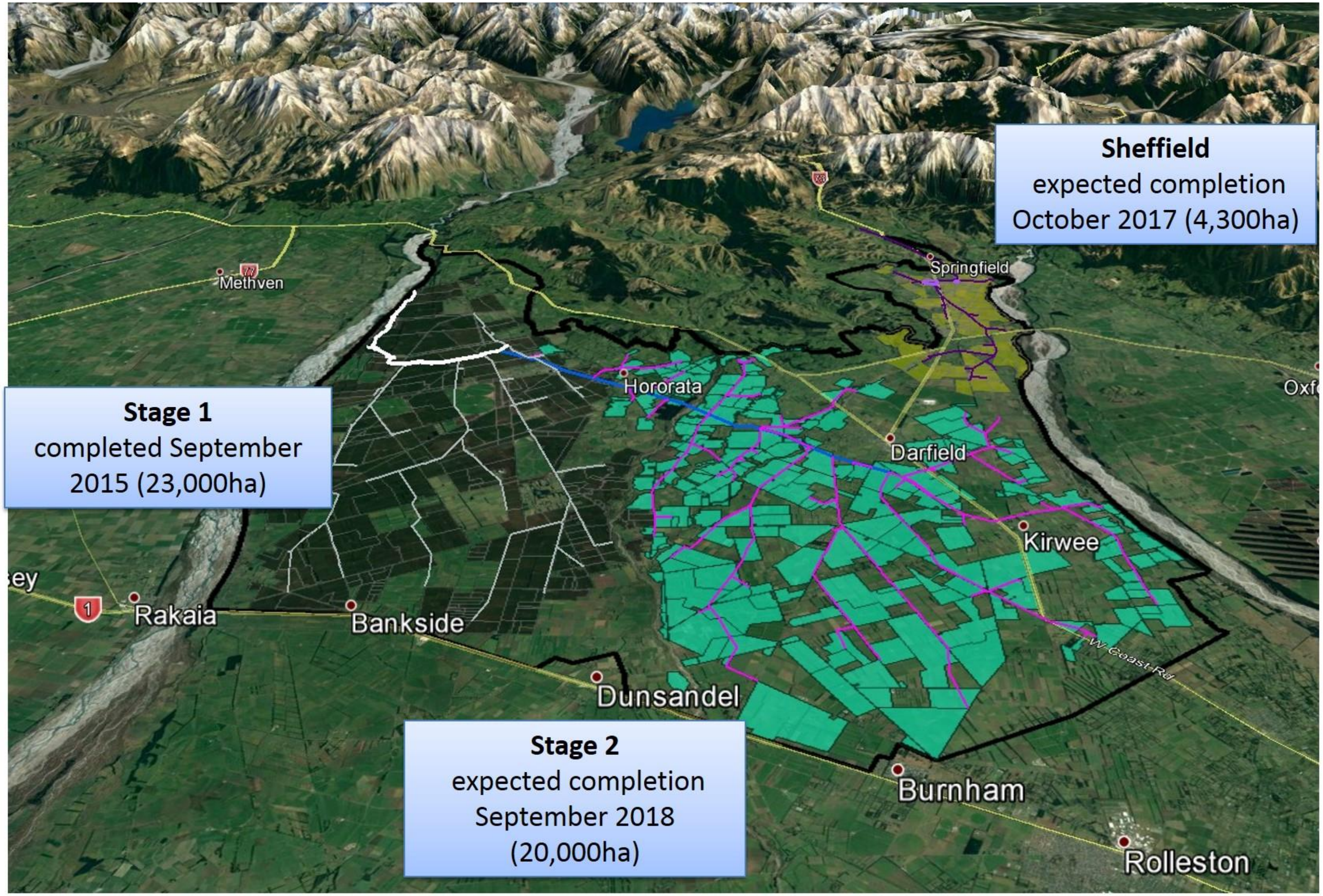


Figure 2. Scheme Overview showing Operational and Planned Stages

Water Use

During the 2016-17 irrigation season, Stage 1 farms introduced 66,395,044m^3 (2015-16 = 91,092,984m^3) of alpine water into the catchment and abstracted 15,228,020m^3 (2015-16 = 20,825,642m^3) of groundwater. The 2016-17 season was much wetter than 2015-16 and subsequently there was a 27% reduction in the amount of CPWL and Groundwater used compared to the previous irrigation year.

On average, Stage 1 farmers used 4,044$m^3$of water per hectare (2015-16 = 5,172m^3). The 4,044m^3 of water per hectare comprised 1,245m^3 of groundwater and 2,798m^3 of CPW water. Please refer to Appendix 6.2: CPWL Annual Compliance Report 2016/2017 Irrigation Season (Section 6(b) for further details on the use of CPWL Scheme water for irrigation.

3.1. Scope of Water Monitoring Programme

River and Stream Water Quality

CPWL is required to monitor on a monthly basis surface water quality at 29 river and stream sites (see Figure 3). Full details of CPWL's surface water monitoring programme is contained in Part 1 of CPWL's Ground and Surface Water Monitoring Plan (available at http://www.cpwl.co.nz/environmental-management/ground-surface-water-monitoring-programme).

CRC165680 authorises CPWL to rely on data collected on Te Waihora/Lake Ellesmere, lowland streams, other rivers/streams or drains and the stockwater network by the Canterbury Regional Council or any other entity in lieu of establishing new monitoring sites. Instances where CPWL rely on data from ECan will be noted in this report.

Parameters to be analysed are: *Escherichia coli* (*E. coli)*, Turbidity, Nitrate + Nitrate-Nitrogen, Total Nitrogen, Total Ammoniacal Nitrogen, Dissolved Reactive Phosphorus, Total Phosphorus, Electrical Conductivity, Dissolved Oxygen, pH and temperature. CPWL has water quality triggers in place for Nitrate-Nitrogen (Annual Medians and Annual 95th Percentiles).

Commencement of the Surface Water Monitoring programme began alongside operation of Stage 1 of the Scheme in September 2015.

Lake Water Quality

This report contains water quality data from ECan's monitoring of Te Waihora from July 2016 to June 2017. Water samples are analysed for a wide range of parameters but only those required by the Ground and Surface Water Plan (as per those listed under 'River and Stream Water Quality' above and Trophic Level Index (TLI_3) and Chlorophyll *a*) are included in this report. Figure 3 shows the five locations sampled by ECan. CPWL has water quality triggers in place for Trophic Level Index (TLI_3), Total Phosphorus, Total Nitrogen and Chlorophyll *a*.

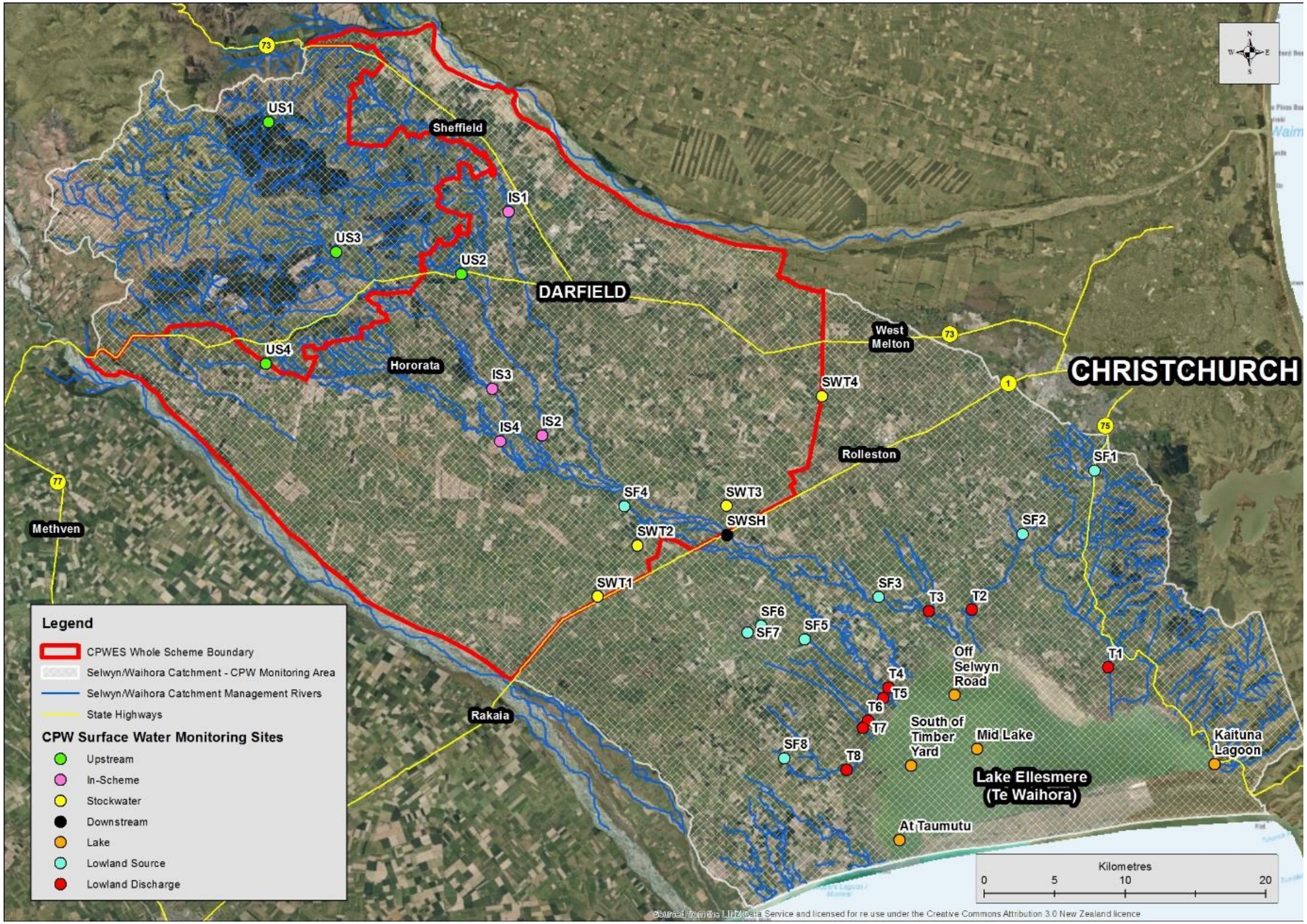


Figure 3. Surface Water Monitoring Sites

Ground Water Quality and Levels

Twenty monitoring bores have been installed by CPWL throughout the Scheme area (refer to Figure 4). Eight bores are located within Stage 1, ten in Stage 2 and two in the Sheffield area.

CRC165680 required two years of ground water monitoring data to be collected prior to the use of water. By 1 September 2015, CPWL had completed seven rounds of quarterly monitoring of our Stage 1 dedicated long-screen bores (Refer to Figure 5 for a comparison of a water supply bore to a dedicated long-screen monitoring bore). Long-screen monitoring bores enable samples to be taken from close to the groundwater's static water level (SWL). This contrasts with typical Canterbury water supply bores that can have relatively short (~2m long) screens located close to the bottom of the bore. Water samples taken from typical Canterbury water supply bores may be abstracted from some distance below the SWL. This difference is important because some groundwater contaminants, in particular nitrate, are typically most concentrated at the SWL and become decreasingly concentrated with depth, rather like cream in a bottle of milk. This means that samples taken from near to the SWL are more likely to accurately reflect nitrate concentrations affected by land surface recharge than samples collected from a bore screened 20m below the SWL. This difference is illustrated in Figure 5.

In order to have two years of monitoring data before the commencement of Stage 1 irrigation, the Stage 1 dedicated monitoring bores were located adjacent to existing water supply bores that had been monitored for at least two years prior to CPWL's first irrigation season. The water supply and long-screen bores were monitored concurrently for two years to establish a relationship between the two forms of monitoring that may be useful when comparing future results to the historic record.

The dedicated long-screen monitoring bores were installed in the Stage 2 area of the Scheme in the first half of 2015. These bores will have been monitored for three and a half years prior to the commencement of Stage 2 irrigation in 2018. At the time of writing nine monitoring rounds had been completed.

Full details of the Groundwater Monitoring Programme are contained in Part 1 of CPWL's Ground and Surface Water Monitoring Plan (available at http://www.cpwl.co.nz/environmental-management/ground-surface-water-monitoring-programme).

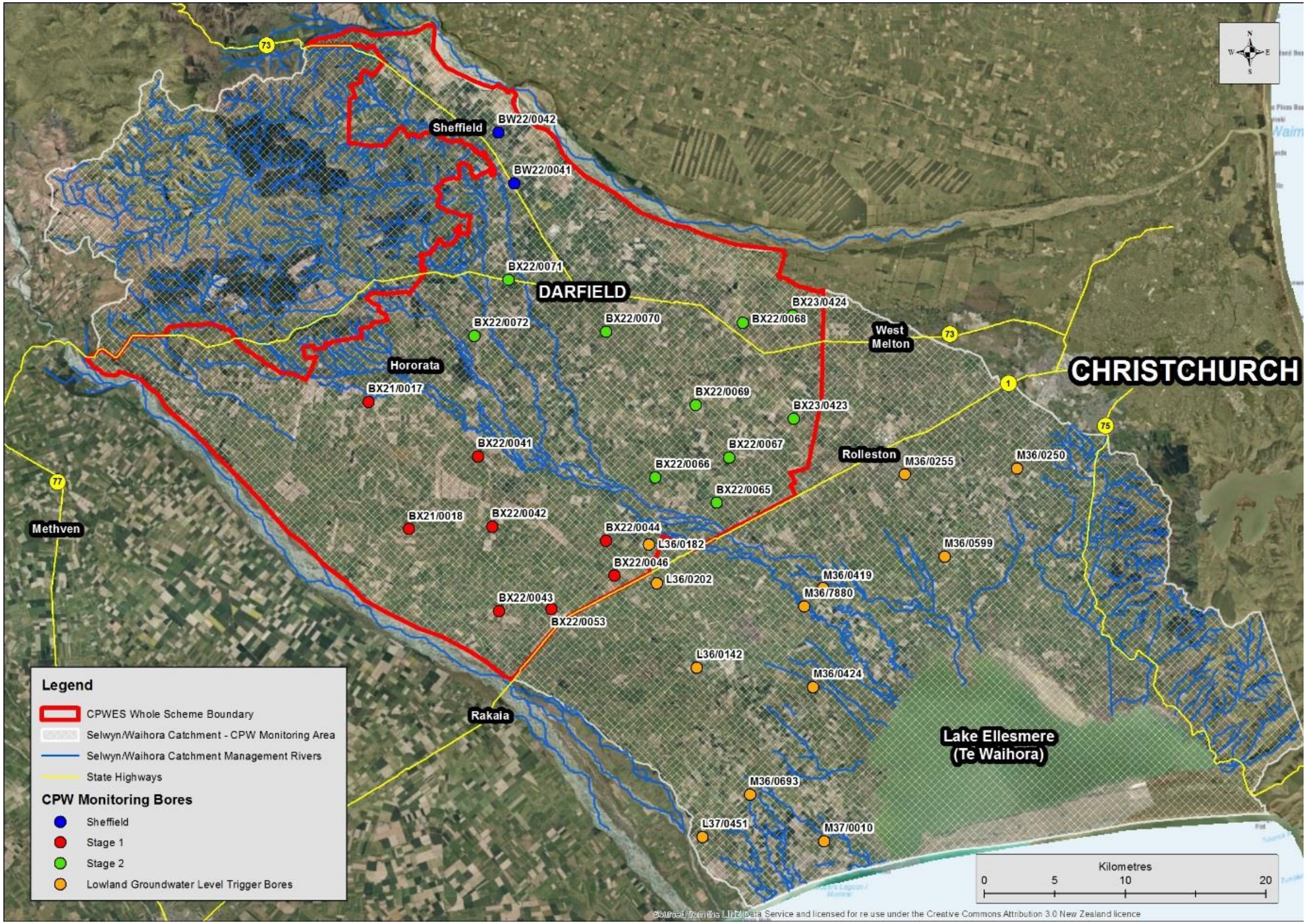


Figure 4. CPWL Groundwater Quality and Lowland Water Level Monitoring Sites

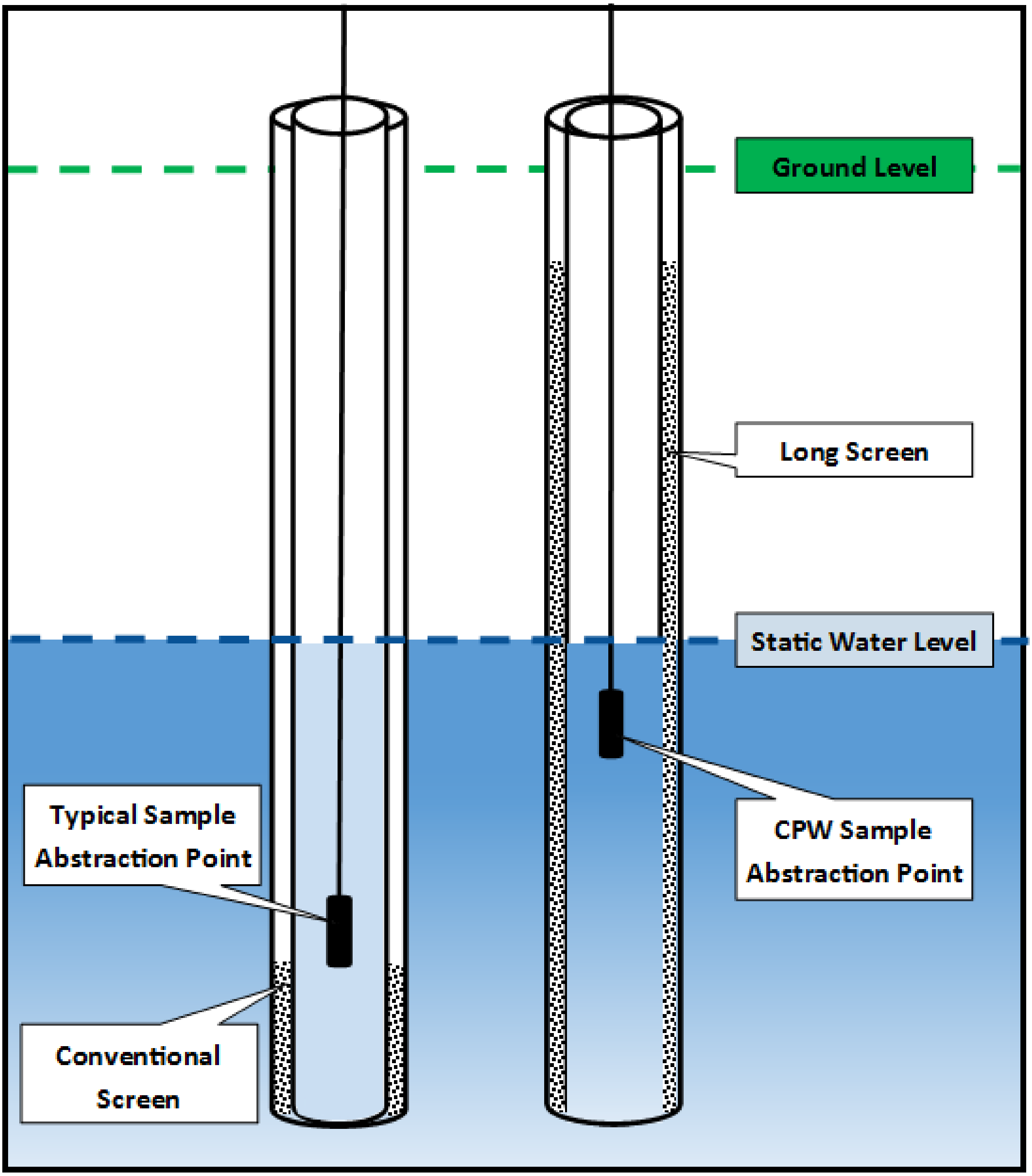


Figure 5. Comparison of a typical Canterbury Water Supply Bore to a dedicated CPWL long-screen Monitoring Bore

Groundwater Level Trigger Levels

CPWL does not carry out any specific groundwater monitoring in the Lowland Central Plains area but instead utilises data collected by Environment Canterbury (ECan). ECan operate an extensive groundwater level monitoring network in the Lowland Central Plains. GSWERP has established groundwater level trigger limits for a series of 12 bores within the ECan network (orange circles in Figure 4). The trigger limits will be used to provide advance warning of potential groundwater mounding. In order to provide sufficient warning of possible groundwater mounding the trigger limits are relatively conservative in that they have been set at a level which has been reached in the past. This may result in occasions where the triggers are reached following for example, high intensity rainfall events that lead to elevated groundwater levels, or for other reasons that are outside of CPWL's control.

Groundwater Quality Trigger Levels

With the exception of Nitrate in groundwater, CPWL's trigger levels are assessed against monthly or annual data.

Trigger levels for Nitrate in groundwater are based on five-year annual averages. This means a comparison of monitoring results to the groundwater Nitrate trigger from five years' of CPWL activities cannot be made until September 2020 for Stage 1, 2022 for Sheffield and 2023 for Stage 2. It will still be useful however, to evaluate the results obtained prior to 2020-23 to see if any developing trends can be identified.

Until a sufficient amount of data has been collected to report against five-year annual averages, CPWL will highlight in the results section instances where new maximum Nitrate-N concentrations are detected and where Nitrate values exceed 7.65mg/L[1] for the Stage 1 area.

It is worth noting that there is a recognised lag effect in the transport of nitrogen in the groundwater system. Therefore elevated and/or increasing Nitrate readings may continue to be measured in deep groundwater, lowland streams and Te Waihora for a period of time, from pre-scheme land use, irrespective of improving farm practices that would be expected to result in lower discharges of nutrients into the environment. Consequently in deep groundwater, lowland streams and Te Waihora it may take many years to detect changes in nitrate concentrations resulting from changed land use under CPWL, if this occurs.

Approximately half (45%) of the water samples taken from long-screen bores prior to the commencement of CPWL irrigation (Stage 1) or to date (Stage 2 and Sheffield), had Nitrate concentrations of more than 7.65mg/L.

Groundwater samples are analysed for pH, Electrical Conductivity, Dissolved Oxygen, Temperature, Alkalinity, Bromide, Chloride, Dissolved Reactive Phosphorus, Nitrate-Nitrogen, Total Nitrogen, Sulphate and *E. coli.* The static groundwater level is also measured at the time of sampling. CPWL has water quality triggers in place for Nitrate Nitrogen and *E. coli*.

Appendix 6.1 contains all trigger limits and trigger response processes from Part II of the Ground and Surface Water Plan.

[1] 7.65mg/L is the trigger level for Nitrate-N based on a five-year annual average concentration.

3.2. 2016/2017 Seasonal Climatic Influence

Rainfall

During the period 1 July 2016 to 30 June 2017, 828mm of rainfall was recorded at NIWA's weather station 4702 located approximately 4km west of Hororata. This was very close to 12-month average from the 1 July 1981 to 30 June 2017 period being 841mm (refer to Figure 6).

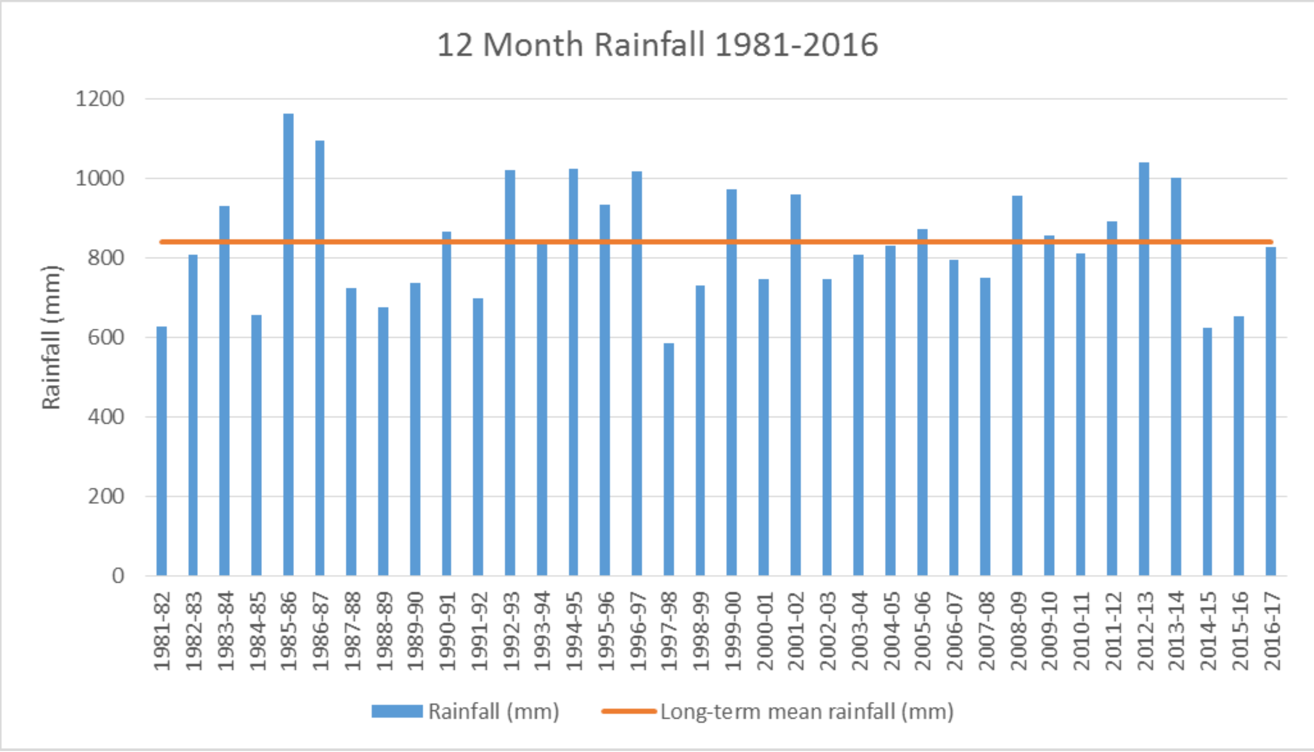


Figure 6. Rainfall record at NIWA's Weather Station 4702, Hororata
Source NIWA Clifo Database.

Rainfall and Soil Moisture Deficit data generated from NIWA's weather station (4702) for the 2015-16 and 2016-17 periods are shown in Figure 7 below. The soil at weather station 4072 site could be classified as being severely dry for 25 days and extremely dry for 17 days during 1 July 2016 to 30 June 2017. This compared with a classification of severely dry for 76 days and extremely dry for 8 days during the period 1 July 2015 to 30 June 2016.

CPWL's 2016-17 irrigation season ended on 18 April. This was 23 days earlier than the 11 May conclusion to the 2015-16 irrigation season. A reason for the shorter 2016-17 is clearly evident in Figure 7; 197.9mm of rain fell during the period 7 March to 12 April 2017. This completely removed the soil moisture deficit at the site of weather station (4702). Figure 7 also shows that a soil moisture deficit remained in place throughout the entirety of 2016 (which was one of only three periods since 1982 that a soil moisture deficit remained in place throughout an entire calendar year).

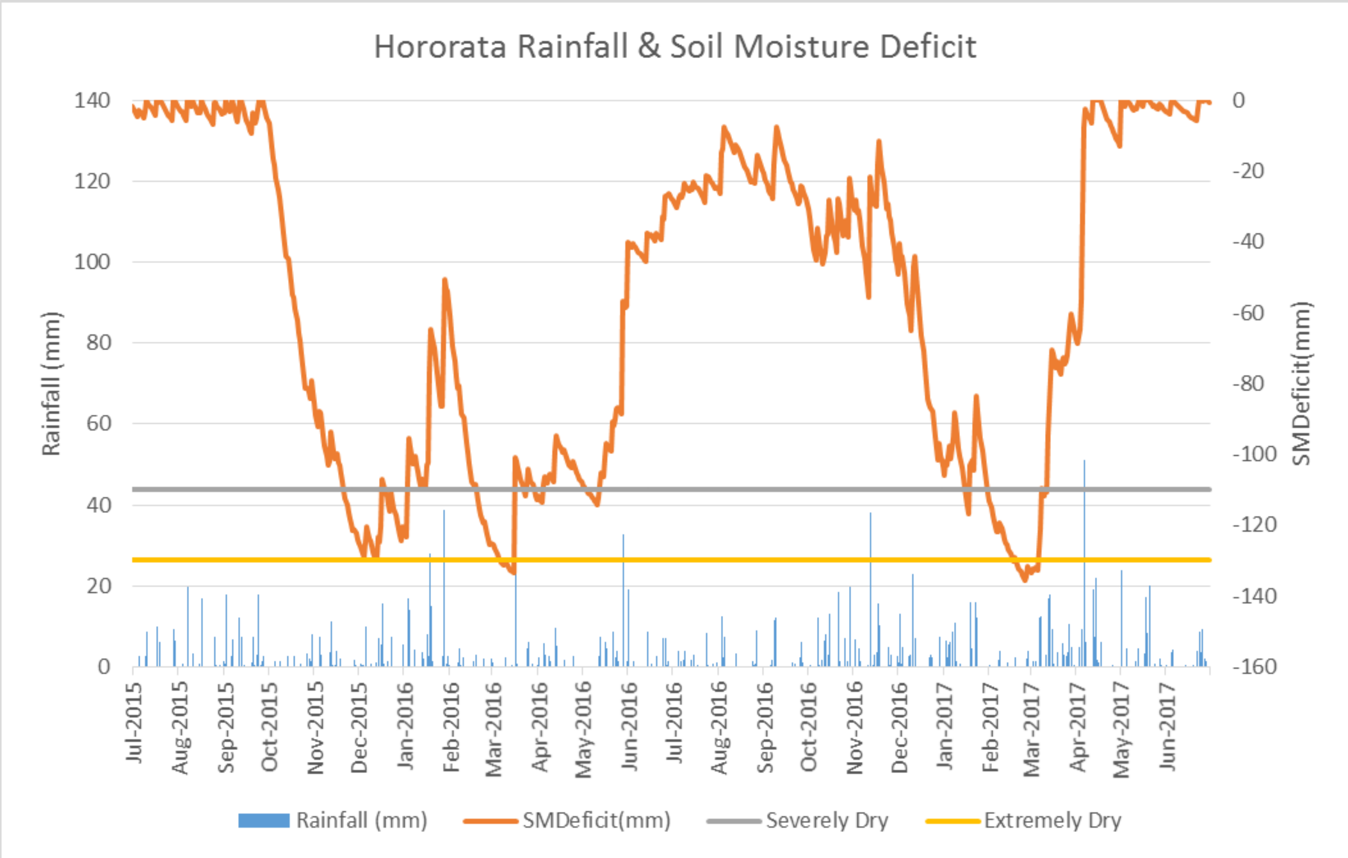


Figure 7. Rainfall and Soil Moisture Deficit Measured at NIWA's Monitoring Station in Hororata
Source NIWA Clifo Database.

4. Results & Interpretation

All monitoring data is listed, as required by CRC165680, in Appendices 6.3-6.6. The entire record of results from the Stage 1 long-screen groundwater quality monitoring bores has also been included as several references are made to pre-September 2015 results.

4.1. River and Stream Water Quality

CPWL has annual median, and annual 95th percentile, trigger limits for Nitrate-N. CPWL has surface water samples analysed for Nitrate + Nitrite-N. Like ECan and the majority of Regional Councils in New Zealand, CPWL monitors oxidised nitrogen as Nitrite-Nitrate-Nitrogen. Nitrite is not directly measured because of its transient nature and the very low concentrations that are present in Canterbury Rivers. When discussing surface (including lake) water quality monitoring results in this report, Nitrate + Nitrite-Nitrogen will be referred to as either Nitrate-N or simply Nitrate.

CPWL River and Stream quality trigger levels are shown in Table 1 and the monitoring results are shown in Table 2 (NB: values depicted in red indicate trigger level exceedances. The number of samples collected, as reported in Table 2, is a reflection of flows in those waterways; samples can only be collected if the waterway is flowing. For example, the Selwyn River at SH1 was only flowing once throughout the monitoring period.

Table 1. Surface Water Quality Triggers for Nitrate in mg/L

River Type	CPWL Surface Water Monitoring	
	Annual Median	Annual 95th Percentile
Hill-fed Lower	1.8	2.6
Spring-fed Plains	5.2	7.4

Table 2. Surface Water Quality Nitrate-N Annual Medians and 95th Percentiles

Site	Site ID	Nitrate Annual Median (mg/L)	Nitrate Annual 95th percentile (mg/L)	No. of samples
Hill-Fed Lower Sites				
Hawkins River In-scheme	IS1	1.8	2.4	9
Waianiwaniwa River In-scheme	IS2	4.4	4.4	1
Selwyn River In-scheme	IS3	0.7	0.7	3
Hororata River In-scheme	IS4	1.0	1.5	12
Selwyn River @ SH1	SWSH	1.1	1.1	1
Hawkins River Upstream	US1	0.5	1.1	12
Waianiwaniwa River Upstream	US2	0.5	1.3	9
Selwyn River Upstream	US3	0.2	0.3	12
Hororata River Upstream	US4	0.7	1.4	12
Spring-Fed Plains Sites				
Halswell River Source	SF1	3.3	3.8	12
LII Stream Source	SF2	4.2	4.6	12
Selwyn River Spring Source	SF3	7.5	8.5	11
Irwell River Source	SF4	1.8	3.4	4
Hanmer Road Drain Source	SF5	7.8	7.8	1
Boggy Creek Source	SF6	8.3	12.2	5
Doyleston Drain Source	SF7	n/a	n/a	0
Harts Creek Source	SF8	8.7	8.8	6
Halswell River Downstream	T1	2.5	3.0	12
LII Stream Downstream	T2	2.9	3.3	12
Selwyn River Downstream	T3	6.1	7.5	12
Irwell River Downstream	T4	<0.01	4.8	4
Hanmer Road Drain Downstream	T5	<0.01	3.6	9
Boggy Creek Downstream	T6	3.8	8.5	16
Doyleston Drain Downstream	T7	0.4	3.2	16
Harts Creek Downstream	T8	7.0	7.3	12

Both the annual median, and annual 95th percentile, trigger limits were exceeded at six monitoring sites, two sites met or exceeded the annual median trigger level only and one site exceeded the 95th percentile only. Figure 8 spatially depicts which sites experienced trigger level exceedances.

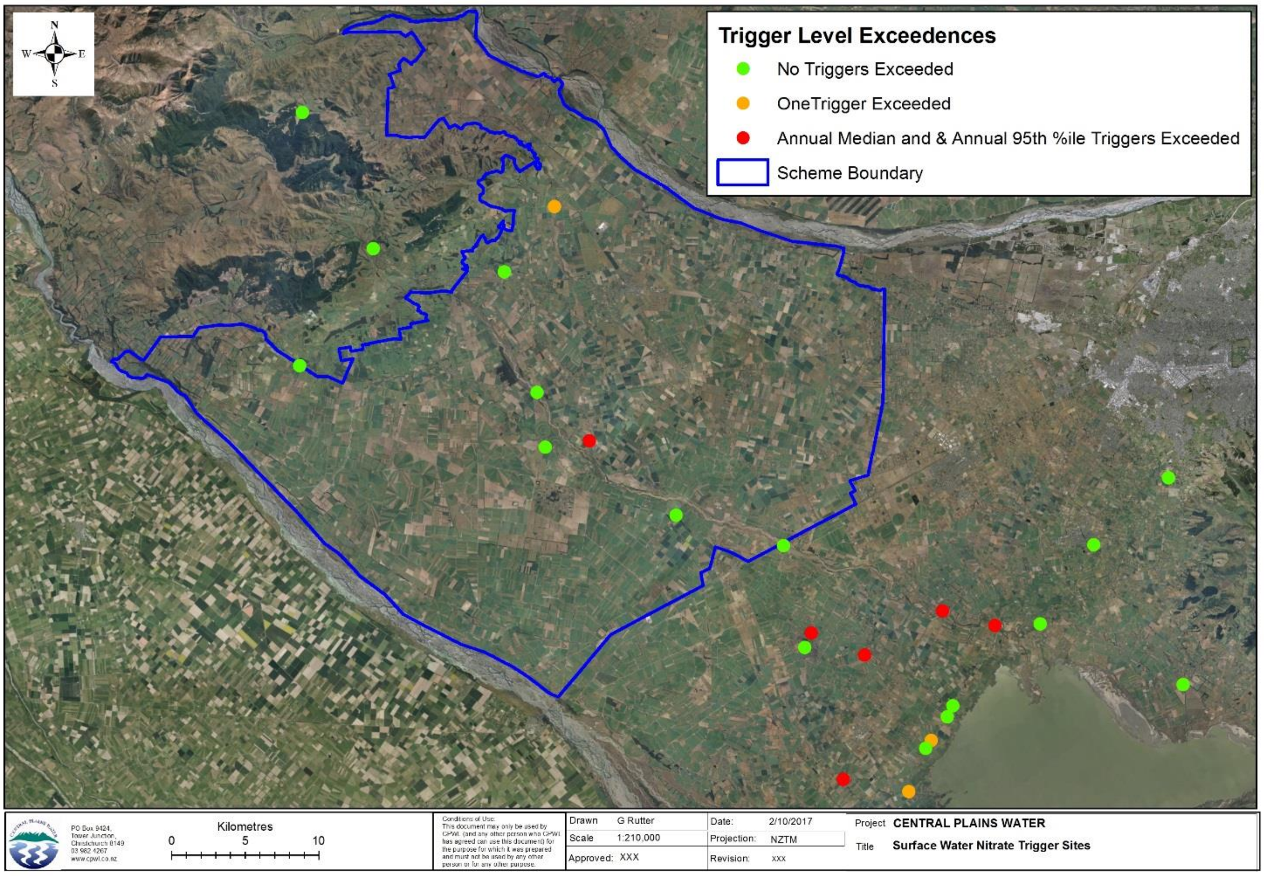


Figure 8. Surface Water Nitrate Trigger Level Exceedances

The trigger exceedances were from six waterways, the Hawkins River, Waianiwaniwa River, Selwyn River, Hanmer Road Drain, Boggy Creek and Harts Creek. Results presented in Part II of CPWL Ground and Surface Water Monitoring Plan also highlighted elevated nitrate readings from sites in the Hawkins River, Selwyn River, Boggy Creek and Harts Creek that would have exceeded CPWL's trigger limits when based on 2014 and/or 2010-15 data.

Hawkins River at the Deans Road location monitored by ECan had a lower annual median (1.65mg/L vs 1.8mg/L) but a higher annual 95th percentile (2.55mg/L vs 2.4mg/L) nitrate concentration compared to CPWL's Hawkins River instream site (located 3.5km downstream) during 2016-17 (see Figure 9).

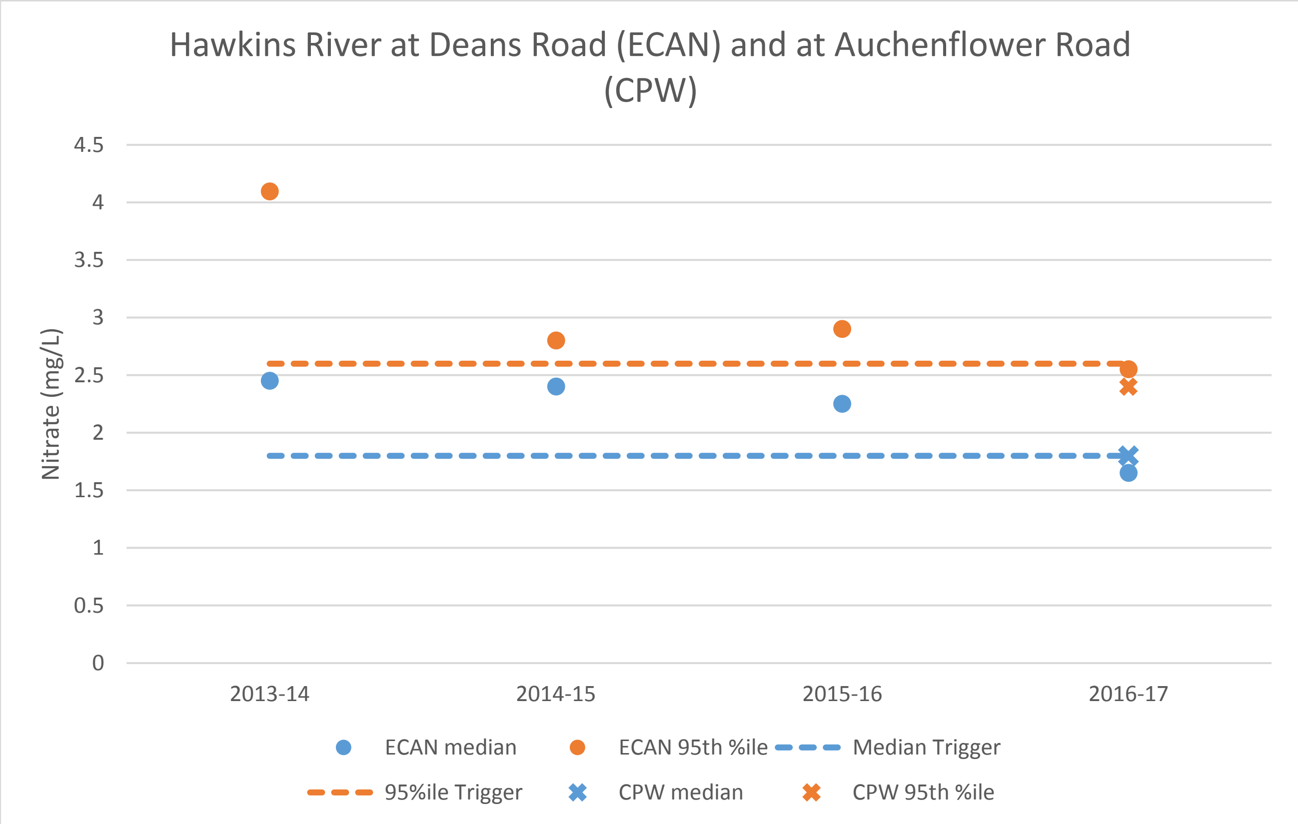


Figure 9. Hawkins River at Deans Road – Nitrate concentrations 2013-14 to 2015-16

Harts Creek Downstream site had equal or higher nitrate results in 2013-14 and 2014-15 compared to the results for 2016-17 (refer to Figure 10).

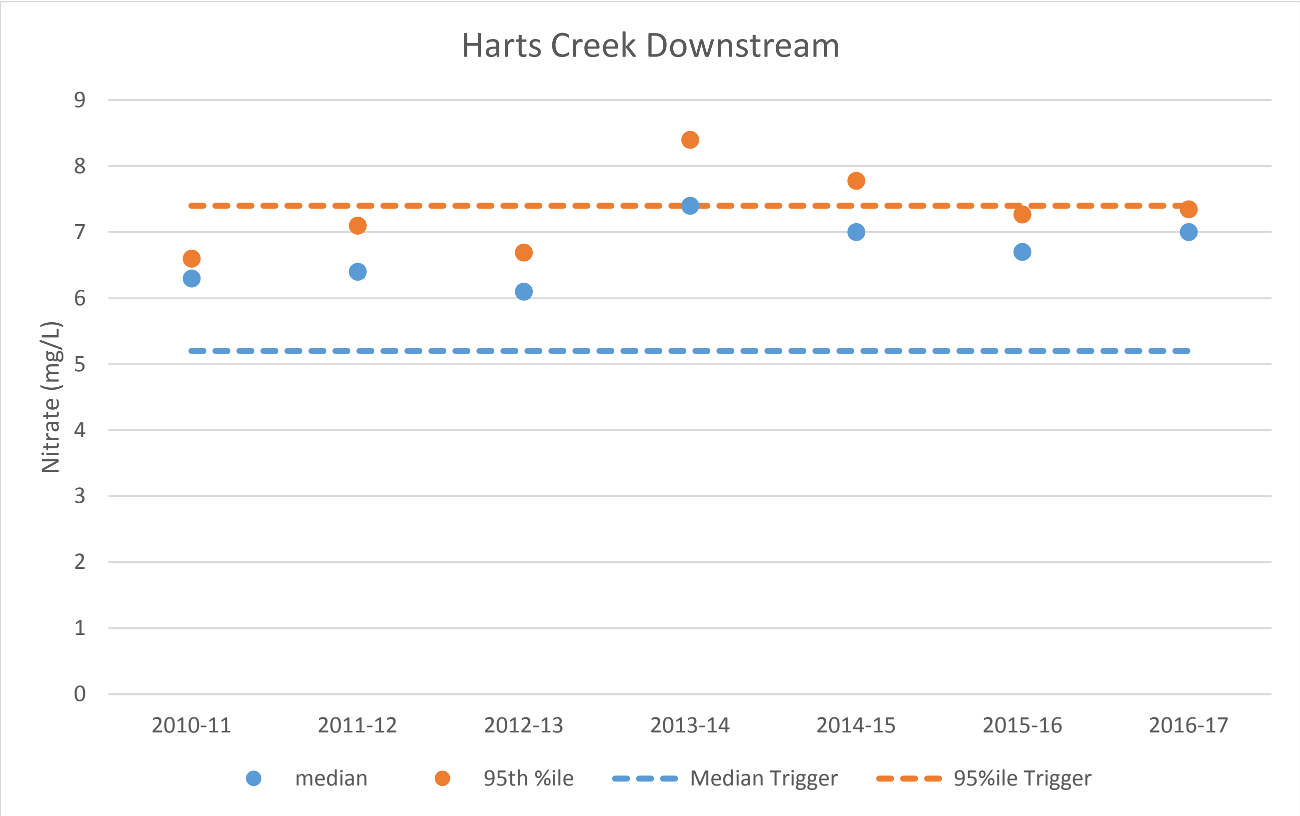


Figure 10. Harts Creek Downstream location – Nitrate concentrations 2010-11 to 2016-17

The annual median Nitrate concentration in Selwyn River at Coes Ford for 2016-17 was lower than 2014-15 and 2015-16 results (see Figure 11). However, the 95th percentile, at 7.5mg/L was the highest level since an annual monitoring regime began in 1992-93 and has been showing a generally increasing trend over this period (see Figure 12).

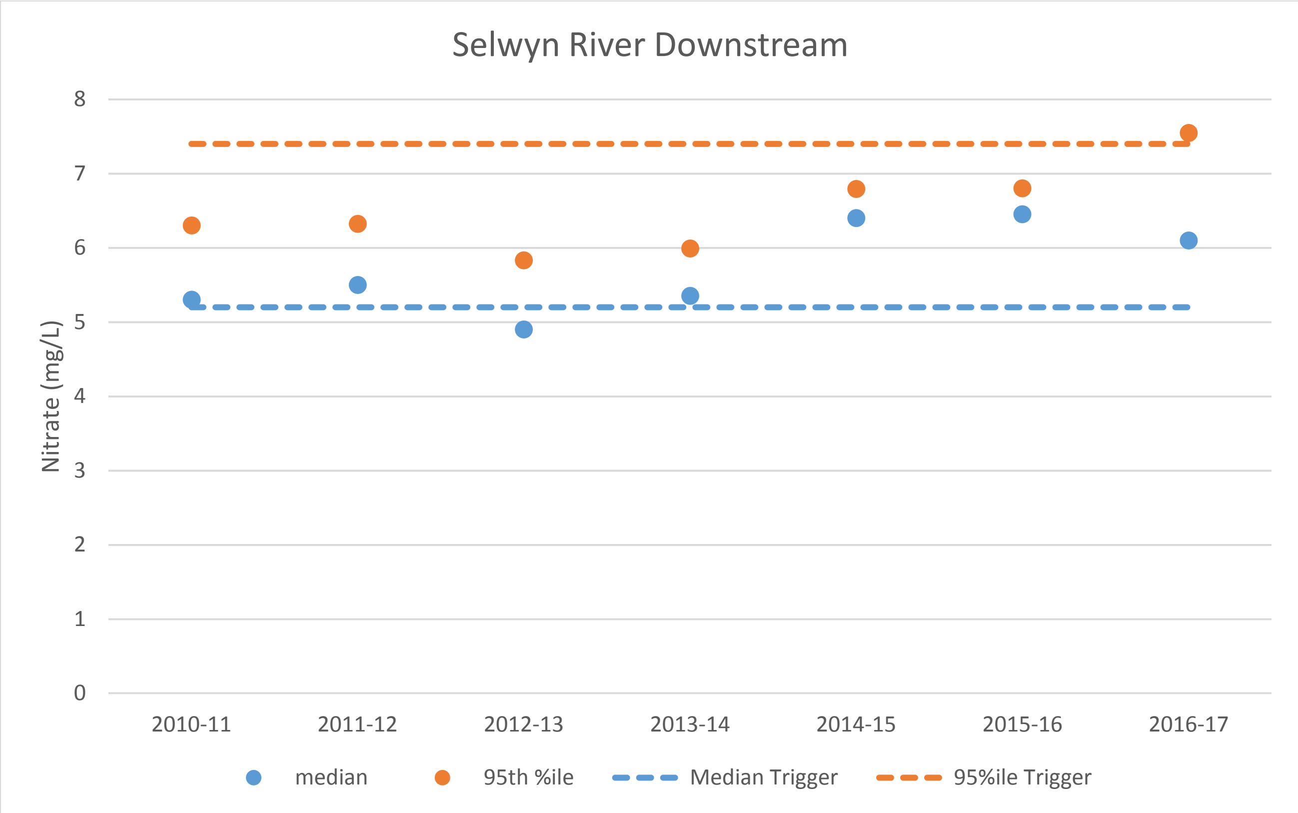


Figure 11. Selwyn River Downstream location – Nitrate concentrations 2010-11 to 2016-17

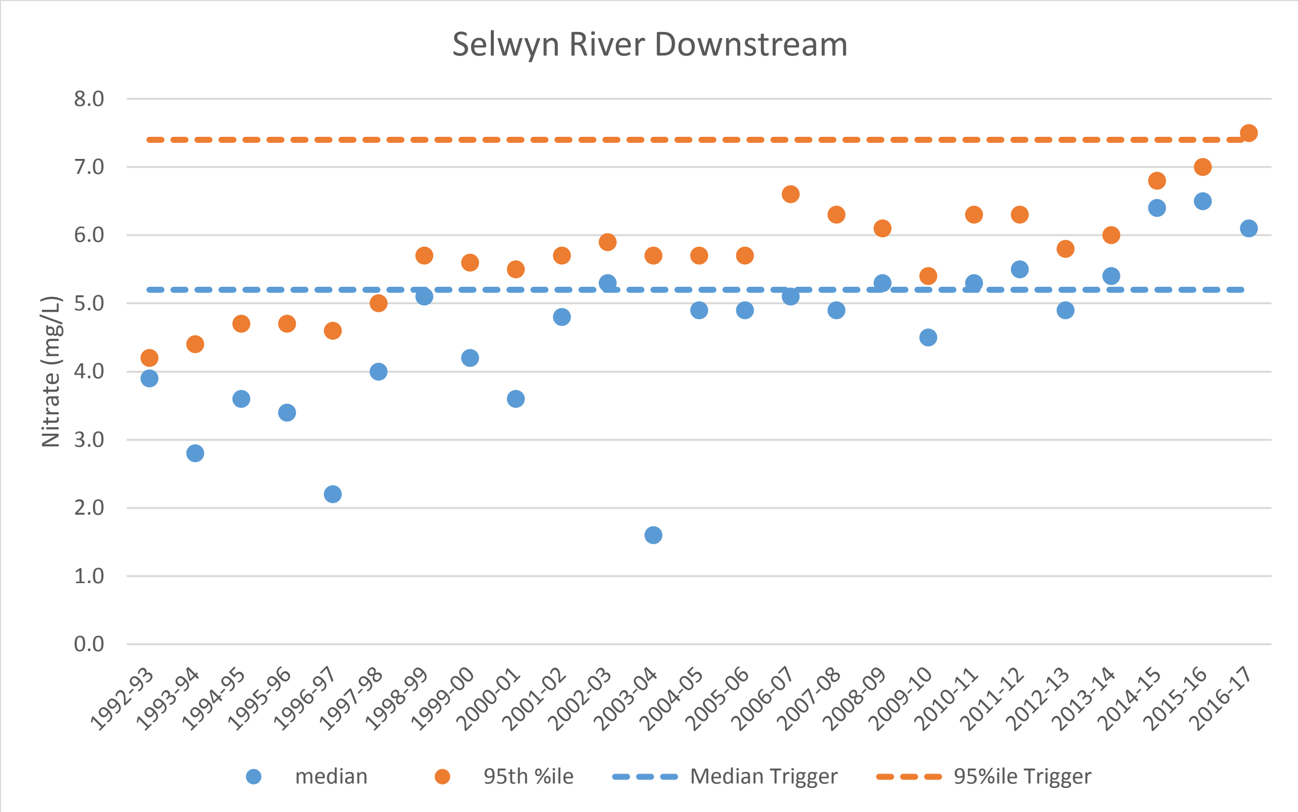


Figure 12. Selwyn River Downstream location – Nitrate concentrations 1992-93 to 2016-17

The Boggy Creek Discharge site's 95th percentile Nitrate concentration for 2016-17 was 8.53mg/L, which although elevated compared to the last few years, was still less than concentrations from 2006-07 (9.85mg/L) and 2008-09 (10.0mg/L) (see Figure 13). Annual median and 95th percentile Nitrate concentrations at the Boggy Creek 'source' site were 8.3mg/L and 12.2mg/L respectively (N=5). This compares to values of 6.4mg/L (median) and 8.5mg/L (95th percentile) for the 2015-16 period. There is a strong relationship (R^2 =0.95) from 2016-17 results at the Boggy Creek Discharge site, between flow and nitrate, with higher nitrate levels corresponding with higher flows. Thus, the stream flows occurring at the time of individual water samplings can have a large effect on the annual median and 95th percentiles. This should be considered when comparing results from different monitoring seasons.

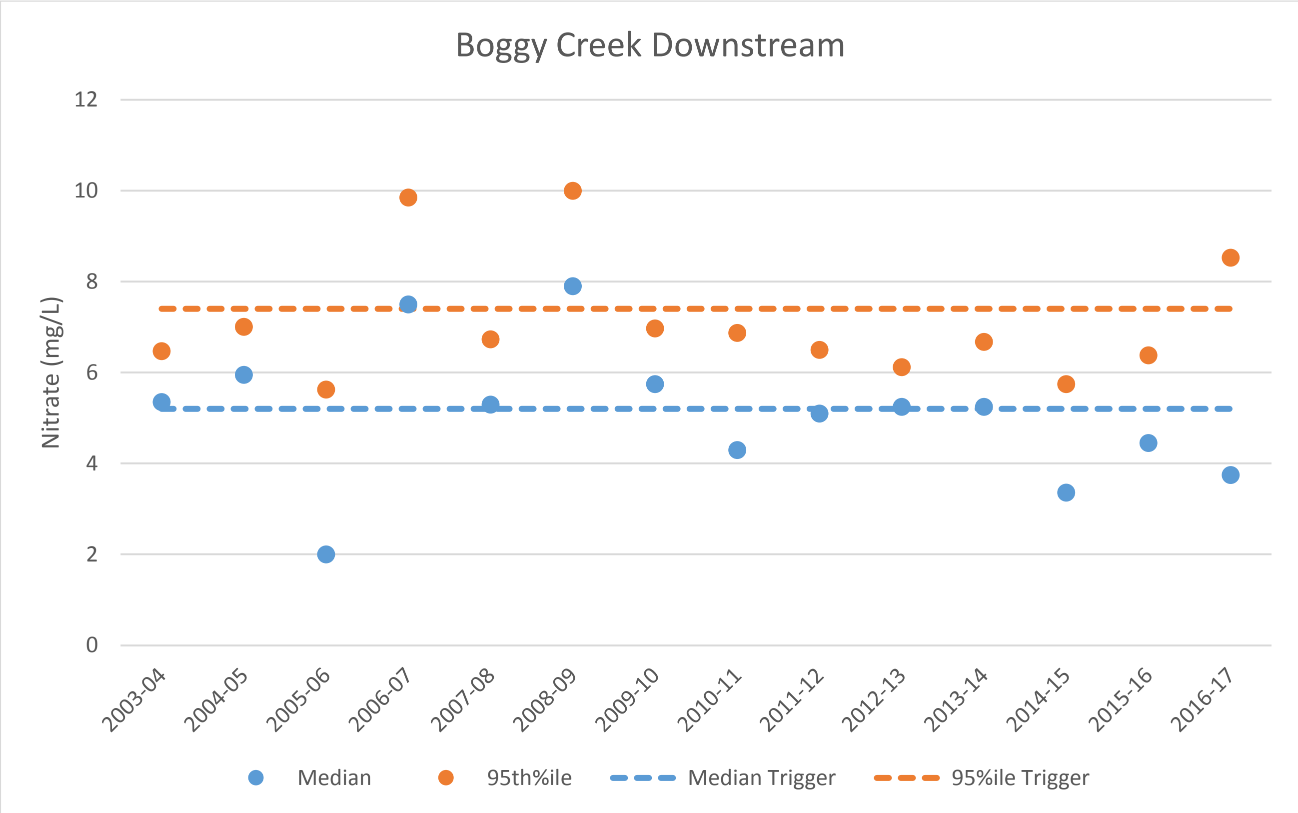


Figure 13. Boggy Creek Discharge location – Nitrate concentrations 2003-04 to 2016-17

On 27 June 2017 the Hanmer Road Drain 'source' site was found to be flowing for the first time since 19 November 2015. The nitrate concentration, at 7.8mg/L was the highest measured so far at this site. The only other concentrations recorded at this site were 3.9mg/L and 3.7mg/L in October and November 2015 respectively. There is insufficient data to draw any conclusions for this site at this time.

The Waianiwaniwa in-scheme site on 10 April 2017 was found to be flowing for the first time since CPWL's surface water monitoring programme commenced. The nitrate concentration was 4.4mg/L. There is insufficient data to draw any conclusions for this site at this time.

Where possible, the comparison to previous monitoring data illustrates that elevated Nitrate concentrations have been prevalent in these waterways for some time, and, as no significant change is evident in the 2016-17 results, CPWL attributes the exceedance of surface water quality triggers to elevated baseline levels.

4.2. Lake Water Quality

The trigger levels for Lake Water Quality are listed in Table 3. The trigger levels have been taken from the water quality limits contained in Table (l) of the Land and Water Regional Plan.

Table 3. Lake Water Quality Triggers

Monitoring Location	**Chlorophyll *a* (µg/L)[(b)]**	**Total Phosphorus (mg/L)[(b)]**	**Total Nitrogen (mg/L)[(b)]**	**TLI[(a)]**
Mid-Lake	74	0.1	3.4	6.6
Lake Margins	no trigger	no trigger	no trigger	6

(a) TLI assumed to be calculated as TLI3 (using TP, TN and chl a)

(b) As a maximum annual average determined from 12 (monthly) rounds of monitoring results.

During the 1 July 2016 to 30 June 2017 period, 11 rounds of monitoring data was obtained by Environment Canterbury.

The total phosphorus trigger limit is an annual average of no more than 0.1mgL^{-1}, the 12 month average for total phosphorus at the Mid Lake monitoring site was 0.24mgL^{-1}. (see Table 4, NB: data in red indicates an exceedance of the applicable trigger limit). This was the only lake water quality trigger level exceedance for an individual parameter during the reporting period.

Table 4. Lake Water Quality Monitoring Results 2016-2017

Te Waihora Site	Chlorophyll *a* (µg/L)	Total Phosphorus[A] (mg L^{-1})	Total Nitrogen[A] (mg L^{-1})	TLI_3
Mid Lake (2016-17)	71	**0.24**	2.30	**6.86**
Lake Margin Sites				
• Kaituna Lagoon (2016-17)[B]	21	0.14	1.25	5.91
• Off Selwyn River Mouth (2016-17)	60	0.21	2.27	**6.78**
• South of Timber Yard (2016-17)	60	0.18	2.16	**6.67**
• Taumutu (2016-17)	67	0.23	2.27	**6.81**

A Annual Mean

B Kaituna Lagoon is included for comparison only; it is not a trigger level site.

ECan has monitored the Mid Lake location on at least a monthly basis since July 1993. During this time the mean annual Total Phosphorus level was 0.24mg L^{-1} (Figure 14).

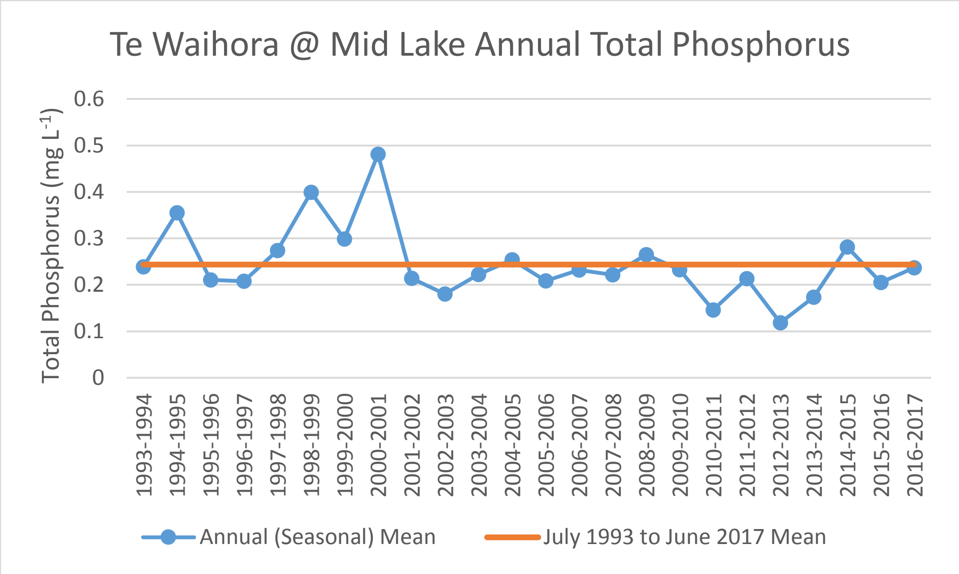


Figure 14. Total Phosphorus at Mid Lake in Te Waihora from 1993 - 2017

Figure 14 suggests that although the result for Total Phosphorus at 'Mid Lake' for 2016-2017 exceeded the trigger level, the level is not inconsistent with previous years' (pre CPWL scheme operation) results that ranged between 0.12mg/L and 0.48mg/L between 1993-94 and 2014-15. CPWL therefore attributes the exceedance of the phosphorus trigger at Mid Lake to elevated baseline levels.

The Trophic Level Index (TLI_3) is an indicator of lake water quality specifically developed for New Zealand lakes. The TLI_3 is derived from a number of water quality measures including total nitrogen, total phosphorus and chlorophyll *a* (found in algae). Triggers were exceeded at all lake water monitoring sites (see Table 4).

A review of monitoring data from the Mid Lake monitoring site from 2013-14 and 2014-15 (see Table 5, NB: trigger exceedances are depicted in red) illustrates that Scheme irrigation in the Stage 1 area during 2015-16 and 2016-17 has had no perceptible effect on trigger level exceedances.

Table 5. Site Mid Lake, Te Waihora Monitoring Results 2013-14, 2014-15, 2015-16 and 2016-2017

Mid Lake, Te Waihora	Chlorophyll *a* (µg/L)	Total Phosphorus[A] (mg/L)	Total Nitrogen[A] (mg/L)	TLI_3
2016-17	71	**0.24**	2.30	**6.86**
2015-16	70	**0.22**	2.31	**6.83**
2014-15	**119**	**0.28**	2.82	**7.21**
2013-14	**76**	**0.17**	2.19	**6.73**

The discharge of phosphate laden sediment to surface waters is not a significant issue for CPWL farms when compared to farms in the lowland areas surrounding Lake Ellesmere/Te Waihora. The discharge of Nitrogen is a more significant issue for (but not exclusive to), CPWL Scheme farms. It is noted that whilst the lake Trophic Level Index was exceeded, the trigger level for total Nitrogen concentration was not.

4.3. Groundwater Quality

CPWL have trigger levels in place for *E. coli* and Nitrate-N (Table 6). With only 22 months of groundwater monitoring results available post commencement of irrigation in Stage 1, it is not possible to assess the results against the trigger level for Nitrate-N (being a five-year annual average concentration of 7.65mg/L).

Table 6. Groundwater Quality Trigger Levels

Contaminant	Measurement	Trigger
Nitrate-Nitrogen	5-year annual average concentration[a]	7.65 mg/L
E.coli	Median concentration[b]	<1 organism/100 millilitres

(a) In shallow groundwater <50 metres below groundwater level

(b) Measured over the length of record

There are however several CPW monitoring bores across both Stage 1 and Stage 2 where Nitrate concentrations have been found to be consistently greater than 7.65mg/L (refer to Tables 7 and 9 and Figures 4 and 23).

4.3.1. Stage 1

E. coli

During routine monitoring *E. coli* was detected on five occasions from four bores from within the operational Stage 1 area of the Scheme during 2016-17 (15% of samples).

Occasional occurrences of *E. coli* in groundwater bores are not uncommon particularly during wet weather sampling. ECan's annual regional groundwater surveys from 2009 to 2016 detected *E. coli* in 3.7% to 12.5% of bores. There is also the possibility that positive *E. coli* readings may result from the sample collection and handling procedures.

Three of the CPWL monitoring bores reported concentrations of 1-2 MPN/100ml and a concentration of 201 MPN/100ml was detected in the fourth bore, BX22/0043. When groundwater *E. coli* trigger levels are met, CPWL works through a response flowchart as per Figure 27 of this report. The lower concentration results are considered to reflect baseline groundwater quality and as such no further action was taken at the time. It was noted that 7.1mm of rainfall was measured at NIWA's Weather Station, 4702 on the day before monitoring took place where an *E. coli* level of 1 MPN/100ml was detected from BX22/0053 on 13 December 2016. 3.8mm of rainfall was recorded two days prior to an *E. coli* level of 2 MPN/100ml being detected from BX22/0044 on 1 March 2017. 18mm of rainfall was measured on the day of sampling, and 17mm on the day before monitoring took place where an *E. coli* level of 1 MPN/100ml was detected from BX22/0041 on 14 March 2017. Bores BX22/0044, BX22/0041 and BX22/0053 are all located in areas periodically grazed by stock.

The higher *E. coli* concentration detected in Bore BX22/0043 on 8 December 2016 prompted CPWL to retest the bore on 11 January 2017, whereby a concentration of 3 MPN/100ml was detected. This significant decrease in *E. coli* concentration between December 2016 and January 2017 suggests that the source of contamination was a short lived event, and subsequently removed the need for further investigation.

Factors that may have contributed to the elevated reading in BX22/0043 include the presence of a stockwater trough approximately 90m northwest (upgradient) of the BX22/0043 and a CPWL water supply pipeline that runs about 10m south of the trough to a pump located 10m south of BX22/0043. The area around the trough could act as a point source of *E. coli* while the pipeline could act as a preferential pathway for *E. coli* to be transmitted from the stockwater trough area to BX22/0043.

At NIWA's Weather Station, 4702 2.7mm of rain was recorded on 8 December 2016 and 19.4mm for the period 1 – 7 December 2016. A centre pivot irrigator operates immediately over BX22/0043 and with the exception of approximately 10 hours, CPWL water was continuously utilised on this farm from 23 October 2016 until 8 December 2016. NB: CPWL water is irrigated through two centre pivot irrigators on the farm where BX22/0043 is located. Rainfall and/or irrigation may have facilitated the transport of *E. coli* from the ground surface to the groundwater.

E. coli was not detected in BX22/0043 during the subsequent March and June 2017 monitoring rounds.

Nitrate-Nitrogen

Annual Medians >7.65mg/L

There are four Stage 1 bores that had an average Nitrate concentration for the 2016-17 monitoring period of greater than 7.65mg/L (see blue shaded columns in Table 7). These four bores also had mean Nitrate concentrations of greater than 7.65mg/L for 2014-15 and 2015-16. Although the results show BX22/0043 and BX22/0046 exceeded 11.3mg/L they were not within 100m of a dwelling and therefore did not breach any consent requirement or require notification to any owners/tenants.

Table 7. Stage 1 Bores Nitrate-N Status March 2014 to June 2017

Date	BX21/0017	BX21/0018	BX22/0041	BX22/0042	BX22/0043	BX22/0053^	BX22/0044	BX22/0046
Jun-17	**14**	3.2	4.8	3.8	**10.4**	**8.3**	7.2	**13.9**
Mar-17	**8.8**	5.4	5.5	5.2	**9.4**	**9.7**	6.3	**11.8**
Dec-16	5.2	3.5	4.9	5.5	**12.7**	**8.3**	6.7	**11.9**
Sep-16	6.8	3.3	4	5	**13.7**	**7.8**	5.2	**11.9**
Jun-16	**9.2**	3.6	4.5	5.4	**13**	**9**	5.9	**12.2**
Mar-16	**8.5**	4.4	6.7	5.7	**13**	**9.8**	5	**12.3**
Dec-15	**9.1**	3.5	5.3	6.1	**13.1**	**8.5**	5.6	**12.4**
Sep-15	**8.5**	2.9	4.1	4.9	**14.3**	**8.3**	6	**12.5**
Jun-15	5.9	3.2	2.7	5.2	**14.6**	**10.5**	4.5	**12.6**
Mar-15	7.1	4	3.1	3.5	**10.9**	**11**	4.6	**12.8**
Dec-14	**7.9**	3.6	4.9	6.2	**13**	**8**	3.9	**12.4**
Sep-14	**10.2**	3.1	3.9	5.5	**10.2**	6.3	4.5	**13.2**
Jun-14	**11.2**	4.3	4.6	5.7	**9.9**	-	7.4	**14.4**
Mar-14	**7.8**	4.3	4.3	5.3	**13.6**	-	4.1	**12.9**
2016-17 Mean	**8.7**	3.9	4.8	4.9	**11.6**	**8.5**	6.4	**12.4**
2015-16 Mean	**8.8**	3.6	5.2	5.5	**13.4**	**8.9**	5.6	**12.4**
2014-15 Mean	**7.8**	3.5	3.7	5.1	**12.2**	**9.0**	4.4	**12.8**
All Data Mean	**8.6**	3.7	4.5	5.2	**12.3**	**8.8**	5.5	**12.7**
Screened Interval (mbgl)	1.1 - 11.1	55.1 - 105.1	10.1 - 40.1	29.4 - 69.4	20.1 - 70.1	20.3 - 50.3	1.0 - 9.0	1.0 - 30.0
Water level range (mbgl)*	8.7 - 9.9	77.5 - 93.7	19.9 - 23.8	40.9 - 49.5	50.7 - 65.2	33.6 - 46.4	5.0 - 7.6	7.5 - 14.4

^ BX22/0045 is located 5m from BX22 /0053. It is no longer monitored by CPW because it only extends 30m below ground.

* To 1 decimal place.

Figure 15 shows the land use, and Figure 16 the irrigation type, of CPWL shareholder farmland located up-gradient of the monitoring bores that had mean annual Nitrate concentrations of greater than 7.65mg/L

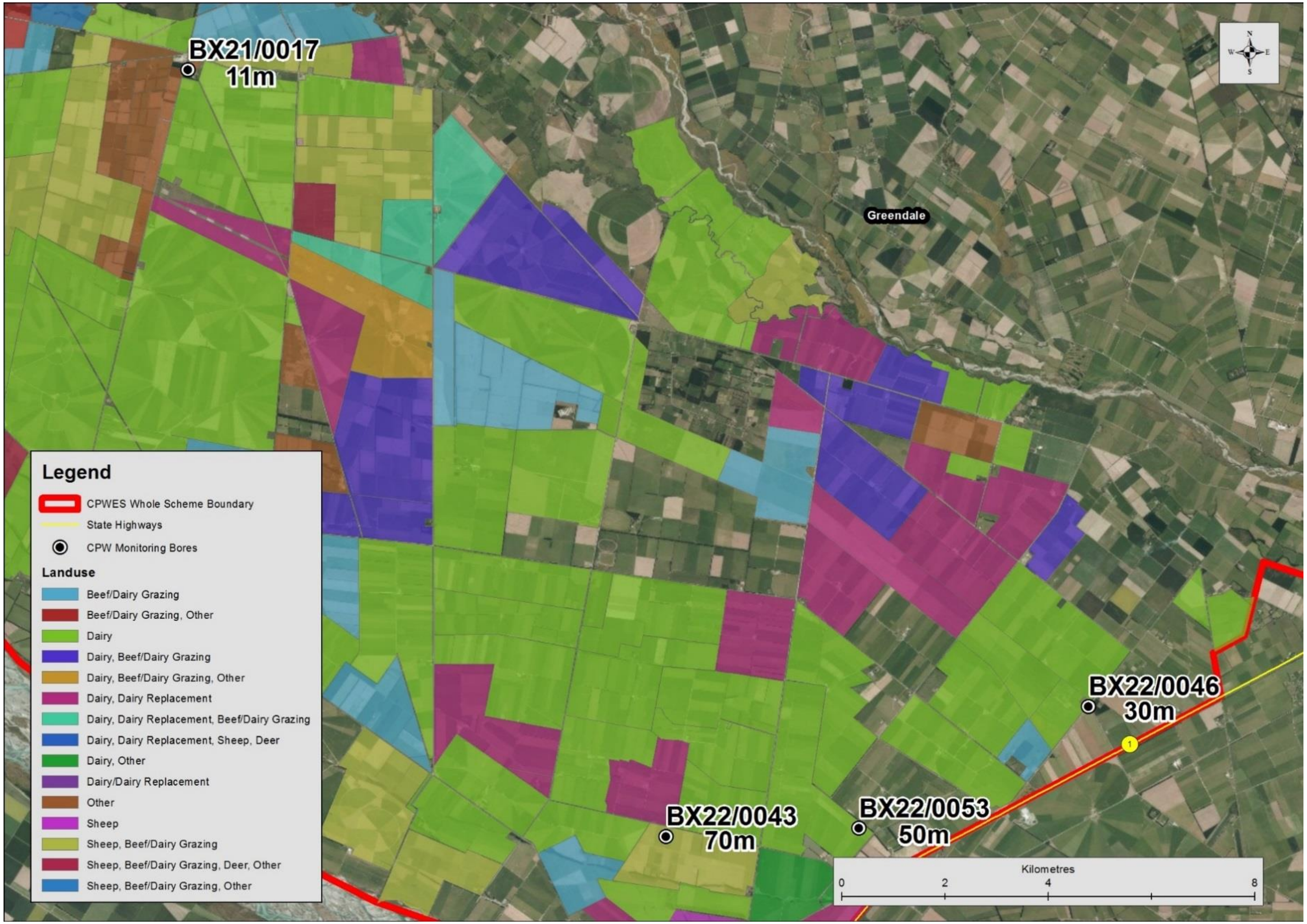


Figure 15. Shareholder Land Use Up-Gradient of the Stage 1 Elevated Nitrate-N Bores

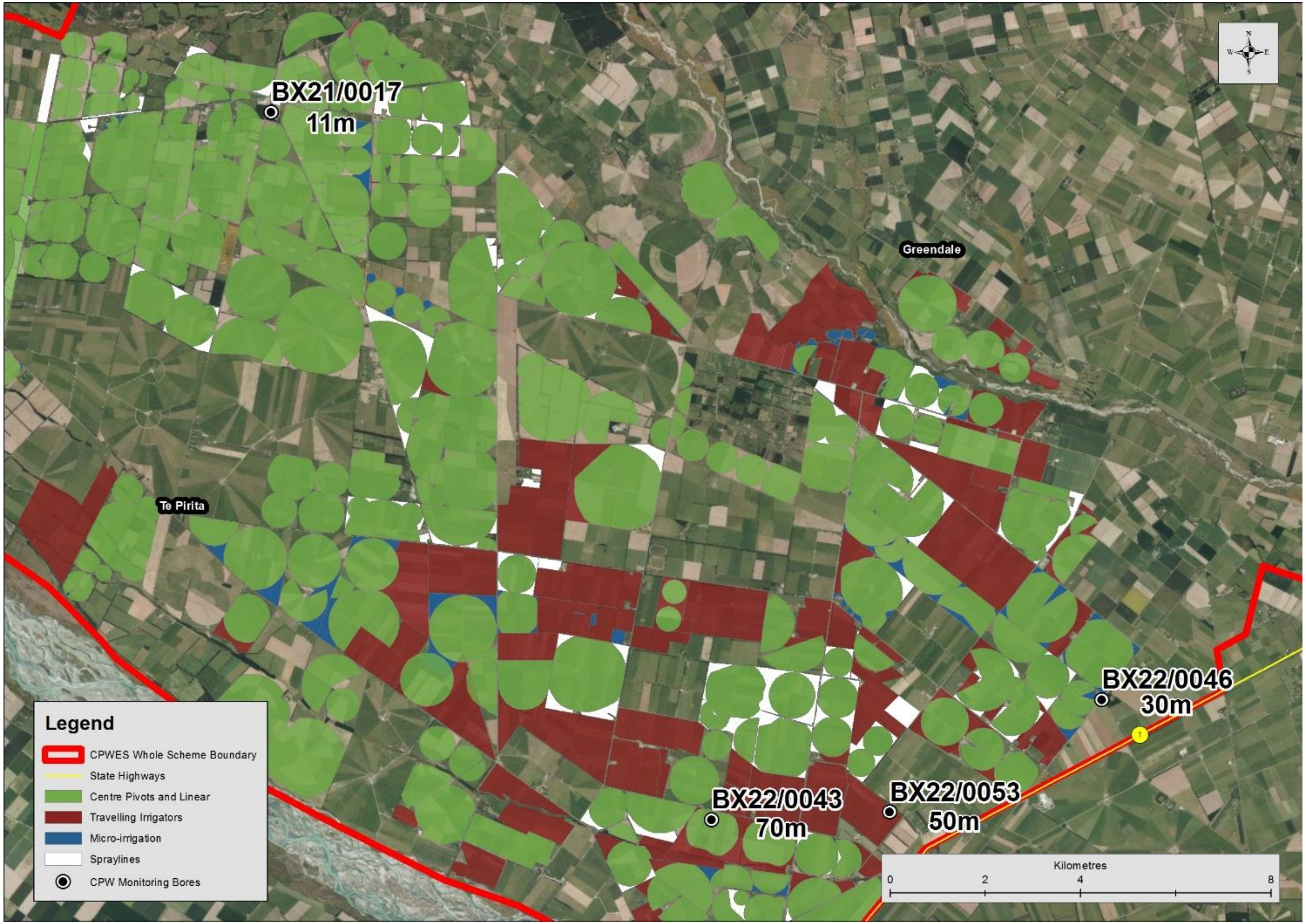


Figure 16. CPWL Shareholder Irrigation Types for Farms Up-Gradient of Stage 1 Elevated Nitrate-N Bores

Bores with new maximum Nitrate concentrations measured within the last 12 months

There were two instances where a Nitrate-N reading from a Stage 1 bore was found, during the 2016-17 monitoring year, to be at all-time maxima for the respective bores.

During the March 2017 monitoring round, bore BX21/0018 had a Nitrate-N concentration of 5.4mg L^{-1} (previous maximum 4.4 mg L^{-1} measured in March 2016), which was also higher than the maximum concentration measured in bore L36/1157 (see Figure 17) which is located approximately 10 metres west of BX21/0018.

The static groundwater level of 93.735mbgl measured at the time of sampling was the deepest encountered so far at bore BX21/0018, both prior to, and following, commencement of CPW irrigation.

In the 2015-16 Ground and Surface Water Report it was suggested that there is a trend of increasing Nitrate concentrations in this area. With the exception of the March 2017 result, Figure 17 suggests the Nitrate concentration may be starting to stabilise at this location. Conversely, Figure 17 may also suggest that during the last three monitoring periods (September to June) the difference between the seasonal Nitrate peaks (2017 = March, 2016 = March, 2015 = April) to the rest of the seasons results may be widening.

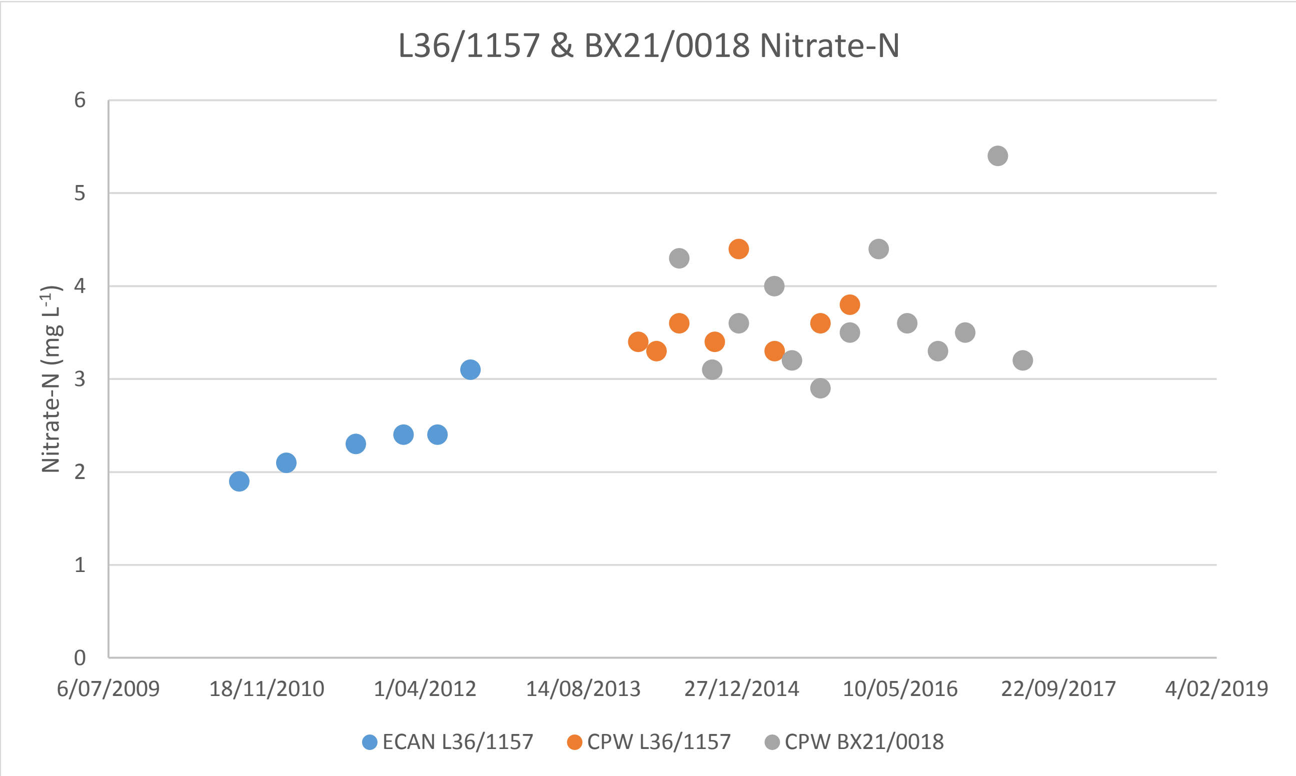


Figure 17. Nitrate Concentrations in L36/1157 & BX21/001

In June 2017 BX21/0017 had a Nitrate concentration of 14.0mg L^{-1} (previous maximum 11.2mg L^{-1} in June 2014). Although the June 2017 Nitrate concentration from bore BX21/0017 was the highest measured in this bore to date, concentrations measured in the adjacent bore, L36/0003, have in the past been found as high as 15.2mg L^{-1} (see Figure 18). Figure 19 shows a strong correlation between nitrate concentrations measured in L36/0003 and BX21/0017. This supports the idea that Nitrate concentrations at the site of BX21/0017 have been at, or greater than 14.0mg L^{-1}, in the past and that this elevated reading should not be attributable to effects of the Scheme.

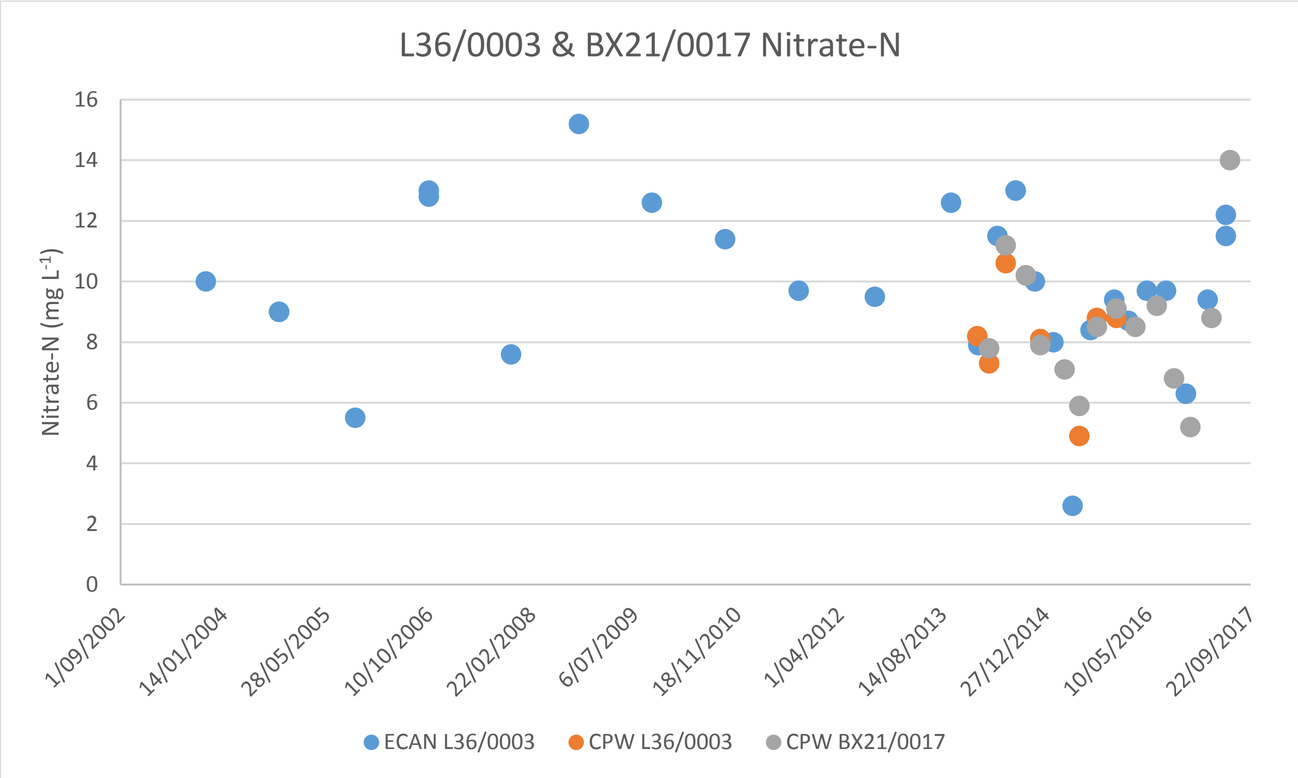


Figure 18. Nitrate Concentrations in L36/0003 & BX21/0017

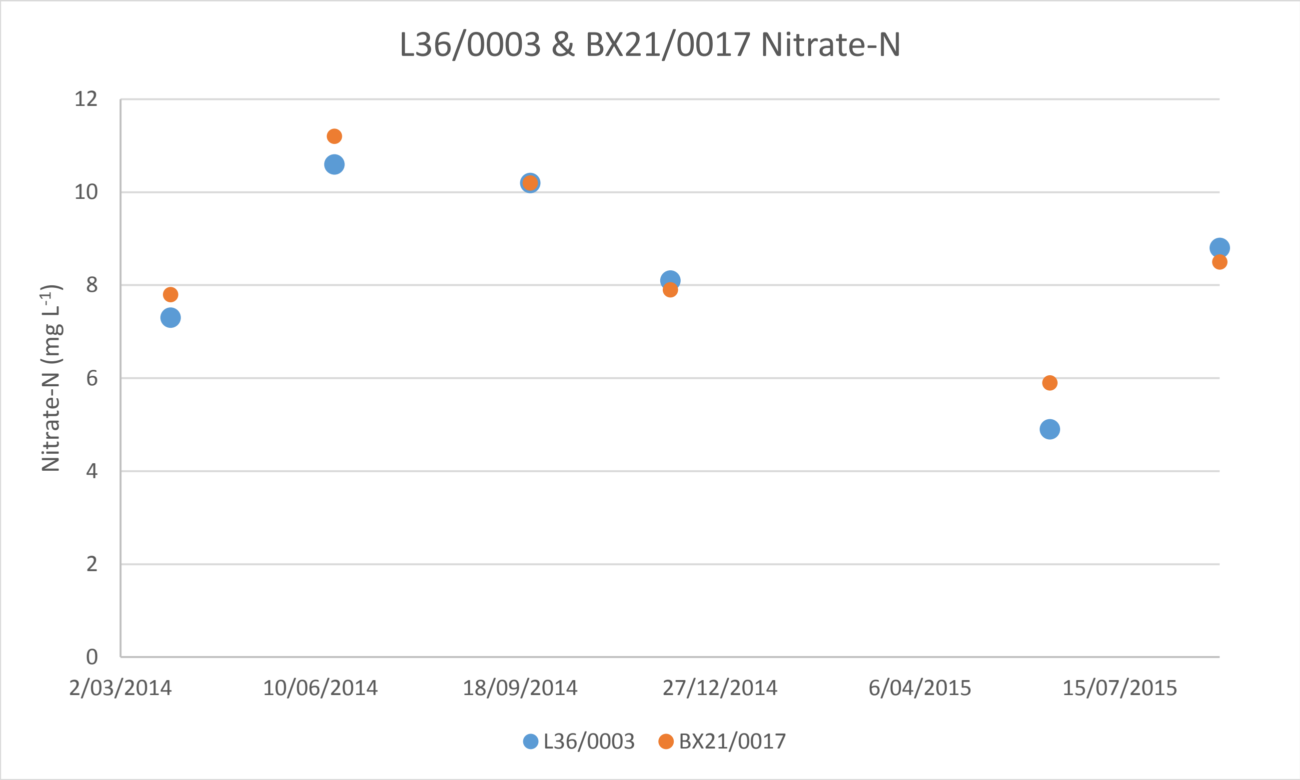


Figure 19. 'Paired' Nitrate Concentrations in L36/0003 & BX21/0017

4.3.2. Sheffield

E. coli

E. coli was detected at 1 MPN/100ml from Bore BW22/0042 on 1 June 2017. This is the second occasion that *E. coli* has been detected in this bore since monitoring began in March 2014 (n=20). A level of 6 MPN/100ml was detected in June 2016. There was very little rainfall measured by a Weather Station located in nearby Waddington (Weather Station ID: ICANTERB351 on Weather Underground https://www.wunderground.com/personal-weather-station/dashboard?ID=ICANTERB351), 0.5mm on the day of sampling and 0.3mm on 31 May 2017. Other than the fact that this bore is located in a paddock grazed by sheep, reasons why a positive *E. coli* detection was recorded are not readily apparent.

E. coli was detected during the last three monitoring rounds in bore BW22/0041. Levels of >201 MPN/100ml, 2 MPN/100ml and 15 MPN/100ml were measured during on 8 December 2016, 6 March 2017 and 6 June 2017 respectively. The >201MPN/100ml detection of *E. coli* from BW21/0041 on 8 December 2016 prompted CPWL to retest the bore on 11 January 2017, where a concentration of 3 MPN/100ml was found. Contributing factors to the positive *E. coli* detections at BW22/0041 are livestock in the paddock where the bore is located and runoff from an outbuilding roof (~80m^2) discharging to ground upgradient of the monitoring bore. Rainfall may have contributed to *E. coli* detections at this site. Higher concentrations of *E. coli* were detected when greater amounts of rainfall occurred on the day of, or two days prior to, water sampling. There was 6.1mm of rain recorded at Weather Station ID: ICANTERB351 (see hyperlink above) on 8 December 2016 (>201 MPN/100ml) but no rain during the previous two days. There was 0.5mm of rainfall recorded two days prior to the 6 March 2017 sampling day (2 MPN/100ml), and 0.3mm and 9.7mm recorded, one and two days respectively, prior to sampling on 6 June 2017 (15 MPN/100ml).

Occasional occurrences of *E. coli* in groundwater bores are not uncommon particularly during wet weather sampling. ECan's annual regional groundwater surveys from 2009 to 2016 detected *E. coli* in 3.7% to 12.5% of bores. There is also the possibility that positive *E. coli* readings may result from the sample collection and handling procedures.

CPWL is not yet providing irrigation to the Sheffield area so the above positive detections of *E. coli* are considered indicative of baseline levels.

Nitrate-Nitrogen

Nitrate levels measured in the two Sheffield monitoring bores between September 2016 and June 2017 were within the ranges previously measured (refer to Figure 20).

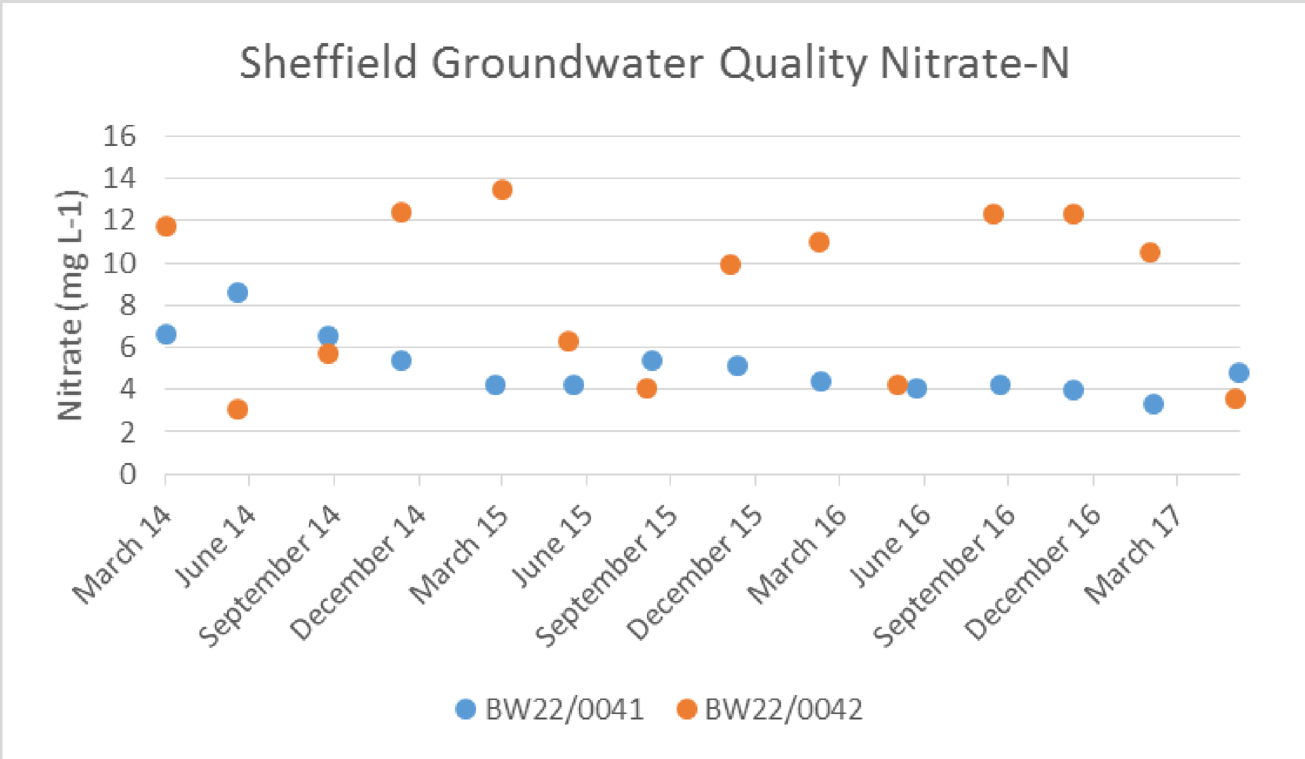


Figure 20. Nitrate Concentrations in CPWLs Sheffield Monitoring Bores

4.3.3. Stage 2

E. coli

The detection of *E. coli* has been more frequent in CPWL's Stage 2 monitoring bores with levels detected in 16 out of a total of 93 samples taken since June 2015. Results from the seven Stage 2 bores that had samples test positive for *E. coli* are shown in Table 8 below. Following positive detection of *E. coli* from Bores BX22/0065, BX22/0066 and BX22/0067 in December 2016, these bores were retested on 10 January 2017 and the results are shown in Table 8. CPWL are not yet operating Stage 2 of the Scheme so all results in Table 8 form part of the baseline to which future monitoring results will be compared to.

Figures 21 and 22 display the land use and irrigation type used by farms up-gradient of the groundwater that gave samples positive for *E. coli* in 2016-17.

Table 8. Stage 2 Bores in which Samples of *E. Coli* were Detected (MPN/100ml).

Date	BX22/0065	BX22/0066	BX22/0067	BX22/0068	BX22/0070	BX22/0071	BX23/0423
Jun-17	0	0	0	3	10	0	2
Mar-17	0	0	78	0	well dry	0	well dry
Jan-17	0	0	34	-	-	-	-
Dec-16	3	8	>201	0	0	2	0
Sep-16	0	0	0	0	0	0	0
Jun-16	0	1	2	0	0	0	0
Mar-16	0	0	5	0	0	0	0
Dec-15	12	0	>201	2	0	0	0
Sep-15	0	0	0	1	0	0	0
Jun-15	0	0	0	0	0	0	0

Only BX22/0067 had a median concentration of *E. coli* greater than zero and hence would constitute a trigger level exceedance had Stage 2 irrigation been in operation during the 2015-16 and 2016-17 seasons. It has been noted that a stock water trough is located approximately 30m west of BX22/0067, and as such could be a contributor to the elevated E. coli levels detected during some monitoring rounds. Rainfall prior to sampling may affect *E. coli* levels in BX22/0067. During the September 2016 and June 2017 monitoring rounds no rain was recorded at NIWAs Hororata weather station, 4702, in the two days prior to samples being taken when *E. coli* was not detected. While rain was recorded in the two days prior to samples being taken in December 2016, January 2017 and March 2017 when positive detections of *E. coli* were recorded.

Generally, when a positive detection of *E. coli* was found in a Stage 2 bore, rainfall was recorded either on, or in the two days prior to, the sampling day. The bores listed in Table 8 are all located in areas where stock periodically graze but there are no other readily apparent factors, i.e. a septic tank located upgradient of the bores, that help explain the positive *E. coli* readings recorded.

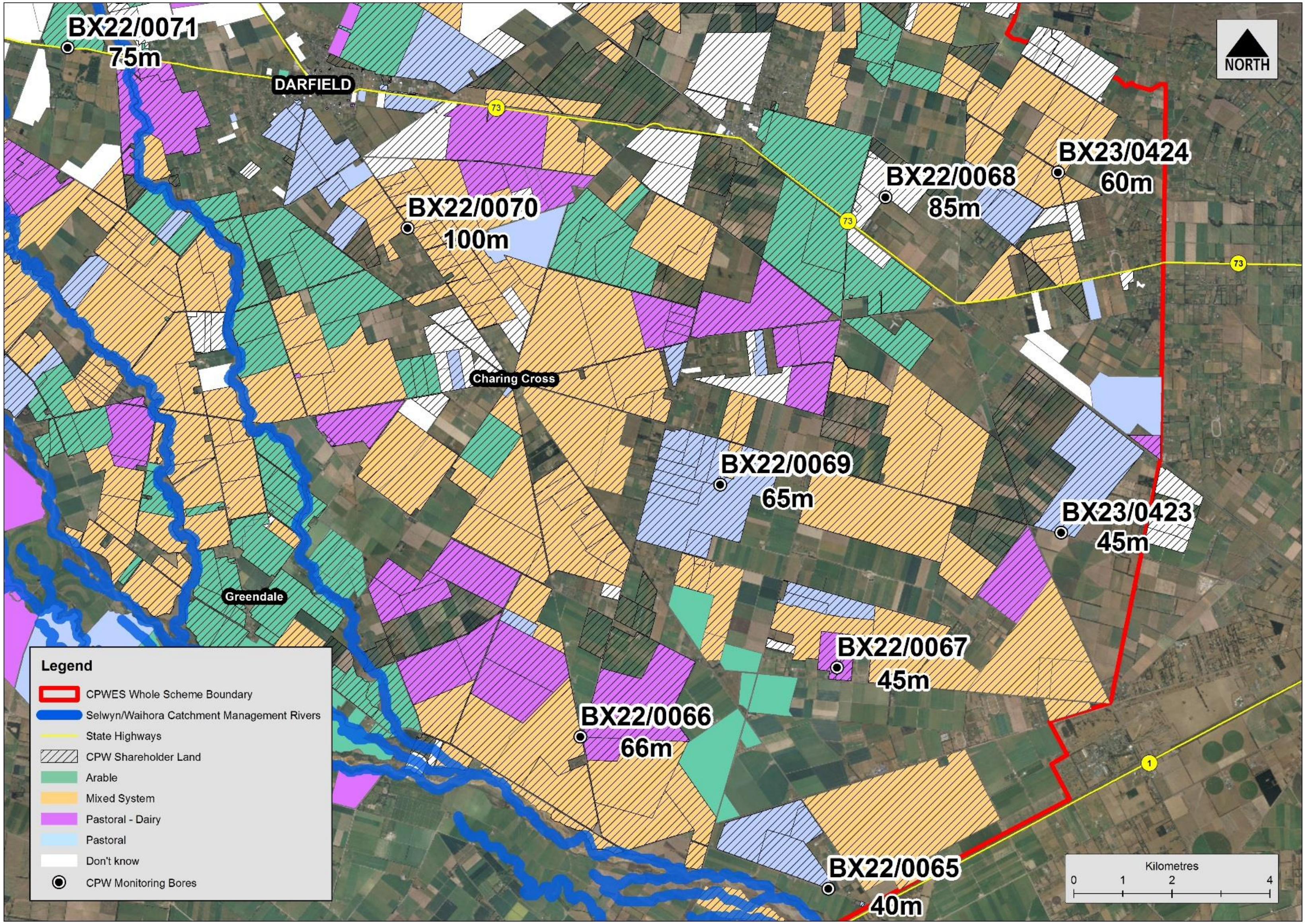
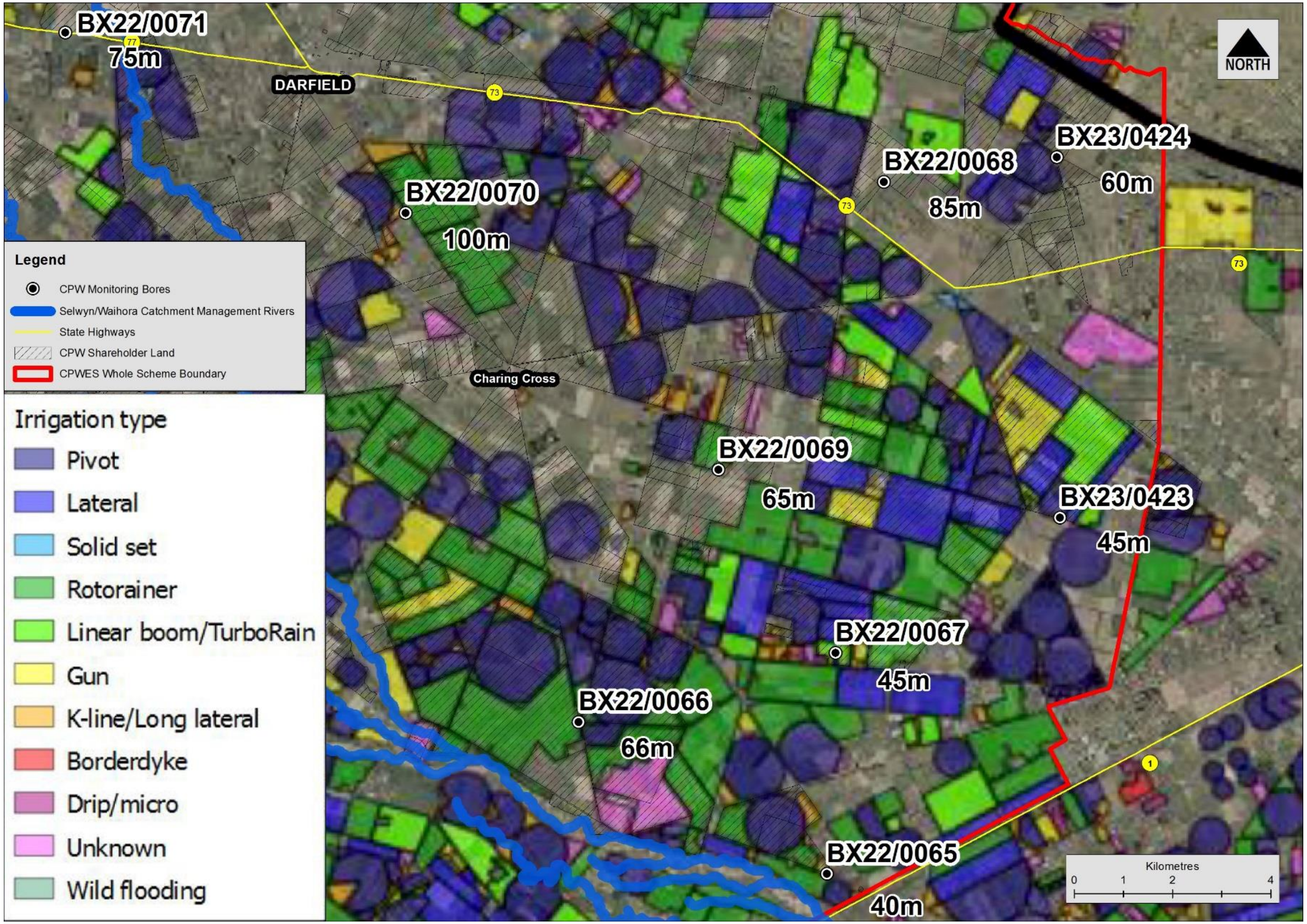


Figure 21. Land use of Stage 2 farms located up-gradient of *E. coli p*ositive, and elevated Nitrate, bores



Irrigation Type data sourced from 'Canterbury Detailed Irrigated Area Mapping' prepared for ECAN by Aqualinc 5 July 2016.

Figure 22. Irrigation status of Stage 2 farms located up-gradient of *E. coli* positive, and elevated Nitrate, bores.

Nitrate-Nitrogen

Five of the ten Stage 2 bores had a 12-month mean Nitrate concentration of greater than 7.65mg/L (Table 9 NB: individual results greater than 7.65mg/L are shown in red).

Table 9. Stage 2 bores with 2016-17 annual mean Nitrate concentration of greater than the trigger level of 7.65mg/L.

Date	BX22/0065	BX22/0067	BX22/0069	BX22/0072	BX23/0424
Jun-17	**17.8**	**11.9**	well dry	**11.3**	7.5
Mar-17	**8.9**	**12.7**	well dry	6.4	7.6
Dec-16	6.4	**12.2**	**9.7**	7.5	**7.8**
Sep-16	**9.1**	**9.6**	**9.4**	7.2	**7.9**
Jun-16	**9.1**	**13.1**	**9.6**	4.6	**7.9**
Mar-16	**8.9**	**12.1**	**9.8**	5.8	**8.1**
Dec-15	**9.5**	**13**	**10.2**	7.4	**9.0**
Sep-15	**10.9**	**14.5**	**9.9**	**9.0**	**11**
Jun-15	**12.0**	**12.7**	**9.9**	4.9	**11.4**
2016-17 Mean	10.55	11.60	9.55	8.10	7.70
2015-16 Mean	9.60	13.18	9.88	6.70	9.00
All Data Mean	10.29	12.42	9.79	7.12	8.69

Figure 23 displays which of CPWL's 20 monitoring bores had a 2016-17 mean nitrate concentration of more than 7.65 mg L^{-1}. NB: Trigger levels for Nitrate in groundwater are based on a five-year annual average so cannot be assessed against until the June 2020 groundwater monitoring round is completed.

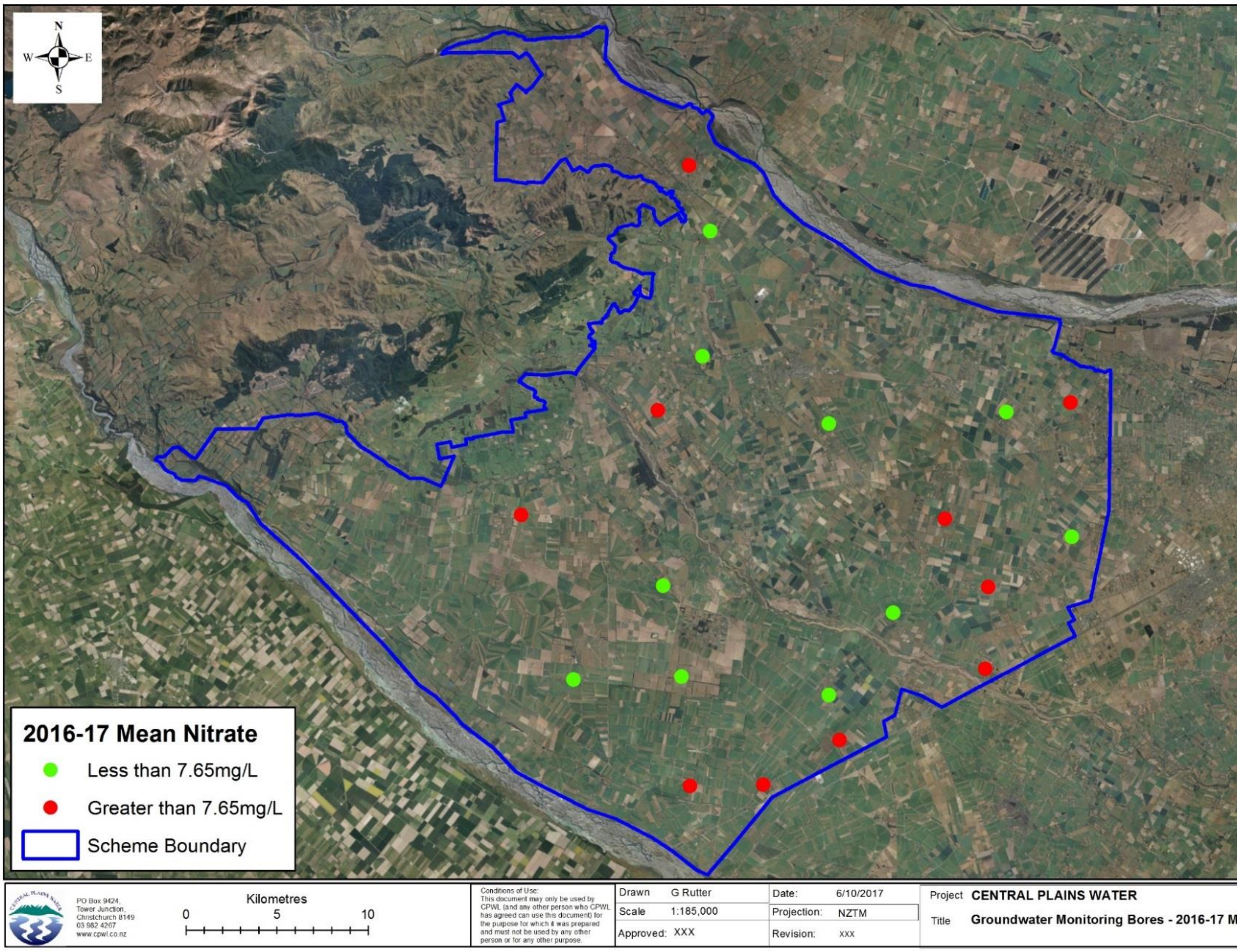


Figure 23. Groundwater monitoring bores 2016-17 Mean Nitrate

4.4. Lowland Groundwater Level Monitoring

The Lowland groundwater level triggers are set at the 95th percentile of the (at least 40 year) historical record.

Between September 2016 and June 2017, no Lowland groundwater level triggers were reached. The nearest any measured groundwater level came to a CPWL trigger was bore M36/7880 on 22 June 2017, where the groundwater level was 0.205m below the trigger level (Figure 24). NB: the levels referred to in Figure 24 are in metres above sea level (mASL).

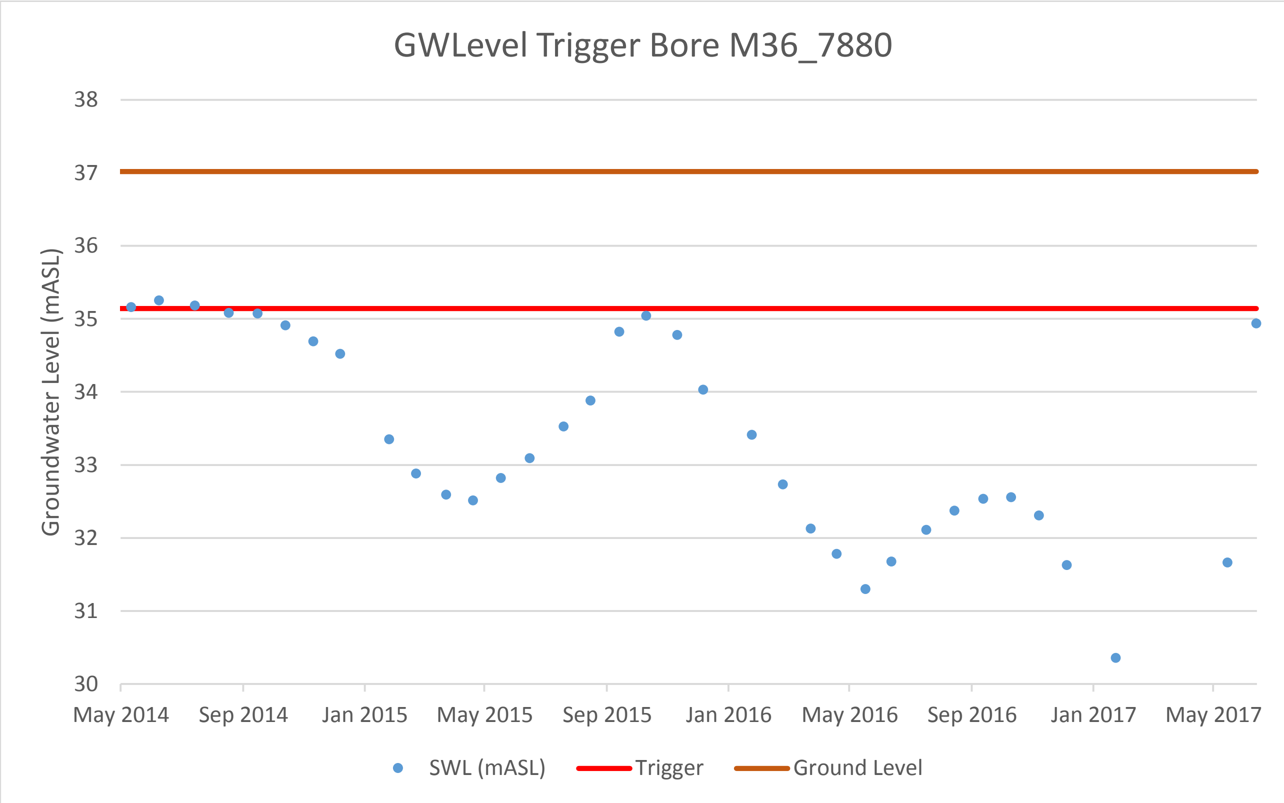


Figure 24. Groundwater Level at Lowland Trigger Bore M36/7880

The longer-term groundwater record shown in Figure 25 highlights the frequency at which the trigger level would have historically been reached. This bore was found to be dry in April and May of 2006.

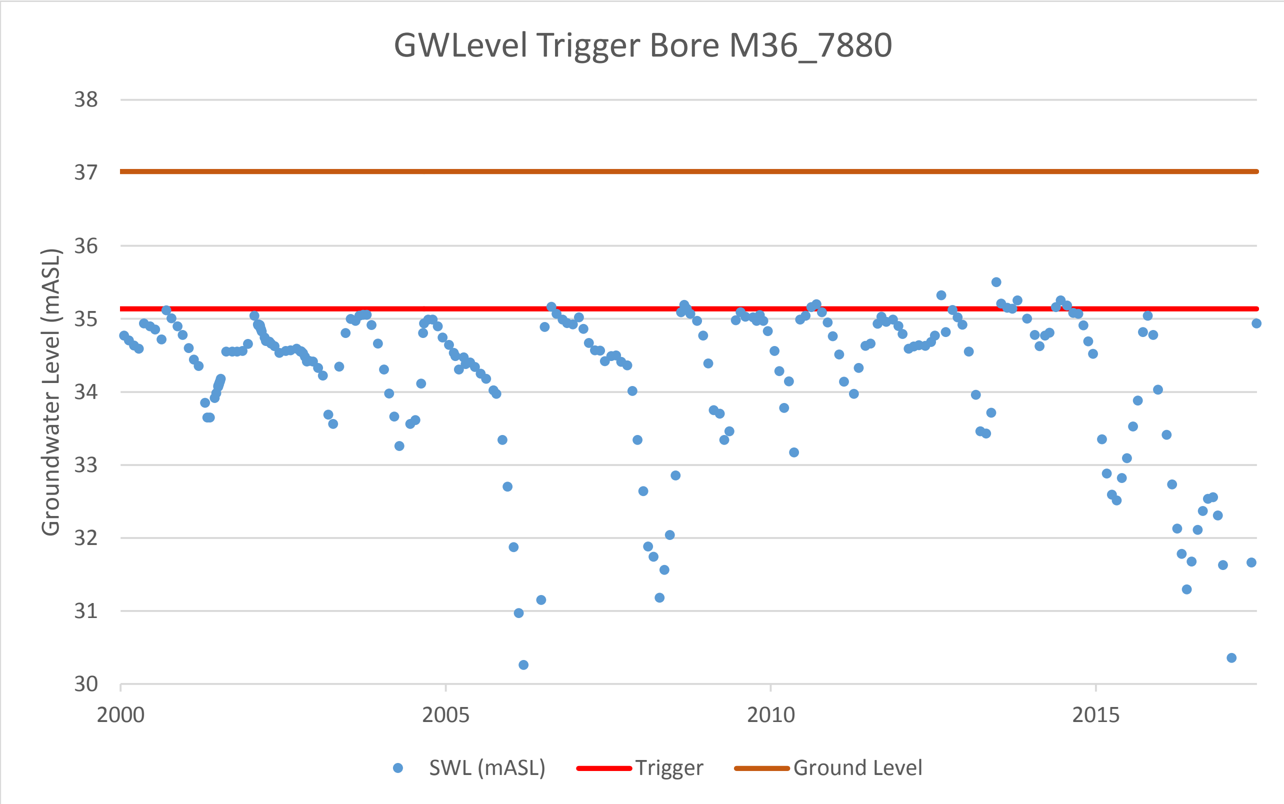


Figure 25. Groundwater Level at M36/7880 2000 to 2016

Due to the low groundwater levels in the Selwyn Waihora catchment during the 2016-17 Irrigation Season and because only Stage 1 of the wider CPWL Scheme was operating in 2016-17, it is not surprising that no lowland groundwater level triggers were reached during the 2016-17 irrigation season.

5. Conclusion

Following the second year of operation of the Stage 1 area only, it is too early to identify what positive and/or negative effects the Scheme may be having in the Selwyn-Waihora catchment.

After three dry years with little groundwater recharge in the area it is not surprising that lowland groundwater levels did not reach their respective triggers.

Some surface water and lake water quality trigger levels were exceeded but levels were found to be consistent with results from previous years (prior to the CPWL Scheme operating) and therefore not attributable to effects of the Scheme.

During routine monitoring *E. coli* was detected from four Stage 1 monitoring bores on a single occasion each during 2016-17. Only a single result could be considered to be greater than a low level concentration. E. coli was detected in a significantly lower number of Stage 1 bore water samples compared to Stage 2 and Sheffield bore samples.

No complaints were received during 2016-17 concerning any adverse environmental effects of the Scheme on groundwater or surface water, including more specifically, impacts on land drainage, or on-site wastewater systems.

Although elevated concentrations of Nitrate were detected in some Stage 1 bores, they were generally found to be consistent with results or trends from previous years.

In general the monitoring results from two years of Scheme operation are insufficient to detect and attribute any effects of the Scheme on water quality, particularly when compared against some existing elevated and increasing contaminant trends caused by historic land uses and practices whose effects are time-lagged. Some years of further water quality monitoring will be necessary, together with on-going assessment of CPW and other land use change patterns in the catchment, to determine any significant change to existing elevated nitrate concentrations and increasing trends, and whether any cause is attributable to CPW, to previous land use changes and/or to improving practices through time.

Through management of the Farm Environment Plan requirements at the Scheme level, CPWL continues to increase its understanding of Stage 1 farmers' management practices and what changes are planned for the future. CPW's knowledge around nitrogen losses in particular, will enhance our ability to better interpret future results from our ground and surface water monitoring programme.

6. Appendices

6.1. Ground and Surface Water Plan Part II – Trigger Limits and Trigger Response Processes

Table 10. Surface water quality triggers (Nitrate-N (mg/L)) for the CPWL monitoring programme

River Type	pLWRP Variation 1		CPWL surface water monitoring	
	Annual Median	Annual 95th percentile	Annual Median	Annual 95th percentile
Spring-fed plains	6.9	9.8	5.2	7.4
Hill-fed lower	2.4	3.5	1.8	2.6

Table 11. Water quality triggers for CPWL lake water quality monitoring

Monitoring Location	TLI[a]	Total Phosphorus (mg/L)[b]	Total Nitrogen (mg/L)[b]	Chlorophyll A (μg/L)[b]
Mid-Lake	6.6	0.1	3.4	74
Lake Margins	6	n/a	n/a	n/a

(a) TLI assumed to be calculated as TLI3 (using TP, TN and chl a)

(b) As a maximum annual average

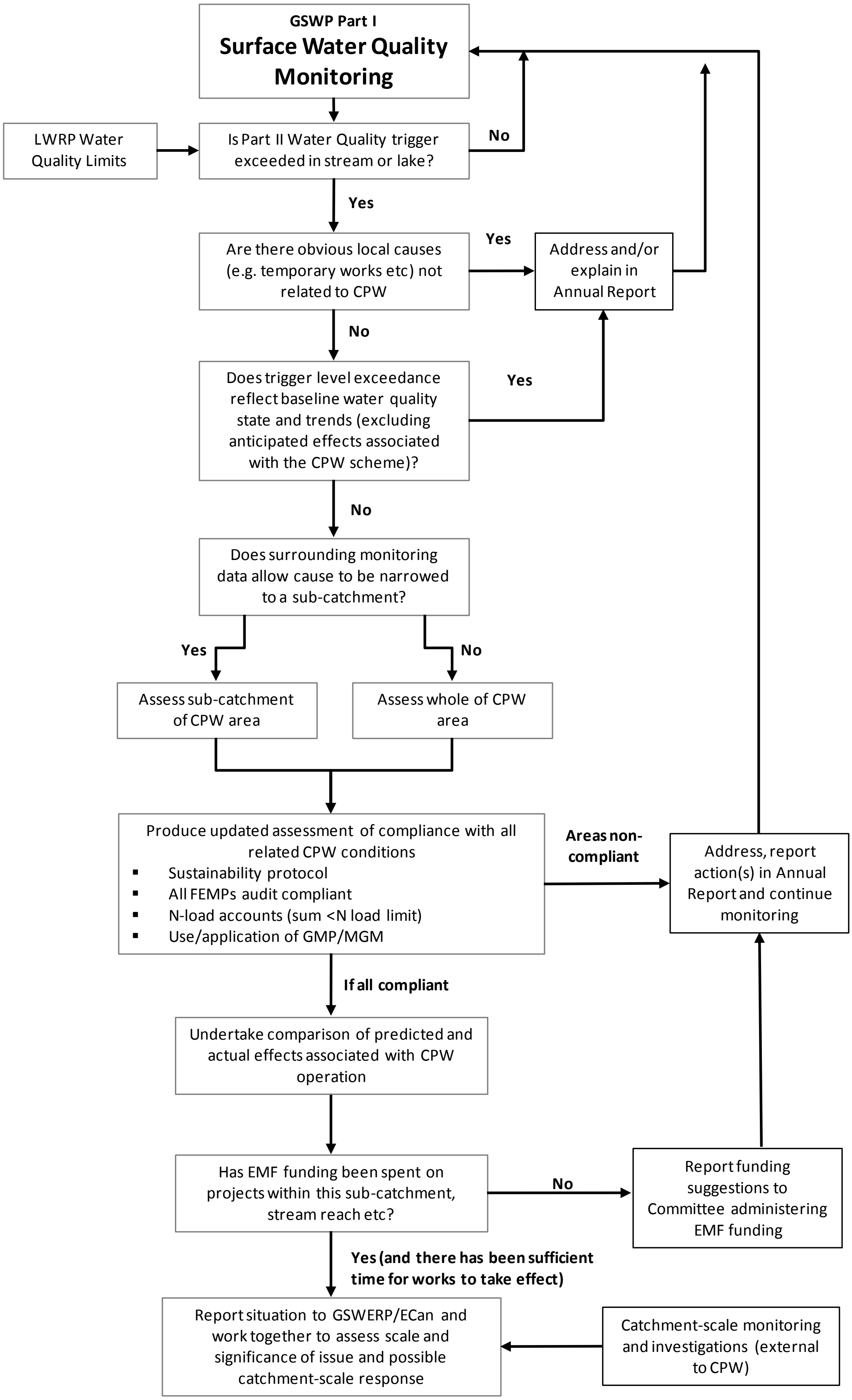


Figure 26. CPWL response to surface water quality trigger level exceedance

The CPWL response initiated following an exceedance of lake water quality triggers is consistent with that established for surface water quality monitoring.

Table 13. Groundwater quality triggers for the CPWL monitoring programme

Contaminant	Measurement	Trigger
Nitrate-Nitrogen	5-year annual average concentration[(a)]	7.65 mg/L
E.coli	Median concentration[(b)]	<1 organism/100 millilitres

(a) In shallow groundwater <50 metres below groundwater level

(b) Measured over the length of record

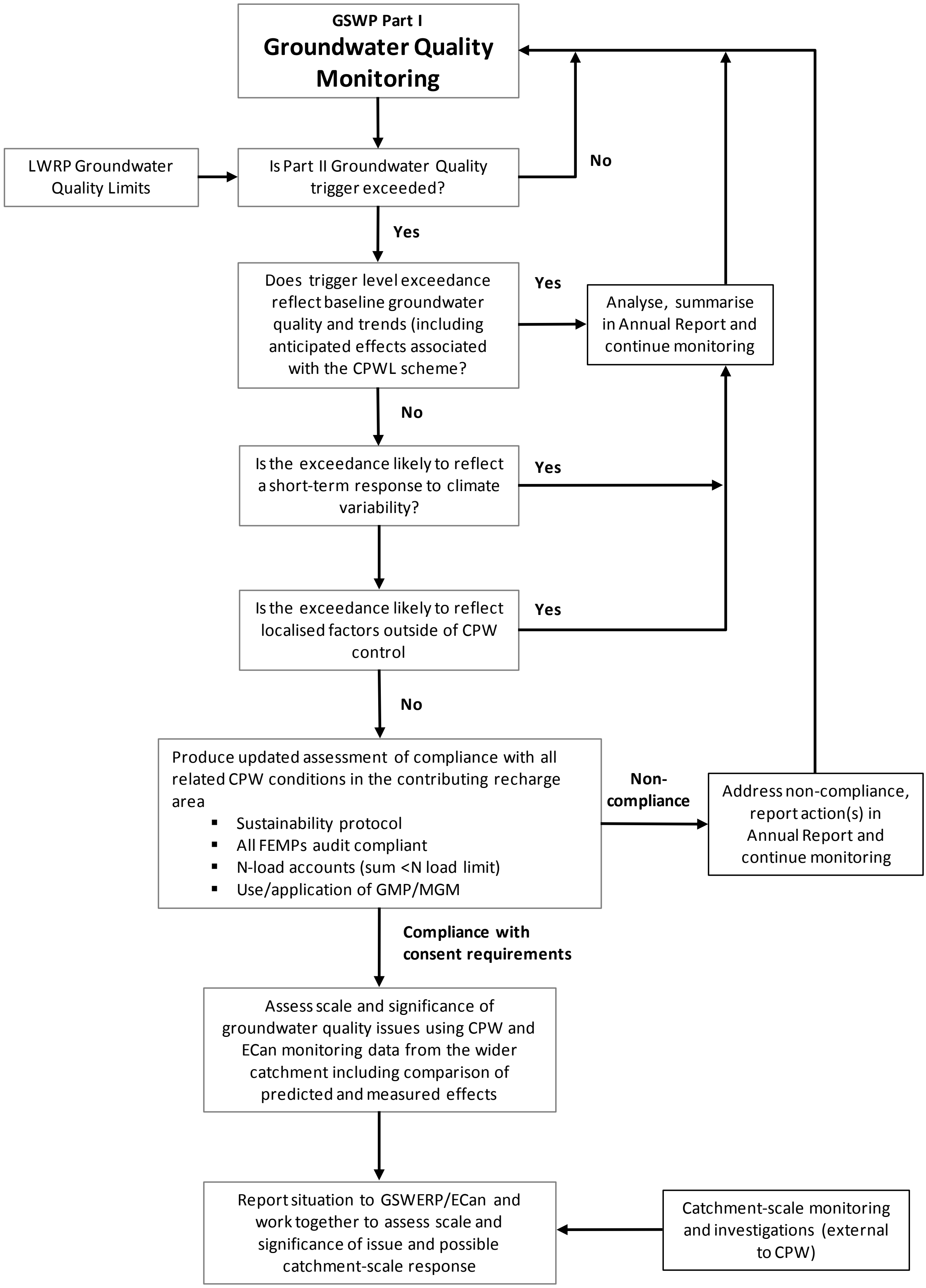


Figure 27. CPWL response to groundwater quality trigger level exceedance

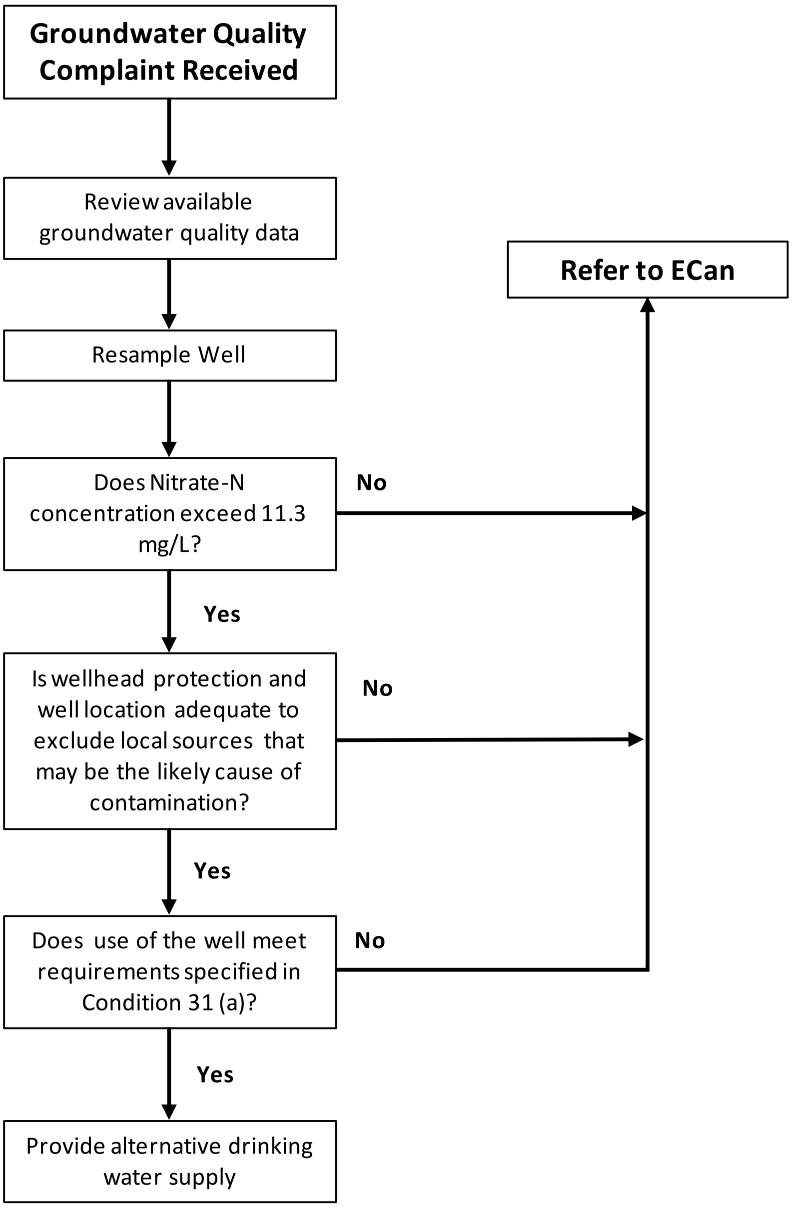


Figure 28. CPWL response to groundwater quality complaints

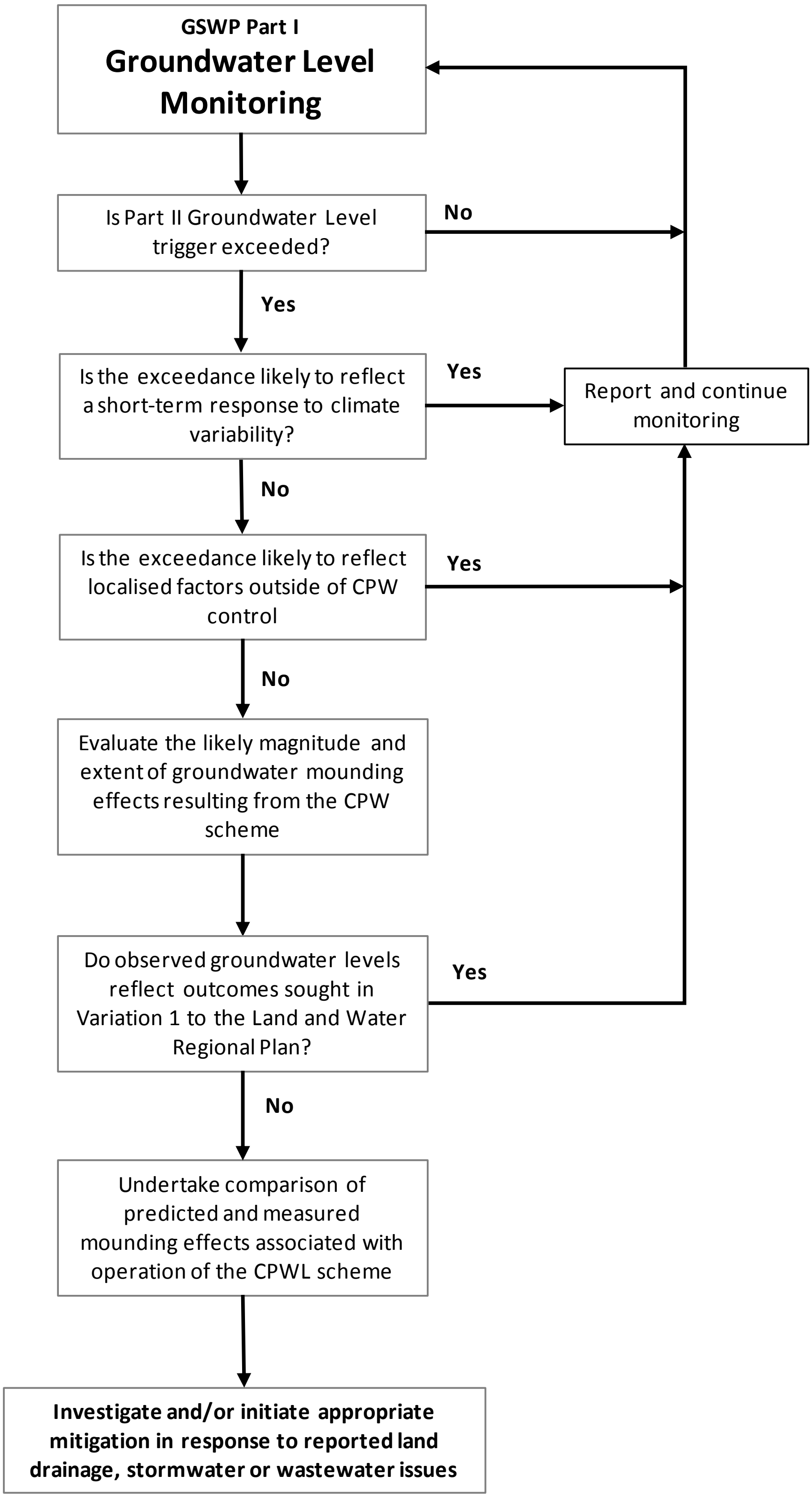


Figure 29. CPWL response to groundwater level trigger exceedance

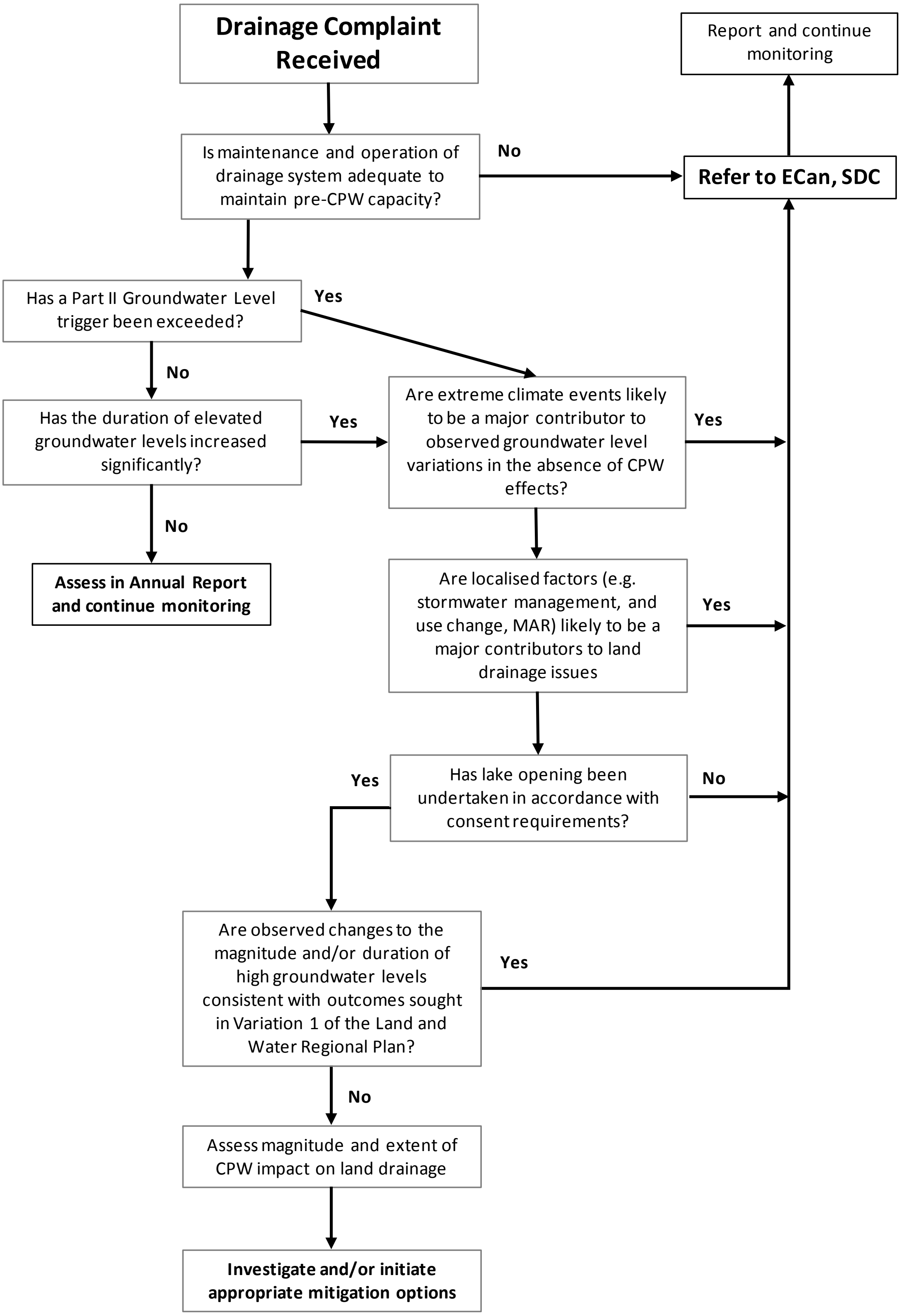


Figure 30. CPWL land drainage complaint response procedure

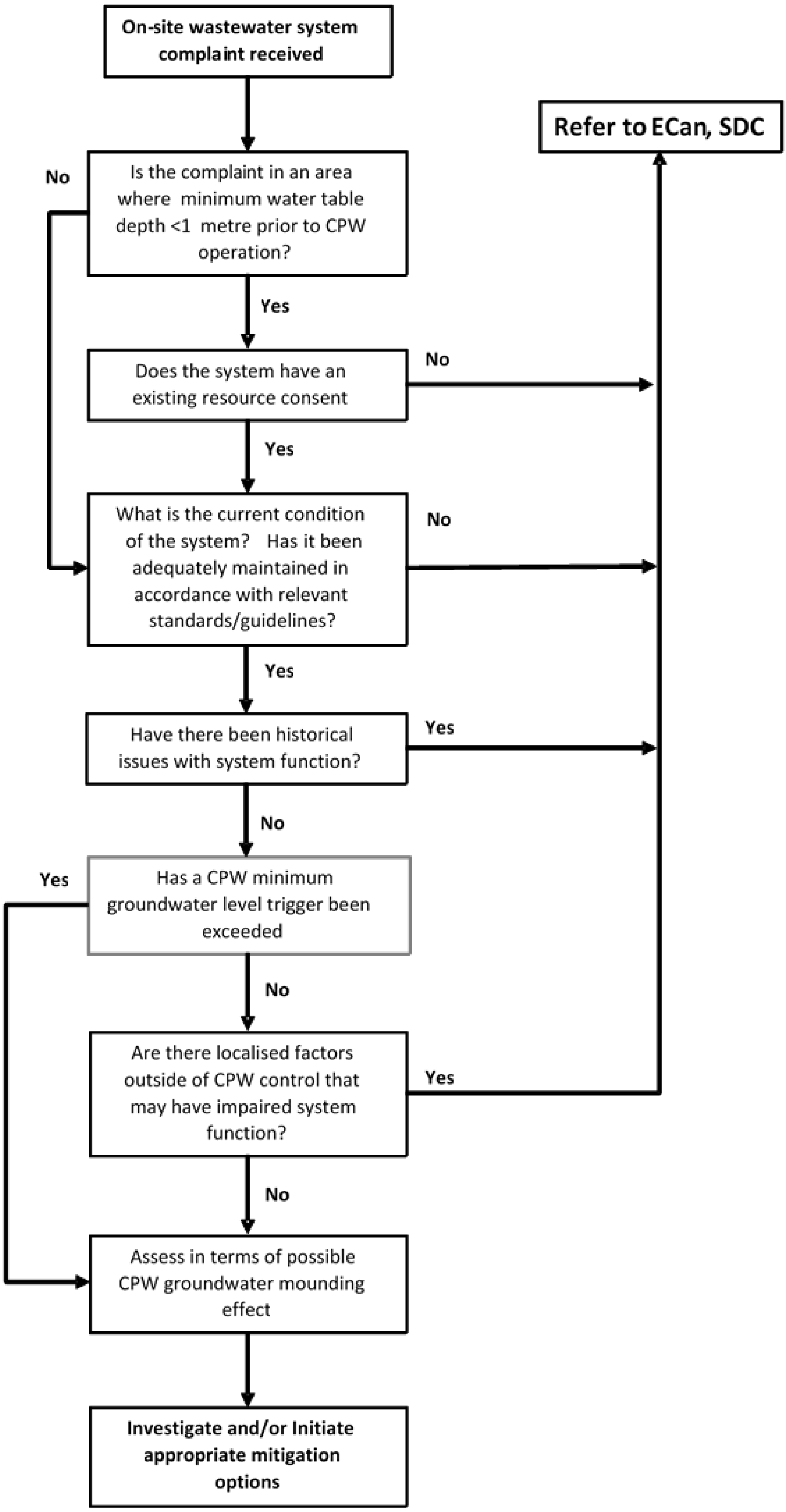


Figure 31. CPWL on-site wastewater complaint response procedure

6.2. Central Plains Water Ltd Annual Compliance Report 2016/2017 Irrigation Season

6.3. River and Stream Monitoring Data (ECan data shown blue)

US1	10/08/16	01/09/16	26/09/16	17/10/16	23/11/16	14/12/16	24/01/17	22/02/17	22/03/17	18/04/17	15/05/17	15/06/17
Nitrate + Nitrite-N (mg/L)	0.55	0.28	0.32	0.51	0.7	0.19	1.14	0.115	0.42	1.08	0.48	0.53
Total Ammoniacal-N (mg/L)	0.01	<0.010	0.021	0.026	<0.010	<0.010	0.027	0.032	<0.010	0.015	<0.010	<0.010
Total Nitrogen (mg/L)	0.67	0.46	0.77	0.66	0.84	0.38	1.49	0.26	0.55	1.2	0.59	0.65
E. coli (MPN/100ml)	31	35	131	99	148	1986	548	461	308	129	84	866
Dissolved Reactive Phosphorus (mg/L)	<0.004	0.004	0.007	0.008	0.006	0.006	0.01	0.01	0.004	0.006	0.005	0.004
Total Phosphorus (mg/L)	0.006	0.007	0.029	0.007	0.013	0.011	0.014	0.01	<0.004	0.008	0.004	0.011
Electrical Conductivity (µS/m)	98.88	91.83	81.31	79.5	84.25	79.81	92.39	114.4	99.98	76.84	89.95	96.51
Dissolved Oxygen (% Sat.)	103.4	103.9	98.1	98.2	97.8	98	97.4	88.5	94.7	98.7	94	98.4
pH	7.6	7.87	7.63	7.62	7.58	7.62	7.51	7.5	7.59	7.45	7.48	7.58
Temperature (DegC)	0.3	5.3	7.1	9.2	11.2	10.7	10.1	15.8	10.7	8.1	4.9	2
Turbidity (NTU)	0.6	0.6	5.8	2.5	1.2	2.6	4.4	<0.5	0.9	0.8	0.6	<0.5
Flow (cumec)	0.119	0.092	0.342	0.405	0.392	0.237	0.25	0.028	0.095	0.69	0.132	0.116

US2	10/08/16	01/09/16	26/09/16	17/10/16	23/11/16	14/12/16	24/01/17	22/02/17	22/03/17	18/04/17	15/05/17	21/06/17
Nitrate + Nitrite-N (mg/L)	0.49	0.07	dry	0.7	0.73	0.09	0.16	dry	dry	1.67	0.5	0.43
Total Ammoniacal-N (mg/L)	<0.010	<0.010	dry	0.015	0.016	<0.010	<0.010	dry	dry	0.024	<0.010	<0.010
Total Nitrogen (mg/L)	0.99	0.33	dry	1.26	1.24	0.75	0.71	dry	dry	2.45	1.09	0.81
E. coli (MPN/100ml)	107	7	dry	613	411	1203	921	dry	dry	326	205	326
Dissolved Reactive Phosphorus (mg/L)	0.018	0.008	dry	0.019	0.019	0.034	0.028	dry	dry	0.03	0.027	0.017
Total Phosphorus (mg/L)	0.031	0.012	dry	0.05	0.043	0.057	0.058	dry	dry	0.057	0.064	0.038
Electrical Conductivity (µS/m)	198.8	198.7	dry	171.4	158.5	183.5	180.9	dry	dry	170.2	197.3	218.2
Dissolved Oxygen (% Sat.)	106.3	98.9	dry	99.2	122.5	100.8	96.9	dry	dry	93.5	97.1	95.7
pH	7.93	7.65	dry	7.51	8.8/8.6	7.68	7.58	dry	dry	7.43	7.6	7.47
Temperature (DegC)	3.8	11.4	dry	13.3	18.3	19	17.2	dry	dry	12.2	8.7	3.6
Turbidity (NTU)	4.8	1	dry	5.9	3.2	3.8	7.8	dry	dry	5.2	4.4	3.5
Flow (cumec)	0.07829	0.01	dry	0.14	0.119	0.059	0.034	dry	dry	0.623	0.109	2.377

US3	10/08/16	16/08/16	15/09/16	13/10/16	15/11/16	08/12/16	17/01/17	17/02/17	13/03/17	11/04/17	16/05/17	15/06/17
Nitrate + Nitrite-N (mg/L)	0.49	0.32	0.191	0.161	0.27	0.184	0.184	0.104	0.155	0.36	0.31	0.33
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	0.99	0.38	0.24	0.25	0.4	0.26	0.22	0.15	0.36	0.51	0.37	0.36
E. coli (MPN/100ml)	107	12	6	26	345	119	59	79	461	649	41	28
Dissolved Reactive Phosphorus (mg/L)	0.018	<0.0010	<0.0010	<0.0010	0.0017	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (mg/L)	0.031	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.005	0.004	0.008
Electrical Conductivity (µS/m)	198.8	94	96.7	99.5	93.1	102.2	101	103.2	101.3	96.5	103.3	103.8
Dissolved Oxygen (% Sat.)	106.3	107.8	113.6	103.3	99.4	99.1	100.1	104.1	100.6	97.4	105.6	102.9
pH	7.93	7.38	7.76	7.2	7.65	7.64	7.53	7.66	7.55	7.42	7.2	7.7
Temperature (DegC)	3.8	5.3	9.3	8.6	13.4	12.7	13.2	14	12.3	12.4	8.7	6
Turbidity (NTU)	4.8	1.11	0.42	0.69	2.4	0.39	0.19	0.19	1.83	1.55	0.31	0.24
Flow (cumec)	0.07829	3.128	2.057	0.629	0.786	2.068	0.827	0.811	2.441	4.64	2.177	1.785

US4	10/08/16	01/09/16	26/09/16	25/10/16	23/11/16	14/12/16	24/01/17	22/02/17	22/03/17	19/04/17	15/05/17	21/06/17
Nitrate + Nitrite-N (mg/L)	0.74	0.24	0.25	0.6	1.53	0.62	0.71	0.33	0.37	1.35	0.99	0.94
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	1.02	0.53	0.78	0.84	1.81	0.97	0.98	0.53	0.52	1.7	1.2	1.4
E. coli (MPN/100ml)	31	31	1733	99	205	228	326	270	194	225	40	25
Dissolved Reactive Phosphorus (mg/L)	0.006	0.005	0.009	0.012	0.012	0.014	0.016	0.014	0.01	0.012	0.009	0.005
Total Phosphorus (mg/L)	0.015	0.045	0.036	0.018	0.018	0.022	0.023	0.019	0.011	0.062	0.014	0.011
Electrical Conductivity (μS/m)	108.7	94.26	94.06	88.58	99.42	84.67	82.58	113.2	95.77	88.68	102.2	107.1
Dissolved Oxygen (% Sat.)	109.5	107.5	99.6	94.9	94.2	94.5	91.9	92.2	94.7	93.5	94.3	100.8
pH	7.74	8.41	7.63	7.32	7.3	7.27	7.2	7.35	7.31	7.05	7.26	7.61
Temperature (DegC)	4.3	8.3	9.1	11	14.3	13	13.3	16.4	12.4	9.6	7.7	6.1
Turbidity (NTU)	2.5	1.2	9.6	1.8	2	2.9	4.1	1.3	1.1	2.5	1	0.7
Flow (cumec)	0.228	0.144	0.324	0.302	0.41	0.487	0.469	0.036	0.195	1.242	0.286	0.162

IS1	10/08/16	01/09/16	26/09/16	25/10/16	23/11/16	14/12/16	24/01/17	22/02/17	22/03/17	18/04/17	15/05/17	15/06/17
Nitrate + Nitrite-N (mg/L)	2.35	1.84	1.48	0.92	1.2	0.94	dry	dry	dry	2.07	1.99	2.37
Total Ammoniacal-N (mg/L)	<0.010	0.014	<0.010	<0.010	<0.010	<0.010	dry	dry	dry	0.011	<0.010	0.01
Total Nitrogen (mg/L)	2.51	2	1.6	1.15	1.36	1.16	dry	dry	dry	2.34	2.14	2.57
E. coli (MPN/100ml)	10	23	155	135	118	91	dry	dry	dry	194	86	30
Dissolved Reactive Phosphorus (mg/L)	0.004	0.008	0.005	0.004	0.006	0.006	dry	dry	dry	0.012	0.005	0.004
Total Phosphorus (mg/L)	<0.004	0.004	<0.004	<0.004	0.005	0.005	dry	dry	dry	0.016	0.005	0.007
Electrical Conductivity (μS/m)	130.1	121.6	120	110.8	116.9	118.5	dry	dry	dry	124.4	132.5	135.6
Dissolved Oxygen (% Sat.)	110	116.3	106.7	101.3	103.7	115.2	dry	dry	dry	91.6	111.1	122
pH	7.9	8.9	.	7.48	7.48	8.39	dry	dry	dry	7.25	8.33	8.46
Temperature (DegC)	6.4	10.4	9.8	10.8	13.1	15.1	dry	dry	dry	11.6	10.1	7.1
Turbidity (NTU)	<0.5	<0.5	<0.5	0.7	0.7	1	dry	dry	dry	0.8	<0.5	<0.5
Flow (cumec)	0.056	0.089	0.113	0.578	1.025	0.133	dry	dry	dry	2.011	0.244	0.207

IS2	10/04/17
Nitrate + Nitrite-N (mg/L)	4.4
Total Ammoniacal-N (mg/L)	<0.010
Total Nitrogen (mg/L)	5.2
E. coli (MPN/100ml)	236
Dissolved Reactive Phosphorus (mg/L)	0.028
Total Phosphorus (mg/L)	0.038
Electrical Conductivity (μS/m)	157.8
Dissolved Oxygen (% Sat.)	74.6
pH	6.34
Temperature (DegC)	14
Turbidity (NTU)	2.8
Flow (cumec)	0.002

IS3	24/11/16	10/04/17	31/05/17
Nitrate + Nitrite-N (mg/L)	0.3	0.66	0.68
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	0.45	0.89	0.85
E. coli (MPN/100ml)	64	172	10
Dissolved Reactive Phosphorus (mg/L)	0.006	0.006	0.007
Total Phosphorus (mg/L)	<0.004	0.007	0.011
Electrical Conductivity (μS/m)	109.1	104.6	114.3
Dissolved Oxygen (% Sat.)	98.8	93.8	98.9
pH	7.68	7.48	7.34
Temperature (DegC)	13.5	13.7	8.7
Turbidity (NTU)	1.7	2.7	<0.5
Flow (cumec)	0.715	2.336	0.003

IS4	10/08/16	01/09/16	26/09/16	25/10/16	23/11/16	14/12/16	24/01/17	22/02/17	15/03/17	11/04/17	16/05/17	21/06/17
Nitrate + Nitrite-N (mg/L)	1.25	1.16	1.12	0.9	0.8	0.69	0.7	0.84	0.87	1.34	1.37	1.65
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	0.012	0.013	0.011	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	1.33	1.3	1.22	1.13	0.94	0.85	0.83	0.97	0.99	1.7	1.64	1.76
E. coli (MPN/100ml)	68	37	43	148	79	114	199	411	579	921	78	96
Dissolved Reactive Phosphorus (mg/L)	0.005	<0.004	<0.004	0.006	0.008	0.004	0.006	0.009	0.007	0.016	0.008	0.006
Total Phosphorus (mg/L)	0.006	0.005	0.004	<0.004	0.007	0.004	0.005	0.006	0.008	0.02	0.01	0.013
Electrical Conductivity (μS/m)	129.1	127.4	128.1	120.3	118.5	117.6	118.4	117.5	119.6	119.7	134.5	133.9
Dissolved Oxygen (% Sat.)	105.1	108.2	109.2	102.1	95	101.1	103.1	92.1	91.9	85.3	94.9	97.2
pH	7.63	7.76	7.79	7.41	7.22	7.3	7.42	7.27	7.43	7.14	7.26	7.4
Temperature (DegC)	9.2	11.5	11	13	13.9	14.7	16.2	13.3	12.4	12.4	10.4	9.9
Turbidity (NTU)	0.7	0.7	<0.5	0.6	0.7	0.6	0.8	1.3	1.8	0.8	<0.5	0.7
Flow (cumec)	0.249	0.669	0.503	0.995	1.077	1.645	0.625	0.11	0.036	1.659	1.813	1.529

SF1	11/08/16	05/09/16	28/09/16	19/10/16	16/11/16	15/12/16	25/01/17	20/02/17	28/03/17	26/04/17	23/05/17	26/06/17
Nitrate + Nitrite-N (mg/L)	3.9	3.8	3.6	3.5	3.3	3.2	2.9	2.7	2.9	3.1	3.3	3
Total Ammoniacal-N (mg/L)	0.042	0.037	0.017	<0.010	<0.010	<0.010	0.01	0.03	0.039	0.015	0.021	0.031
Total Nitrogen (mg/L)	4	4	3.8	3.6	3.5	3.5	3.2	3	3	3.4	3.5	3.3
E. coli (MPN/100ml)	59	770	313	387	249	201	1203	2419	1414	488	248	548
Dissolved Reactive Phosphorus (mg/L)	0.034	0.017	0.016	0.016	0.018	0.024	0.024	0.03	0.025	0.024	0.017	0.019
Total Phosphorus (mg/L)	0.088	0.053	0.029	0.026	0.022	0.026	0.034	0.038	0.027	0.034	0.029	0.028
Electrical Conductivity (μS/m)	232.2	232.6	226.3	216.2	217.5	212.2	214.8	212.8	217.2	226.9	229.2	225.7
Dissolved Oxygen (% Sat.)	98.2	97.3	107.3	126	97.8	112.7	80.9	84.1	77.5	102.5	82.6	82.3
pH	7.86	7.72	8	8.53	7.64	8.03	7.38	7.24	7.42	7.76	7.35	7.3
Temperature (DegC)	11.2	12.8	14.6	16.5	14.3	17.5	15.2	16.9	13.4	14.1	10.5	8.4
Turbidity (NTU)	10.5	7.7	3.3	3.8	2	1.2	1.5	2.7	2.7	2.8	1.4	3
Flow (cumec)	0.435	0.442	0.443	0.440	0.462	0.409	0.351	0.282	0.370	0.455	0.517	0.600

SF2	11/08/16	05/09/16	28/09/16	19/10/16	16/11/16	15/12/16	25/01/17	20/02/17	28/03/17	26/04/17	23/05/17	26/06/17
Nitrate + Nitrite-N (mg/L)	4.2	4.3	4.3	4.2	4.2	4.4	4.3	4.8	4.1	4	3.9	3.7
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.014	<0.010	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	4.2	4.5	4.4	4.3	4.2	4.5	4.4	49	4.1	4	4	3.8
E. coli (MPN/100ml)	42	42	61	14	41	147	93	66	108	185	123	285
Dissolved Reactive Phosphorus (mg/L)	0.008	0.004	0.006	0.005	0.006	0.008	0.008	0.005	0.008	0.008	0.01	0.009
Total Phosphorus (mg/L)	0.008	0.012	<0.004	0.01	0.005	0.008	0.007	<0.004	0.009	0.008	0.017	0.009
Electrical Conductivity (µS/m)	241.9	241.3	237.5	232.2	233.3	233.3	230.4	236.1	236.4	232.7	230.1	228
Dissolved Oxygen (% Sat.)	94.7	88.4	86.1	103.2	91.4	80	82.8	78	79.6	93.6	72.9	78.3
pH	7.36	7.11	7.04	7.18	7.03	6.87	7.15	6.81	7.03	7.12	n/a	7.27
Temperature (DegC)	11.2	13.4	13.4	15.7	14.9	14.2	15.5	15.6	13.9	14.2	12.4	11.6
Turbidity (NTU)	0.7	0.9	<0.5	0.5	1.2	0.5	0.8	<0.5	<0.5	0.7	0.5	1
Flow (cumec)	0.084	0.056554	0.07	0.07	0.087	0.059	0.065	0.059	0.081	0.086	0.09	0.087

SF3	11/08/16	31/08/16	22/09/16	19/10/16	16/11/16	15/12/16	25/01/17	20/02/17	22/03/17	27/04/17	23/05/17	26/06/17
Nitrate + Nitrite-N (mg/L)	8.5	8.4	8.1	7.9	7.5	7.3	7.4	8.2	dry	6.9	6.7	6.4
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	dry	<0.010	<0.010	<0.01
Total Nitrogen (mg/L)	8.6	8.5	8.1	8	7.6	7.4	7.6	8.3	dry	7.2	6.9	6.6
E. coli (MPN/100ml)	4	4	11	21	27	35	79	105	dry	46	18	13
Dissolved Reactive Phosphorus (mg/L)	0.006	<0.004	0.004	0.004	0.004	0.004	0.006	0.007	dry	<0.004	0.006	<0.004
Total Phosphorus (mg/L)	<0.004	<0.004	<0.004	0.007	<0.004	0.005	<0.004	0.005	dry	0.005	0.01	<0.004
Electrical Conductivity (µS/m)	258.5	256.4	253	242.6	241.6	240.9	237.8	238.9	dry	240.9	241.3	242.4
Dissolved Oxygen (% Sat.)	95.2	93.1	91	83.3	78.2	71.5	59.2	58.6	dry	87.4	99.7	96.5
pH	7.4	7.42	7.31	7.15	7.07	6.98	6.83	6.71	dry	7.37	7.48	7.39
Temperature (DegC)	9.6	12.2	12.1	15.8	16.6	18.2	17.7	17.6	dry	13.3	11.8	9.4
Turbidity (NTU)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	dry	0.6	<0.5	<0.5
Flow (cumec)	0.19	0.1793882	0.18	0.151	0.133	0.085	0.005	0.006	dry	0.261	0.459	0.582

SF4	24/11/16	19/12/16	16/05/17	21/06/17
Nitrate + Nitrite-N (mg/L)	3.7	1.77	1.59	1.84
Total Ammoniacal-N (mg/L)	0.02	0.017	0.01	<0.010
Total Nitrogen (mg/L)	4	1.99	1.84	2.11
E. coli (MPN/100ml)	548	228	172	123
Dissolved Reactive Phosphorus (mg/L)	0.044	0.018	0.02	0.017
Total Phosphorus (mg/L)	0.048	0.019	0.021	0.018
Electrical Conductivity (µS/m)	200.5	154	151.8	140.8
Dissolved Oxygen (% Sat.)	67.9	42.9	68.3	75.4
pH	6.45	6.37	6.54	6.63
Temperature (DegC)	12.4	12.3	11.9	11.1
Turbidity (NTU)	0.8	<0.5	<0.5	<0.5
Flow (cumec)	0.049	0.058	0.093	0.067

SF5	27/06/17
Nitrate + Nitrite-N (mg/L)	7.8
Total Ammoniacal-N (mg/L)	<0.010
Total Nitrogen (mg/L)	8.3
E. coli (MPN/100ml)	21
Dissolved Reactive Phosphorus (mg/L)	0.042
Total Phosphorus (mg/L)	0.048
Electrical Conductivity (µS/m)	386.4
Dissolved Oxygen (% Sat.)	101.1
pH	7.24
Temperature (DegC)	7.9
Turbidity (NTU)	1.3
Flow (cumec)	0.135

SWSH	18/04/17
Nitrate + Nitrite-N (mg/L)	1.05
Total Ammoniacal-N (mg/L)	<0.010
Total Nitrogen (mg/L)	1.36
E. coli (MPN/100ml)	101
Dissolved Reactive Phosphorus (mg/L)	0.01
Total Phosphorus (mg/L)	0.014
Electrical Conductivity (µS/m)	114.6
Dissolved Oxygen (% Sat.)	94.8
pH	7.51
Temperature (DegC)	13.8
Turbidity (NTU)	2
Flow (cumec)	6.440

SF6	15/08/16	05/09/16	26/09/16	27/10/16	28/11/16	15/12/16	23/01/17	20/02/17	22/03/17	19/04/17	29/05/17	27/06/17
Nitrate + Nitrite-N (mg/L)	5	3.9	dry	dry	dry	dry	dry	dry	dry	8.3	12.6	10.6
Total Ammoniacal-N (mg/L)	<0.010	<0.010	dry	dry	dry	dry	dry	dry	dry	0.019	0.015	0.01
Total Nitrogen (mg/L)	5.4	4.3	dry	dry	dry	dry	dry	dry	dry	8.8	12.9	11.1
E. coli (MPN/100ml)	4	17	dry	dry	dry	dry	dry	dry	dry	122	272	22
Dissolved Reactive Phosphorus (mg/L)	0.005	0.004	dry	dry	dry	dry	dry	dry	dry	<0.004	0.006	0.007
Total Phosphorus (mg/L)	0.006	0.007	dry	dry	dry	dry	dry	dry	dry	0.006	0.005	<0.004
Electrical Conductivity (μS/m)	348.9	334.8	dry	dry	dry	dry	dry	dry	dry	664.6	464.2	391.7
Dissolved Oxygen (% Sat.)	105.5	110.9	dry	dry	dry	dry	dry	dry	dry	93	74.8	81.1
pH	7.72	8.17	dry	dry	dry	dry	dry	dry	dry	6.31	6.36	6.45
Temperature (DegC)	9	12.4	dry	dry	dry	dry	dry	dry	dry	14.8	11.5	11.2
Turbidity (NTU)	1.2	1	dry	dry	dry	dry	dry	dry	dry	0.8	3	<0.5
Flow (cumec)	0.001	0.001	dry	dry	dry	dry	dry	dry	dry	0.039	0.052	0.075

SF7 - dry for the entire monitoring period												

SF8	15/08/16	05/09/16	28/09/16	27/10/16	28/11/16	19/12/16	23/01/17	20/02/17	22/03/17	19/04/17	29/05/17	28/06/17
Nitrate + Nitrite-N (mg/L)	8.2	8.8	8.7	8.7	dry	dry	dry	dry	dry	dry	8.3	8.6
Total Ammoniacal-N (mg/L)	<0.010	0.01	<0.010	0.023	dry	dry	dry	dry	dry	dry	0.024	0.012
Total Nitrogen (mg/L)	8.4	9	8.7	8.9	dry	dry	dry	dry	dry	dry	8.8	8.8
E. coli (MPN/100ml)	29	88	649	172	dry	dry	dry	dry	dry	dry	613	91
Dissolved Reactive Phosphorus (mg/L)	0.004	<0.004	<0.004	0.008	dry	dry	dry	dry	dry	dry	0.028	0.009
Total Phosphorus (mg/L)	<0.004	0.009	<0.004	0.007	dry	dry	dry	dry	dry	dry	0.038	0.01
Electrical Conductivity (μS/m)	324.6	318.2	311.4	304.1	dry	dry	dry	dry	dry	dry	327.3	323.7
Dissolved Oxygen (% Sat.)	84.8	82.9	85.7	70.4	dry	dry	dry	dry	dry	dry	56	88.2
pH	6.9	6.8	6.81	6.75	dry	dry	dry	dry	dry	dry	6.72	7.8
Temperature (DegC)	12.1	12.5	13	14.4	dry	dry	dry	dry	dry	dry	10.5	12.2
Turbidity (NTU)	<0.5	0.6	<0.5	<0.5	dry	dry	dry	dry	dry	dry	2	<0.5
Flow (cumec)	0.004	4	0.01	0.005	dry	dry	dry	dry	dry	dry	0.001	0.01

SWT1	15/08/16	31/08/16	22/09/16	25/10/16	28/11/16	19/12/16	23/01/17	23/02/17	15/03/17	10/04/17	16/05/17	21/06/17
Nitrate + Nitrite-N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.005	<0.01	<0.01	<0.01	0.03
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	<0.010	0.014	<0.010	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	<0.10	0.38	0.14	0.13	<0.1	0.19	<0.1	<0.11	0.12	<0.10	0.1	0.27
E. coli (MPN/100ml)	77	96	816	2419	1553	2419	488	579	345	167	49	19
Dissolved Reactive Phosphorus (mg/L)	0.004	0.004	0.006	0.006	<0.004	0.004	0.004	<0.004	<0.004	<0.004	0.004	0.005
Total Phosphorus (mg/L)	0.008	0.012	0.008	0.024	0.007	0.019	0.01	<0.004	<0.004	0.005	<0.004	<0.004
Electrical Conductivity (μS/m)	67.79	64.33	61.25	58.83	52.49	56.33	50.3	59.97	63.09	65.19	67.8	73.21
Dissolved Oxygen (% Sat.)	100.4	101.5	101	100.1	99.8	96.5	99.7	96.6	98.9	98.3	99.2	98.4
pH	7.72	7.94	7.9	8.38	7.49	7.52	7.64	7.69	7.96	8.08	7.86	7.83
Temperature (DegC)	5.2	10	11	20.8	12.5	16.2	16	18.3	15.9	14.7	8.3	7.3
Turbidity (NTU)	4.3	4.9	10.2	8.2	15.1	27.9	29.8	3.2	2.3	2.5	2.7	2.9
Flow (cumec)	dry	dry	dry	dry	dry	dry	dry	dry	dry	6.44	dry	dry

SWT2	15/08/16	31/08/16	22/09/16	25/10/16	28/11/16	19/12/16	23/01/17	23/02/17	15/03/17	11/04/17	16/05/17	21/06/17
Nitrate + Nitrite-N (mg/L)	0.04	0.11	<0.01	0.03	<0.01	<0.01	0	0.003	<0.01	<0.01	<0.01	<0.01
Total Ammoniacal-N (mg/L)	<0.010	0.131	<0.010	<0.010	<0.010	<0.010	0	<0.010	0.012	<0.010	0.015	<0.010
Total Nitrogen (mg/L)	0.2	0.53	0.14	0.51	0.34	0.64	0	0.27	0.15	0.28	0.4	0.3
E. coli (MPN/100ml)	99	32	199	308	219	365	0	687	195	816	185	33
Dissolved Reactive Phosphorus (mg/L)	0.01	0.014	0.01	0.026	0.008	0.016	0	0.01	0.008	0.006	0.01	0.008
Total Phosphorus (mg/L)	0.027	0.046	0.024	0.086	0.043	0.129	0	0.014	0.033	0.016	0.029	0.02
Electrical Conductivity (µS/m)	67.91	67.52	58.83	57.13	73.02	60.2	0	58.35	61.35	67.66	68.87	68.7
Dissolved Oxygen (% Sat.)	99.1	108.1	108.6	140.1	106.1	108.3	0	91.9	90.9	89.2	96.4	99.6
pH	7.52	7.84	[8.55] err	9.84	7.92	8.11	0	7.22	7.15	7.47	7.55	7.69
Temperature (DegC)	4.6	9.4	10.7	20.9	10.6	16.2	0	19.6	16.1	13.5	8.6	7.8
Turbidity (NTU)	15.6	17.5	10	20.9	22.5	54.6	<0.0001	7.1	4.7	2.7	6	3.7
Flow (cumec)	0.009	0.010	0.022	0.008	0.003	0.005	0.000	0.016	0.006	0.012	0.008	0.019

SWT3	15/08/16	31/08/16	22/09/16	27/10/16	24/11/16	19/12/16	23/01/17	22/02/17	15/03/17	11/04/17	16/05/17	27/06/17
Nitrate + Nitrite-N (mg/L)	0.17	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.004	0.18	0.15	0.53	0.63
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.018
Total Nitrogen (mg/L)	0.27	0.3	0.15	0.15	0.23	0.15	0.24	0.19	0.54	0.53	0.67	0.81
E. coli (MPN/100ml)	5	285	70	435	387	517	276	770	65	99	46	24
Dissolved Reactive Phosphorus (mg/L)	0.007	0.004	0.008	0.006	0.004	0.004	0.006	<0.004	<0.004	0.016	0.006	0.006
Total Phosphorus (mg/L)	<0.004	0.004	0.005	0.005	0.008	0.017	0.007	0.008	0.01	0.013	0.007	<0.004
Electrical Conductivity (µS/m)	93.79	87.01	82.69	82	94.03	85.12	90.2	69.18	82.68	71.91	85.15	95.67
Dissolved Oxygen (% Sat.)	100.2	103.2	101.5	100.9	99.7	91.8	92	111	109.1	113.3	99.6	96.4
pH	7.72	7.91	7.67	7.7	7.46	7.47	7.34	8.78	8.35	9.33	7.75	n/a
Temperature (DegC)	4.5	8	10	13.8	16.1	13.6	13.7	19.8	13.9	14.1	8.1	3.7
Turbidity (NTU)	0.8	1	1.2	2	1.6	0.8	4	2.8	3.6	7.1	2.6	2
Flow (cumec)	0.002	0.005	0.01	0.005	0.005	0.018	0.014	0.009	0.003	0.007	0.006	0.006

SWT4	11/08/16	31/08/16	22/09/16	27/10/16	24/11/16	15/12/16	23/01/17	22/02/17	15/03/17	11/04/17	16/05/17	27/06/17
Nitrate + Nitrite-N (mg/L)	0.59	0.02	0.03	<0.01	0.01	<0.01	0.03	0.003	<0.01	0.07	0.08	0.29
Total Ammoniacal-N (mg/L)	<0.010	0.015	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	0.66	0.12	<0.10	0.15	<0.1	0.1	0.16	<0.11	<0.1	0.1	0.16	0.41
E. coli (MPN/100ml)	109	205	345	613	488	1553	579	816	261	127	411	38
Dissolved Reactive Phosphorus (mg/L)	0.004	<0.004	0.006	0.004	0.0006	0.005	0.004	0.005	0.005	0.004	<0.004	0.005
Total Phosphorus (mg/L)	0.013	0.011	0.007	0.01	0.009	0.011	0.018	0.006	0.007	0.015	0.005	<0.004
Electrical Conductivity (μS/m)	107	74.31	64.38	69.92	68.51	70.03	59.02	66.22	74.94	75.95	76.94	86.59
Dissolved Oxygen (% Sat.)	101	99.7	96.8	96.5	97.6	94	96.7	98	97.1	98.1	95.6	92.6
pH	7.67	7.76	7.62	7.64	7.61	7.48	7.43	7.76	7.68	7.82	7.66	7.59
Temperature (DegC)	4.6	8.2	9.3	12.2	14.4	16.8	13.2	18.7	13.7	13.5	8.4	4.6
Turbidity (NTU)	9.1	6	13.5	5.5	13.3	8.8	115	6.8	5.1	4.7	3.9	2.4
Flow (cumec)	0.099	0.124	0.139	0.199	0.16	0.191	0.171	0.165	0.197	0.191	0.187	0.001

T1	11/08/16	05/09/16	28/09/16	19/10/16	16/11/16	15/12/16	25/01/17	20/02/17	28/03/17	26/04/17	23/05/17	26/06/17
Nitrate + Nitrite-N (mg/L)	3	3	2.57	2.7	2.5	2.24	2.11	1.85	2.23	2.4	2.7	2.25
Total Ammoniacal-N (mg/L)	0.059	0.038	0.014	0.012	<0.010	0.015	<0.010	0.014	0.016	<0.010	<0.010	0.099
Total Nitrogen (mg/L)	3.3	3.2	2.87	2.9	2.8	2.56	2.46	2.08	2.33	2.8	3.2	4
E. coli (MPN/100ml)	21	146	238	63	93	108	28	48	157	22	108	816
Dissolved Reactive Phosphorus (mg/L)	0.024	0.023	0.028	0.022	0.022	0.036	0.03	0.04	0.027	0.066	0.053	0.083
Total Phosphorus (mg/L)	0.036	0.042	0.043	0.034	0.03	0.04	0.043	0.044	0.034	0.078	0.075	0.169
Electrical Conductivity (µS/m)	291.5	283.9	275.8	265.7	260.4	256.6	247.8	248.2	262.4	289.5	327.5	356.2
Dissolved Oxygen (% Sat.)	96.2	86.6	94.2	131.3	122.5	115.4	110.1	110.6	97.3	94.7	76.2	73.7
pH	7.73	7.56	7.64	8.64	8.44err	8.34	8.26	8.74	7.68	7.67	n/a	7.19
Temperature (DegC)	8.4	12.1	14.2	16.5	18.2	18.4	17.8	20.8	15.5	13.6	8.3	7.5
Turbidity (NTU)	3.7	3.4	4.4	3	2.1	1.5	1.6	1.1	0.6	1.6	4.4	33.2
Flow (cumec)	1.85	1.974	2.019	1.497	1.159	1.41	1.124	0.856	1.641	1.835	2.022	2.571

T2	19/07/16	18/08/16	21/09/16	17/10/16	22/11/16	13/12/16	18/01/17	20/02/17	21/03/17	20/04/17	16/05/17	20/06/17
Nitrate + Nitrite-N (mg/L)	3.4	3.3	2.9	2.9	2.8	2.7	2.7	2.7	2.8	2.8	3	2.9
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.024	0.022	<0.010
Total Nitrogen (mg/L)	3.4	3.1	3.3	3	2.9	2.9	3	3.1	2.7	3.2	3.3	3.1
E. coli (MPN/100ml)	81	67	138	313	147	134	125	96	69	162	144	105
Dissolved Reactive Phosphorus (mg/L)	0.0095	0.0078	0.0079	0.01	0.0045	0.0122	0.003	0.0069	0.01	0.028	0.0134	0.0089
Total Phosphorus (mg/L)	0.013	0.009	0.006	0.015	0.018	0.023	0.01	0.013	0.02	0.045	0.017	0.015
Electrical Conductivity (µS/m)	215.4	218.7	213.3	211.2	205.1	215.1	211.3	217.8	213.8	223.4	216.5	214.3
Dissolved Oxygen (% Sat.)	83.5	98.6	99.03	82.4	98.5	85	57.4	55.2	52	66.9	82.2	81.2
pH	7.56	7.56	7.47	7.29	7.49	7.37	7.11	7.18	7.25	6.98	7.09	7.07
Temperature (DegC)	10.8	11.5	11.6	12.5	14.7	13.7	16	17.1	5.38	13	12.2	10.9
Turbidity (NTU)	1.5	1.17	0.85	1.06	1.03	1.16	0.95	0.37	0.42	1.94	1.6	0.89
Flow (cumec)	0	1.85	2.136	1.508	1.518	1.531	0.846	0.857	1.221	2.05	1.909	2.2

T3	19/07/16	18/08/16	21/09/16	17/10/16	22/11/16	13/12/16	18/01/17	20/02/17	21/03/17	20/04/17	16/05/17	20/06/17
Nitrate + Nitrite-N (mg/L)	7.5	7.6	6.9	6.8	5.9	5.2	3.3	1.4	3.1	2.7	6.3	6.4
Total Ammoniacal-N (mg/L)	<0.010	0.019	<0.010	<0.010	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	6.6	6.6	6.6	6.1	5.7	5.6	5.6	1.74	3.4	2.9	6.5	6.6
E. coli (MPN/100ml)	210	60	152	236	135	249	579	461	86	141	93	120
Dissolved Reactive Phosphorus (mg/L)	0.0109	0.0062	0.0068	0.0097	0.0064	0.067	0.03	0.014	0.0127	0.0086	0.0067	0.0066
Total Phosphorus (mg/L)	0.014	0.195	0.005	0.015	0.018	0.089	0.03	0.012	0.03	0.018	0.006	0.007
Electrical Conductivity (μS/m)	261.3	263.3	262.7	256.7	248.5	267.2	258.8	258.7	209.3	181.1	257.5	265.9
Dissolved Oxygen (% Sat.)	93	111.3	110.9	89.7	123.4	120	58.9	78.6	68.9	83.9	113.4	102.3
pH	7.62	7.85	7.56	7.4	8.16	8.17	7.17	7.28	7.2	7.17	7.55	7.28
Temperature (DegC)	8.9	9.3	11.2	12.3	17.9	14.7	17.7	19.6	15	13.3	11.4	9.1
Turbidity (NTU)	0.22	0.34	0.36	0.5	0.45	0.47	0.29	0.18	0.16	0.54	0.28	0.36
Flow (cumec)	0	0.402	0.405	0.333	0.218	0.221	0.019	0.003	0.032	1.473	0.565	0.758

T4	15/08/16	05/09/16	28/09/16	26/06/17
Nitrate + Nitrite-N (mg/L)	<0.01	<0.01	<0.01	5.6
Total Ammoniacal-N (mg/L)	0.023	<0.01	<0.010	<0.010
Total Nitrogen (mg/L)	0.4	0.43	0.35	6.2
E. coli (MPN/100ml)	46	57	31	238
Dissolved Reactive Phosphorus (mg/L)	0.015	0.015	0.02	0.026
Total Phosphorus (mg/L)	0.039	0.059	0.053	0.044
Electrical Conductivity (µS/m)	478.4	473.5	469.8	305
Dissolved Oxygen (% Sat.)	38.3	45.8	48.1	83.1
pH	6.77	6.75	.	6.92
Temperature (DegC)	7.8	11.6	12.6	6.5
Turbidity (NTU)	7.1	6	3	1
Flow (cumec)	0.001	0.001	0.001	0.159

T5	15/08/16	05/09/16	26/09/16	27/10/16	28/11/16	15/12/16	23/01/17	20/02/17	22/03/17	19/04/17	29/05/17	28/06/17
Nitrate + Nitrite-N (mg/L)	0.067	<0.01	<0.01	<0.01	<0.01	<0.01	0	0	0	0.02	0.33	5.8
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	0	0	0	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	0.36	0.33	0.26	0.44	0.24	0.34	0	0	0	0.52	0.72	6.3
E. coli (MPN/100ml)	46	53	115	33	214	387	0	0	0	115	23	23
Dissolved Reactive Phosphorus (mg/L)	0.005	0.007	0.006	0.01	0.014	0.025	0	0	0	0.0064	0.018	0.03
Total Phosphorus (mg/L)	0.007	0.021	0.011	0.014	0.017	0.028	0	0	0	0.074	0.02	0.034
Electrical Conductivity (µS/m)	538.6	528.9	532.8	520.7	532.5	488.2	0	0	0	581.5	547.9	426.3
Dissolved Oxygen (% Sat.)	111.2	102.2	93.9	84.1	73.3	65.3	0	0	0	68.4	88.4	95
pH	8.33	8.22	7.91	7.66	7.45	7.38	0	0	0	7.45	7.62	7.5
Temperature (DegC)	7.6	11.5	11.1	13.5	12.6	17.6	0	0	0	11.4	8.7	8.6
Turbidity (NTU)	0.5	0.9	<0.5	<0.5	0.6	0.5	dry	dry	dry	0.8	8.7	0.6
Flow (cumec)	0.01	0.005	0.01	0.006	0.0002	0.002	dry	dry	dry	0.002	0.008	0.129

T6	15/08/16	05/09/16	21/09/16	28/09/16	27/10/16	28/11/16	13/12/16	19/12/16	23/01/17	20/02/17	21/03/17	22/03/17	27/04/17	29/05/17	20/06/17	28/06/17
Nitrate + Nitrite-N (mg/L)	4.3	4.2	4.2	4	3.5	1.43	2.3	0.28	0.18	0.141	0.143	0.08	6	8.1	9.5	8.2
Total Ammoniacal-N (mg/L)	0.041	0.028	0.031	0.039	0.034	0.048	0.032	0.012	0.048	0.087	0.027	0.03	<0.010	0.03	0.041	0.05
Total Nitrogen (mg/L)	5	4.8	4.8	4.5	4.2	1.92	3.2	0.9	0.44	0.63	0.48	0.42	6.7	8.6	9.8	8.9
E. coli (MPN/100ml)	55	291	365	866	649	727	1986	770	816	2419	>2420	>2419	291	172	167	173
Dissolved Reactive Phosphorus (mg/L)	0.043	0.031	0.04	0.048	0.06	0.084	0.092	0.1	0.042	0.034	0.024	0.026	0.032	0.027	0.039	0.028
Total Phosphorus (mg/L)	0.055	0.055	0.047	0.067	0.076	0.109	0.123	0.124	0.047	0.1	0.038	0.037	0.054	0.029	0.049	0.039
Electrical Conductivity (µS/m)	425.7	409.3	389.8	398.8	349.6	332.4	344.6	346.6	301.2	305.6	298	306.4	600	582.3	539	544.8
Dissolved Oxygen (% Sat.)	109.2	102.1	102.3	102.9	88.5	77.7	68.4	72.3	37.4	22.4	24	38.8	87.1	87.7	91.7	89.2
pH	8.11	7.9	7.71	7.78	7.47	7.32	7.33	7.24	6.8	7	6.88	6.81	7.71	7.06	7.33	7.27
Temperature (DegC)	9.3	12.7	10.8	14.1	15.6	16.3	14.9	17.4	15	17.7	14	14.3	13.1	8.9	7.8	9.4
Turbidity (NTU)	1.1	3.3	1.22	1.5	2.4	1.2	1.29	1.3	2.6	13.8	3.1	1.6	1	0.9	0.52	1
Flow (cumec)	0.071	0.0563	n/a	0.0486	0.031	0.018	n/a	0.012	0.008	0.008	n/a	0.007	0.07	0.126	n/a	0.202

T7	15/08/16	05/09/16	21/09/16	28/09/16	27/10/16	28/11/16	13/12/16	19/12/16	23/01/17	20/02/17	21/03/17	22/03/17	19/04/17	29/05/17	20/06/17	28/06/17
Nitrate + Nitrite-N (mg/L)	1.76	1.57	0.76	0.72	0.3	0.31	0.21	0.1	0.02	0.004	0.066	0.09	0.41	2.7	3.5	3.1
Total Ammoniacal-N (mg/L)	0.015	0.011	<0.010	0.011	0.039	0.026	0.041	0.017	0.037	0.012	0.018	0.018	0.022	<0.010	0.012	<0.010
Total Nitrogen (mg/L)	2.22	2.01	1.23	1.11	0.73	0.62	0.75	0.56	0.4	0.46	0.46	0.42	0.9	3.4	3.9	3.6
E. coli (MPN/100ml)	28	291	548	387	517	770	548	>2419	1300	687	866	816	140	83	69	49
Dissolved Reactive Phosphorus (mg/L)	0.009	0.008	0.0069	0.012	0.034	0.024	0.068	0.056	0.042	0.032	0.038	0.04	0.056	0.011	0.0151	0.015
Total Phosphorus (mg/L)	0.011	0.017	0.016	0.016	0.043	0.03	0.103	0.071	0.053	0.045	0.042	0.051	0.06	0.015	0.032	0.019
Electrical Conductivity (µS/m)	402.3	397.2	316.8	375.5	306.8	283	265.4	284.6	295.8	285.2	296.2	305.8	362.2	476.5	341.3	481.2
Dissolved Oxygen (% Sat.)	107.4	114	112	113.1	94.1	8.91	63.3	93.5	72	117.8	49	46.2	65.7	80.4	89.9	96
pH	7.77	8.02	7.99	7.91	7.43	7.42	7.2	7.18	6.97	7.26	7.06	6.92	7.41	7.04	7.35	7.89
Temperature (DegC)	10.5	12.7	10.8	14	16.5	17.1	13.3	19.6	19.4	25.8	11.2	14.8	13.3	9.6	7.5	9.9
Turbidity (NTU)	1	0.9	0.63	0.7	0.9	0.7	0.64	2	1.2	0.8	0.5	0.6	0.7	0.6	0.56	0.5
Flow (cumec)	0.051	0.041	0.033	0.031	1.128	1.101	0.018	0.004	0.002	0.0002	0.004	0.004	0.033	0.045	0.066	0.094

T8	19/07/16	18/08/16	21/09/16	17/10/16	22/11/16	13/12/16	18/01/17	20/02/17	21/03/17	20/04/17	16/05/17	20/06/17
Nitrate + Nitrite-N (mg/L)	7.4	7.1	7	7.1	6.8	6.9	7	7	7.3	6.5	7	7
Total Ammoniacal-N (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010
Total Nitrogen (mg/L)	6.3	6.5	6.7	6.2	6	6.5	6.4	6.5	6.4	6.6	6.6	6.4
E. coli (MPN/100ml)	162	199	1046	435	201	980	649	980	326	204	326	345
Dissolved Reactive Phosphorus (mg/L)	0.0071	0.0063	0.0026	0.0037	0.0052	0.0069	0.0118	0.0075	0.0042	0.0055	0.0078	0.0077
Total Phosphorus (mg/L)	0.012	0.011	<0.004	0.006	0.008	0.009	0.009	0.005	0.008	0.012	0.007	0.011
Electrical Conductivity (µS/m)	240.5	247.9	245.5	242.2	225.4	230.4	212.8	216	219.1	242.3	240.4	258.7
Dissolved Oxygen (% Sat.)	87.3	89.4	99.6	87.4	92.9	83.7	82	80.8	78.8	82.5	87.9	85.9
pH	7.01	7.8	8.09	7.98	7.52	7.52	7.66	7.79	7.57	7.9	7.58	7.96
Temperature (DegC)	10.7	11.1	11.1	11.8	12.4	11.9	12.6	13.1	12.3	11.8	11.6	10.5
Turbidity (NTU)	2.8	1.55	1.95	1.55	0.71	0.81	1.08	0.85	0.42	0.82	1.36	0.88
Flow (cumec)	0	0.94	0.967	data gap	0.492	0.738	0.594	0.564	0.627	0.751	0.817	0.958

6.4. Lake Water Quality Monitoring Results (Ecan data)

Kaituna Lagoon	22/07/16	18/08/16	19/09/16	03/10/16	02/11/16	30/11/16	19/12/16	12/01/17	07/02/17	09/03/17	10/04/17	15/05/17	16/06/17
Ammoniacal-N (mg/L)	0.053	<0.010	<0.010	-	0.036	<0.010	<0.010	-	<0.010	<0.010	<0.010	0.026	<0.010
Nitrate + Nitrite-N (mg/L)	0.42	0.25	0.0024	-	0.106	0.0014	<0.0010	-	0.0021	0.026	0.176	0.0037	0.0031
Total Nitrogen (mg/L)	0.84	0.82	1.02	-	0.41	1.51	1.67	-	1.35	1.62	0.95	1.73	1.84
Chlorphyll A (mg/L)	0.0019	0.009	0.03	-	0.0008	0.022	0.04	-	0.016	0.019	0.008	0.039	0.041
Dissolved Oxygen	72.4	100.7	96.1	76.1	69.7	87.1	117.2	98.5	101.1	103.8	105.9	100.7	-
Electrical Conductivity (mS/m)	230	437.8	806	-	27.2	1294	1440	-	1762	5490	479	1349	1050
E coli (MPN/100ml)	15	98	110	-	579	1333	110	-	>24200	670	1553	52	1014
Dissolved Reactive Phosphorus (mg/L)	0.021	0.0169	0.0072	-	0.035	0.0051	0.0063	-	0.016	0.04	0.0079	0.0069	0.0138
Total Phosphorus (mg/L)	0.069	0.057	0.114	-	0.061	0.159	0.3	-	0.064	0.28	0.07	0.123	0.21
pH	8	7.84	8.2	8.25	7.48	7.9	8.2	-	8.2	-	7.85	8.1	-
Temperature (DegC)	9.3	11.9	14.2	16.3	17.1	13.5	21.2	16.8	16.5	21.8	16.8	10.5	-
Turbidity (NTU)	28	21	44	-	15.5	97	148	-	63	153	27	78	56

Off Selwyn River Mouth	22/07/16	18/08/16	19/09/16	02/11/16	30/11/16	19/12/16	07/02/17	09/03/17	10/04/17	15/05/17	16/06/17
Ammoniacal-N (mg/L)	0.021	<0.010	0.015	<0.010	0.029	0.014	0.028	<0.010	0.016	0.032	<0.01
Nitrate + Nitrite-N (mg/L)	0.39	0.113	0.0037	<0.0010	0.0017	0.001	0.0015	0.0012	0.0024	0.031	0.43
Total Nitrogen (mg/L)	1.81	1.34	1.79	2.1	2.6	2.3	3.2	3	2.3	2	2.5
Chlorphyll A (mg/L)	0.043	0.042	0.094	0.058	0.041	0.07	0.087	0.07	0.069	0.068	0.07
Dissolved Oxygen	107.7	114.8	104.9	78.2	100.9	122.8	93.1	101.1	101.8	109.6	103.2
Electrical Conductivity (mS/m)	1388	1417	1310	1880	1771	1650	1926	1969	1713	1532	1360.8
E coli (MPN/100ml)	20	<10	<10	<10	<10	<10	228	96	1414	<10	31
Dissolved Reactive Phosphorus (mg/L)	0.0098	0.0153	0.077	0.0099	0.0079	0.0106	0.0109	0.0062	0.0069	0.0068	0.0113
Total Phosphorus (mg/L)	0.098	0.059	0.155	0.21	0.3	0.25	0.46	0.28	0.21	0.145	0.183
pH	8.3	8.5	8.5	8.33	8.5	8.6	8.4	8.3	8.4	8.3	8.4
Temperature (DegC)	6.3	8.4	12.9	14.9	16.8	19.5	18.4	14.1	12.7	9.4	6.6
Turbidity (NTU)	94	19.4	160	230	360	200	470	290	158	89	94

Mid Lake	22/07/16	18/08/16	19/09/16	02/11/16	30/11/16	19/12/16	07/02/17	09/03/17	10/04/17	15/05/17	16/06/17
Ammoniacal-N (mg/L)	0.014	<0.010	0.025	<0.010	0.033	0.031	0.027	0.019	0.027	0.027	0.027
Nitrate + Nitrite-N (mg/L)	0.0014	<0.0010	0.0023	<0.0010	0.0028	0.0022	0.0016	0.0011	0.002	0.0029	0.003
Total Nitrogen (mg/L)	1.61	1.2	1.68	2.5	2.7	2.6	3.3	3.2	2.3	1.9	2.3
Chlorphyll A (mg/L)	0.042	0.051	0.09	0.075	0.06	0.08	0.08	0.09	0.061	0.06	0.09
Dissolved Oxygen	104.1	116.7	99.1	93.8	97.8	106.2	94.2	98.8	106.5	106	95
Electrical Conductivity (mS/m)	1481	1512	1371	1860	1896	1700	1999	2113	1872	1627	1471.6
E coli (MPN/100ml)	<10	<10	<10	<10	<10	<10	134	<10	74	<10	<10
Dissolved Reactive Phosphorus (mg/L)	0.0103	0.0152	0.0075	0.0103	0.0078	0.0107	0.0111	0.0064	0.0077	0.0064	0.0109
Total Phosphorus (mg/L)	0.1	0.057	0.143	0.34	0.29	0.33	0.44	0.33	0.23	0.121	0.22
pH	8	8.5	8.2	8.21	8.4	8.4	8.4	8.3	8.3	8.2	-
Temperature (DegC)	5.8	7.3	12.1	14.4	15.9	18.2	18.6	15	12.9	9.3	6.3
Turbidity (NTU)	111	17.2	147	310	400	360	520	350	168	98	173

South of Timber Yard	22/07/16	18/08/16	19/09/16	02/11/16	30/11/16	19/12/16	07/02/17	09/03/17	10/04/17	15/05/17	16/06/17
Ammoniacal-N (mg/L)	0.024	<0.010	0.047	<0.010	0.036	0.018	0.019	<0.010	0.03	0.024	0.013
Nitrate + Nitrite-N (mg/L)	0.002	0.047	0.0023	<0.010	0.0021	0.0012	<0.0010	0.0018	0.0021	0.032	0.131
Total Nitrogen (mg/L)	1.61	1.21	1.76	1.88	2.5	2.2	3	2.9	2.4	1.91	2.4
Chlorphyll A (mg/L)	0.045	0.04	0.061	0.052	0.045	0.07	0.076	0.06	0.07	0.066	0.08
Dissolved Oxygen	110.6	117.3	106.2	82.6	101.7	115.8	98.5	98.8	103.1	111.5	102.9
Electrical Conductivity (mS/m)	1622	1443	1307	1920	1764	1752	1966	2055	1844	1509	1418
E coli (MPN/100ml)	<10	<10	<10	10	<10	<10	63	<10	399	<10	<10
Dissolved Reactive Phosphorus (mg/L)	0.0102	0.0152	0.077	0.0102	0.0078	0.0104	0.0116	0.0066	0.008	0.0071	0.011
Total Phosphorus (mg/L)	0.101	0.055	0.142	0.21	0.29	0.26	0.24	0.26	0.22	0.121	0.113
pH	no reading	8.6	8.5	8.33	8.6	8.5	8.5	8.4	8.4	8.4	8.38
Temperature (DegC)	6.5	8.1	12.5	14.6	16	18.8	18.2	14.4	12.3	9	6.6
Turbidity (NTU)	129	16.7	145	230	290	240	420	290	181	76	108

Taumutu	22/07/16	18/08/16	19/09/16	02/11/16	30/11/16	19/12/16	07/02/17	09/03/17	10/04/17	15/05/17	16/06/17
Ammoniacal-N (mg/L)	0.021	<0.010	0.027	<0.010	0.027	0.014	0.026	<0.010	0.027	0.029	0.018
Nitrate + Nitrite-N (mg/L)	0.063	0.31	0.0062	<0.0010	0.0014	0.0013	0.0011	0.0011	0.0019	0.002	0.26
Total Nitrogen (mg/L)	1.52	1.33	1.7	2.7	2.4	2.4	3	3.3	2.2	1.92	2.5
Chlorphyll A (mg/L)	0.051	0.041	0.087	0.069	0.06	0.07	0.076	0.07	0.063	0.069	0.08
Dissolved Oxygen	110.4	117.4	105.1	86.4	106.1	115.3	95.3	99.6	100.8	119.5	96.6
Electrical Conductivity (mS/m)	1970	1401	1324	1790	1783	1640	1998	2134	1795	1529	1489.1
E coli (MPN/100ml)	<10	<10	<10	<10	20	10	393	<10	209	<10	31
Dissolved Reactive Phosphorus (mg/L)	0.008	0.0167	0.0081	0.0103	0.0072	0.0104	0.011	0.0063	0.0071	0.0064	0.0111
Total Phosphorus (mg/L)	0.103	0.062	0.145	0.33	0.25	0.34	0.38	0.35	0.21	0.121	0.192
pH	8.2	8.5	8.5	8.32	8.6	8.6	8.6	8.5	8.4	8.5	8.31
Temperature (DegC)	6.3	7.8	12.5	14.4	16	19.2	18.1	14.1	12.8	9.2	6.2
Turbidity (NTU)	83	33	150	260	250	290	340	280	1791	70	108

6.5. Groundwater Quality Monitoring Data

BW22/0041	20/09/2016	8/12/2016	6/03/2017	6/06/2017
Groundwater Level (mbgl)	6.925	6.7	9.465	6.16
Alkalinity (mg/L)	31	31	34	30
Bromide (mg/L)	0.02	0.02	<0.02	0.02
Chloride (mg/L)	5.6	5.8	5.3	6.5
Dissolved Oxygen (% Sat.)	89.9	90.6	87.7	90.2
Dissolved Reactive Phosphorus (mg/L)	0.008	0.009	0.008	0.009
Electrical Conductivity (mS/m)	13.7	13.6	13.4	14.8
E. coli (MPN/100ml)	0	>201	2	15
Nitrate-N (mg/L)	4.2	4	3.3	4.8
Total Nitrogen (mg/L)	4.3	4.3	3.5	4.9
pH	6.6	6.5	6.9	6.5
Sulphate (mg/L)	8.1	8.1	8.3	9.4
Temperature (DegC)	11.2	11.8	12.3	11.5

BW22/0042	12/09/2016	8/12/2016	2/03/2017	1/06/2017
Groundwater Level (mbgl)	20.12	19.44	23.01	18.905
Alkalinity (mg/L)	47	47	48	37
Bromide (mg/L)	0.04	0.04	0.04	0.04
Chloride (mg/L)	15.7	15.7	13.5	10.3
Dissolved Oxygen (% Sat.)	78.1	75	70	85.2
Dissolved Reactive Phosphorus (mg/L)	<0.004	0.006	<0.004	0.006
Electrical Conductivity (mS/m)	31.8	31	28.3	21.6
E. coli (MPN/100ml)	0	0	0	1
Nitrate-N (mg/L)	12.3	12.3	10.5	3.6
Total Nitrogen (mg/L)	12.3	12.3	10.6	3.7
pH	7	7	7.2	6.4
Sulphate (mg/L)	28.2	27.9	22.2	31.7
Temperature (DegC)	11.8	12.3	12.6	11.6

BX21/0017	12/09/2016	1/12/2016	14/03/2017	12/06/2017
Groundwater Level (mbgl)	9.595	9.615	9.455	8.87
Alkalinity (mg/L)	33	38	30	29
Bromide (mg/L)	0.03	0.03	0.04	0.04
Chloride (mg/L)	12.6	15.1	11.4	18.9
Dissolved Oxygen (% Sat.)	84.4	79.3	78.3	82
Dissolved Reactive Phosphorus (mg/L)	0.012	0.014	0.013	0.013
Electrical Conductivity (mS/m)	18.9	19.2	19.9	26.6
E. coli (MPN/100ml)	0	0	0	0
Nitrate-N (mg/L)	6.8	5.2	8.8	14
Total Nitrogen (mg/L)	6.9	5.3	8.9	14
pH	6.3	6.3	6.3	6.2
Sulphate (mg/L)	7.8	8.1	8.4	10.5
Temperature (DegC)	12.5	12.4	11.5	12.2

BX21/0018	6/09/2016	1/12/2016	14/03/2017	1/06/2017
Groundwater Level (mbgl)	88.83	89.6	93.735	91.79
Alkalinity (mg/L)	46	44	42	54
Bromide (mg/L)	<0.02	<0.02	0.02	<0.02
Chloride (mg/L)	8.3	8.4	10.3	8.8
Dissolved Oxygen (% Sat.)	101.5	104.6	93.6	95.1
Dissolved Reactive Phosphorus (mg/L)	0.008	0.012	0.008	0.012
Electrical Conductivity (mS/m)	15.7	15.5	17.3	17.5
E. coli (MPN/100ml)	0	0	0	0
Nitrate-N (mg/L)	3.3	3.5	5.4	3.2
Total Nitrogen (mg/L)	3.4	3.6	5.5	3.2
pH	7.8	7.8	7.9	7.9
Sulphate (mg/L)	3.3	3.2	3.6	4.7
Temperature (DegC)	11	11.5	11.6	10.9

BX22/0041	15/09/2016	1/12/2016	14/03/2017	12/06/2017
Groundwater Level (mbgl)	21.985	21.225	21.17	20.64
Alkalinity (mg/L)	51	52	54	55
Bromide (mg/L)	0.02	0.02	0.02	0.02
Chloride (mg/L)	7.7	8.1	8.4	8.1
Dissolved Oxygen (% Sat.)	77.2	75.4	67.5	79.9
Dissolved Reactive Phosphorus (mg/L)	<0.004	<0.004	0.005	<0.004
Electrical Conductivity (mS/m)	18	19.4	20.7	19.7
E. coli (MPN/100ml)	0	0	1	0
Nitrate-N (mg/L)	4	4.9	5.5	4.8
Total Nitrogen (mg/L)	4	5	5.6	4.9
pH	7.1	7	7	7
Sulphate (mg/L)	7.7	8.8	9	9.1
Temperature (DegC)	12.2	12.5	12.3	12.5

BX22/0042	14/09/2016	7/12/2016	2/03/2017	12/06/2017
Groundwater Level (mbgl)	47.855	48.365	49.48	47.54
Alkalinity (mg/L)	48	49	50	45
Bromide (mg/L)	0.03	0.03	0.03	0.02
Chloride (mg/L)	9.3	9.9	9.5	7.9
Dissolved Oxygen (% Sat.)	89.3	79.9	79.5	94.6
Dissolved Reactive Phosphorus (mg/L)	0.005	0.005	<0.004	<0.004
Electrical Conductivity (mS/m)	18.2	19.1	19	16.4
E. coli (MPN/100ml)	0	0	0	0
Nitrate-N (mg/L)	5	5.5	5.2	3.8
Total Nitrogen (mg/L)	5.1	5.5	5.3	3.8
pH	7.4	7.2	7.4	7.3
Sulphate (mg/L)	6	6.1	6.7	6.1
Temperature (DegC)	12	12.7	13.6	11.8

BX22/0043	12/09/2016	8/12/2016	14/03/2017	13/06/2017
Groundwater Level (mbgl)	58.21	60.44	63.48	58.6
Alkalinity (mg/L)	61	49	38	91
Bromide (mg/L)	0.06	0.05	0.04	0.05
Chloride (mg/L)	21.8	20.8	16.7	17.5
Dissolved Oxygen (% Sat.)	101.8	97.4	103.3	93.4
Dissolved Reactive Phosphorus (mg/L)	<0.004	0.005	0.007	<0.004
Electrical Conductivity (mS/m)	34.6	30	23.5	35.4
E. coli (MPN/100ml)	0	201	0	0
Nitrate-N (mg/L)	13.7	12.7	9.4	10.4
Total Nitrogen (mg/L)	13.7	12.7	9.5	10.4
pH	7.7	7.6	7.7	7.9
Sulphate (mg/L)	13.3	9.8	6.1	15.6
Temperature (DegC)	12.1	12.1	11.8	11.5

BX22/0044	15/09/2016	13/12/2016	1/03/2017	7/06/2017
Groundwater Level (mbgl)	6.88	5.46	5.605	5.16
Alkalinity (mg/L)	51	48	49	49
Bromide (mg/L)	0.03	0.03	0.02	0.02
Chloride (mg/L)	7.7	8.5	8	9.1
Dissolved Oxygen (% Sat.)	87.7	86.1	78.9	84.2
Dissolved Reactive Phosphorus (mg/L)	0.008	0.006	0.012	0.008
Electrical Conductivity (mS/m)	19.4	20.4	20.3	21.6
E. coli (MPN/100ml)	0	0	2	0
Nitrate-N (mg/L)	5.2	6.7	6.3	7.2
Total Nitrogen (mg/L)	5.2	6.8	6.3	7.3
pH	6.6	6.4	7.8	6.4
Sulphate (mg/L)	9.1	9.6	10.7	11.9
Temperature (DegC)	12.3	12.3	13.2	12.2

BX22/0046	20/09/2016	13/12/2016	8/03/2017	13/06/2017
Groundwater Level (mbgl)	12.895	14.115	14.41	11.07
Alkalinity (mg/L)	72	75	77	78
Bromide (mg/L)	0.05	0.05	0.04	0.05
Chloride (mg/L)	13.8	13.8	13.2	15.7
Dissolved Oxygen (% Sat.)	82.3	80.3	84.9	96.9
Dissolved Reactive Phosphorus (mg/L)	<0.004	<0.004	0.004	<0.004
Electrical Conductivity (mS/m)	33.6	33	33.3	36
E. coli (MPN/100ml)	0	0	0	0
Nitrate-N (mg/L)	11.9	11.9	11.8	13.9
Total Nitrogen (mg/L)	11.9	11.9	11.9	13.9
pH	6.9	6.9	7	6.8
Sulphate (mg/L)	17.7	16.8	18.9	17.5
Temperature (DegC)	12	13	12.7	12.4

BX22/0053	20/09/2016	13/12/2016	8/03/2017	14/06/2017
Groundwater Level (mbgl)	42.21	43.57	46.355	44.3
Alkalinity (mg/L)	64	61	66	63
Bromide (mg/L)	0.03	0.03	0.04	0.03
Chloride (mg/L)	11.6	11.7	12.5	11.3
Dissolved Oxygen (% Sat.)	90.1	87.3	91	83.2
Dissolved Reactive Phosphorus (mg/L)	0.014	<0.004	0.004	0.006
Electrical Conductivity (mS/m)	26.9	25.4	28.1	25.7
E. coli (MPN/100ml)	0	1	0	0
Nitrate-N (mg/L)	7.8	8.3	9.7	8.3
Total Nitrogen (mg/L)	8	8.4	9.8	8.4
pH	7.6	7.5	7.8	7.5
Sulphate (mg/L)	11.1	10.2	9.9	10.2
Temperature (DegC)	11.8	12.6	12.4	9.9

BX22/0065	7/09/2016	6/12/2016	1/03/2017	6/06/2017
Groundwater Level (mbgl)	16.18	14.97	19.14	10.175
Alkalinity (mg/L)	44	47	43	33
Bromide (mg/L)	0.05	0.04	0.05	0.09
Chloride (mg/L)	14.7	14.4	19.3	39.7
Dissolved Oxygen (% Sat.)	86.4	80.7	74	76.7
Dissolved Reactive Phosphorus (mg/L)	<0.004	0.006	0.004	0.006
Electrical Conductivity (mS/m)	24.2	22.4	27.5	41.2
E. coli (MPN/100ml)	0	3	0	0
Nitrate-N (mg/L)	9.1	6.4	8.9	17.8
Total Nitrogen (mg/L)	9.2	6.5	9.1	18
pH	6.8	6.7	7	6.2
Sulphate (mg/L)	11.4	12.3	16.2	26.4
Temperature (DegC)	12	13.2	13.4	12.5

BX22/0066	15/09/2016	8/12/2016	1/03/2017	7/06/2017
Groundwater Level (mbgl)	34.65	32.34	36.44	28.56
Alkalinity (mg/L)	44	44	46	41
Bromide (mg/L)	0.04	0.03	0.02	0.02
Chloride (mg/L)	11.6	9	8.6	8.7
Dissolved Oxygen (% Sat.)	76.6	82.9	73.6	84.8
Dissolved Reactive Phosphorus (mg/L)	<0.004	<0.004	0.004	0.006
Electrical Conductivity (mS/m)	21.9	17.4	17.8	15.5
E. coli (MPN/100ml)	0	8	0	0
Nitrate-N (mg/L)	7.2	3.9	4.1	3
Total Nitrogen (mg/L)	7.2	4	4.2	3.1
pH	6.9	6.8	7.2	6.7
Sulphate (mg/L)	12.2	9.4	9.8	8.4
Temperature (DegC)	12.1	12.6	13.2	12.1

BX22/0067	14/09/2016	13/12/2016	8/03/2017	13/06/2017
Groundwater Level (mbgl)	37.88	39.935	43.39	38.35
Alkalinity (mg/L)	42	45	46	69
Bromide (mg/L)	0.06	0.08	0.08	0.11
Chloride (mg/L)	14.3	24.5	22.9	30.2
Dissolved Oxygen (% Sat.)	85.3	81.1	80.4	80.2
Dissolved Reactive Phosphorus (mg/L)	<0.004	<0.004	0.008	0.006
Electrical Conductivity (mS/m)	23.5	30.3	32.8	38.2
E. coli (MPN/100ml)	0	>201	78	0
Nitrate-N (mg/L)	9.6	12.2	12.7	11.9
Total Nitrogen (mg/L)	9.7	12.5	13.1	12.1
pH	7	6.4	6.6	6.8
Sulphate (mg/L)	9.2	11.4	17.2	20.6
Temperature (DegC)	11.6	12	11.7	11.6

BX22/0068	7/09/2016	7/12/2016	6/03/2017	1/06/2017
Groundwater Level (mbgl)	64.255	67.985	70.21	67.24
Alkalinity (mg/L)	48	48	49	50
Bromide (mg/L)	0.03	0.03	0.03	0.03
Chloride (mg/L)	9	9.6	8.6	8.9
Dissolved Oxygen (% Sat.)	84.8	82.2	78.7	88.5
Dissolved Reactive Phosphorus (mg/L)	0.01	0.01	0.014	0.016
Electrical Conductivity (mS/m)	15.9	16.3	15.6	16.1
E. coli (MPN/100ml)	0	0	0	3
Nitrate-N (mg/L)	2.8	3.3	2.5	2.8
Total Nitrogen (mg/L)	2.8	3.4	2.6	2.8
pH	7.8	7.8	7.8	7.8
Sulphate (mg/L)	3	3	3.5	3.1
Temperature (DegC)	11.4	11.8	12.4	11.6

BX22/0069	7/09/2016	6/12/2016	6/03/2017	6/06/2017
Groundwater Level (mbgl)	62.4	63.565	well dry	well dry
Alkalinity (mg/L)	32	31	well dry	well dry
Bromide (mg/L)	0.05	0.05	well dry	well dry
Chloride (mg/L)	12.5	12.7	well dry	well dry
Dissolved Oxygen (% Sat.)	89.4	86.6	well dry	well dry
Dissolved Reactive Phosphorus (mg/L)	<0.004	<0.004	well dry	well dry
Electrical Conductivity (mS/m)	19.5	19.5	well dry	well dry
E. coli (MPN/100ml)	0	0	well dry	well dry
Nitrate-N (mg/L)	9.4	9.7	well dry	well dry
Total Nitrogen (mg/L)	9.4	9.7	well dry	well dry
pH	7	7.1	well dry	well dry
Sulphate (mg/L)	3	2.9	well dry	well dry
Temperature (DegC)	11.6	13	well dry	well dry

BX22/0070	6/09/2016	6/12/2016	8/03/2017	6/06/2017
Groundwater Level (mbgl)	95.65	97.84	well dry	99.285
Alkalinity (mg/L)	32	33	well dry	30
Bromide (mg/L)	0.04	0.04	well dry	0.04
Chloride (mg/L)	10.1	10.2	well dry	10.1
Dissolved Oxygen (% Sat.)	84.4	91.3	well dry	87.1
Dissolved Reactive Phosphorus (mg/L)	<0.004	0.006	well dry	<0.004
Electrical Conductivity (mS/m)	17.2	17.4	well dry	16.8
E. coli (MPN/100ml)	0	0	well dry	10
Nitrate-N (mg/L)	7.5	7.7	well dry	7.6
Total Nitrogen (mg/L)	7.6	7.8	well dry	7.6
pH	6.9	6.9	well dry	6.9
Sulphate (mg/L)	3.6	3.7	well dry	3.7
Temperature (DegC)	10.9	14.9	well dry	11.2

BX22/0071	6/09/2016	6/12/2016	2/03/2017	8/06/2017
Groundwater Level (mbgl)	67.22	62.66	64.04	56.13
Alkalinity (mg/L)	35	35	37	35
Bromide (mg/L)	0.02	0.02	<0.02	<0.02
Chloride (mg/L)	6	6.2	6.7	6.8
Dissolved Oxygen (% Sat.)	95.2	93.5	79.7	94.1
Dissolved Reactive Phosphorus (mg/L)	0.004	<0.004	0.0004	0.006
Electrical Conductivity (mS/m)	13.3	13.1	13.9	13.4
E. coli (MPN/100ml)	0	2	0	0
Nitrate-N (mg/L)	3	3	2.9	3
Total Nitrogen (mg/L)	3.1	3	3	3.1
pH	6.7	6.7	7.1	6.7
Sulphate (mg/L)	6.7	6.3	7.7	6.2
Temperature (DegC)	9.9	11.7	12.1	10.1

BX22/0072	12/09/2016	1/12/2016	2/03/2017	12/06/2017
Groundwater Level (mbgl)	15.11	12	18.85	9.575
Alkalinity (mg/L)	36	40	38	38
Bromide (mg/L)	0.03	0.03	0.03	0.03
Chloride (mg/L)	8.9	9.3	8.8	9.1
Dissolved Oxygen (% Sat.)	97.5	90.2	80.7	91.7
Dissolved Reactive Phosphorus (mg/L)	<0.004	0.004	0.006	<0.004
Electrical Conductivity (mS/m)	18.9	20	18.7	22.3
E. coli (MPN/100ml)	0	0	0	0
Nitrate-N (mg/L)	7.2	7.5	6.4	11.3
Total Nitrogen (mg/L)	7.3	7.6	6.4	11.4
pH	6.9	6.8	7.2	6.7
Sulphate (mg/L)	9.7	9.8	10.2	9
Temperature (DegC)	12.3	12.4	13.2	12.1

BX23/0423	20/09/2016	7/12/2016	8/03/2017	8/06/2017
Groundwater Level (mbgl)	39.24	41.77	well dry	41.31
Alkalinity (mg/L)	40	44	well dry	35
Bromide (mg/L)	0.03	0.03	well dry	0.05
Chloride (mg/L)	8.8	8.3	well dry	13.9
Dissolved Oxygen (% Sat.)	95.1	93.9	well dry	91
Dissolved Reactive Phosphorus (mg/L)	<0.004	0.004	well dry	0.004
Electrical Conductivity (mS/m)	17.5	17.4	well dry	24.8
E. coli (MPN/100ml)	0	0	well dry	2
Nitrate-N (mg/L)	4.9	4.4	well dry	11.2
Total Nitrogen (mg/L)	4.9	4.4	well dry	11.3
pH	6.9	7	well dry	6.8
Sulphate (mg/L)	9.6	9.2	well dry	13.7
Temperature (DegC)	12	13	well dry	12.3

BX23/0424	7/09/2016	7/12/2016	6/03/2017	8/06/2017
Groundwater Level (mbgl)	51.22	51.81	53.495	52.97
Alkalinity (mg/L)	44	42	44	44
Bromide (mg/L)	0.05	0.05	0.05	0.04
Chloride (mg/L)	13.6	13.7	13.2	12.6
Dissolved Oxygen (% Sat.)	74.1	74.2	65.5	77.3
Dissolved Reactive Phosphorus (mg/L)	<0.004	<0.004	<0.004	<0.004
Electrical Conductivity (mS/m)	21.3	21.2	21.1	20.7
E. coli (MPN/100ml)	0	0	0	0
Nitrate-N (mg/L)	7.9	7.8	7.6	7.5
Total Nitrogen (mg/L)	7.9	7.9	7.6	7.5
pH	7.4	7.3	7.6	7.3
Sulphate (mg/L)	5.5	5.5	6.3	5.8
Temperature (DegC)	11.9	12.7	13.5	12.1

6.6. Lowland Groundwater Level Results (ECan Data)

L36/0142	Trigger	26/07/16	23/08/16	21/09/16	19/10/16	16/11/16	13/12/16	1/02/17	1/03/17	30/03/17	27/04/17	24/05/17	22/06/17		
SWL (mASL)	≥46.01	41.395	41.459	41.415	41.145	40.69	39.423	37.88	37.045	38.56	39.63	40.961	41.39		
L36/0182	Trigger	28/07/16	24/08/16	22/09/16	18/11/16	13/12/16	31/03/17	28/04/17	25/05/17	23/06/17					
SWL (mASL)	≥82.26	80.29	80	80.165	80.84	81.19	80.875	81.215	81.615	81.63					
L36/0202	Trigger	26/07/16	23/08/16	29/08/16	21/09/16	19/10/16	1/11/16	16/11/16	13/12/16	1/02/17	1/03/17	30/03/17	28/04/17	24/05/17	22/06/17
SWL (mASL)	≥72.88	70.4	dry	dry	dry	dry	69.285	69.445	70.64	71.875	71.51	71.835	72.19	72.17	72.285
L37/0451	Trigger	28/07/16	23/08/16	21/09/16	19/10/16	16/11/16	14/12/16	1/02/17	1/03/17	30/03/17	27/04/17	24/05/17	22/06/17		
SWL (mASL)	≥23.5	20.13	19.884	19.995	19.87	20.094	19.813	19.61	19.606	20.719	21.325	21.177	21.094		
M36/0250	Trigger	26/07/16	22/08/16	20/09/16	18/10/16	15/11/16	12/12/16	31/01/17	28/02/17	29/03/17	26/04/17	23/05/17	21/06/17		
SWL (mASL)	≥16.1	13.4	13.487	13.533	13.555	13.49	13.25	12.805	12.52	12.655	13.002	13.263	13.47		
M36/0255	Trigger	26/07/16	23/08/16	21/09/16	19/10/16	16/11/16	14/12/16	1/02/17	1/03/17	30/03/17	27/04/17	23/05/17	22/06/17		
SWL (mASL)	≥36.25	31.92	31.73	31.845	31.445	31.855	31.111	29.275	28.655	31.105	33.23	32.904	32.77		
M36/0419	Trigger	26/07/16	23/08/16	21/09/16	19/10/16	16/11/16	14/12/16	1/02/17	1/03/17	30/03/17	27/04/17	24/05/17	22/06/17		
SWL (mASL)	≥33.5	30.92	31.053	31.115	31.065	30.81	30.303	29.525	28.88	28.905	30.295	32.045	32.55		
M36/0424	Trigger	26/07/16	22/08/16	20/09/16	18/10/16	15/11/16	12/12/16	31/01/17	28/02/17	29/03/17	26/04/17	23/05/17	21/06/17		
SWL (mASL)	≥21.02	20.353	20.519	20.514	20.42	20.107	19.623	18.758	18.238	18.473	19.858	20.474	20.565		
M36/0599	Trigger	26/07/16	22/08/16	20/09/16	18/10/16	15/11/16	12/12/16	28/02/17	29/03/17	26/04/17	23/05/17	21/06/17			
SWL (mASL)	≥13.63	11.42	11.672	11.88	12.02	11.993	11.74	10.725	10.565	10.716	10.88	11.18			
M36/0693	Trigger	26/07/16	23/08/16	21/09/16	19/10/16	1/11/16	16/11/16	14/12/16	1/02/17	1/03/17	30/03/17	27/04/17	24/05/17	22/06/17	
SWL (mASL)	≥21.53	18.09	18.084	18.045	18.025	17.96	17.85	dry	dry	dry	dry	dry	18.1	18.365	
M36/7880	Trigger	26/07/16	23/08/16	21/09/16	19/10/16	16/11/16	14/12/16	1/02/17	1/03/17	30/03/17	27/04/17	24/05/17	22/06/17		
SWL (mASL)	≥35.14	32.11	32.369	32.535	32.555	32.305	31.627	30.355	-962.37	-962.37	-962.37	31.66	34.935		
M37/0010	Trigger	26/07/16	23/08/16	21/09/16	19/10/16	16/11/16	14/12/16	1/02/17	1/03/17	30/03/17	27/04/17	24/05/17	22/06/17		
SWL (mASL)	≥6.21	5.64	5.638	5.645	5.635	5.518	5.457	5.21	5.085	5.365	5.505	5.61	5.68		