sunwater

Lower Fitzroy Water Quality Monitoring and Reporting Program

Program Design, version 4

EPBC: 2009/5173

May 2024

RWP-SUN-ENV-RP-0005

Prepared for Sunwater by Nicole Flint, Catherine E. Jones and John C. Rolfe, CQUniversity Australia.

Report contents

Acronyms

AHD	Australian Height Datum
AMTD	Adopted Middle Thread Distance
BOM	Bureau of Meteorology
DCCEEW	Australian Department of Climate Change, Energy, the Environment and Water
DESI	Queensland Department of Environment, Science and Innovation
DGV	Default Guideline Values
DIN	dissolved inorganic nitrogen
DIP	dissolved inorganic phosphorous
DON	dissolved organic nitrogen
DS	downstream of impoundment area
EIS	Environmental Impact Statement
EPBC Act	Australian *Environment Protection and Biodiversity Conservation Act 1999*
FBA	Fitzroy Basin Association
FRP	filtered reactive phosphorous
FRW	Fitzroy River Water
FSL	full supply level
LFRIP	Lower Fitzroy River Infrastructure Project
LOR	limit of analytical reporting
ML	megalitres
MNES	matters of national environmental significance
PN	particulate nitrogen
PON	particulate organic nitrogen
PP	particulate phosphorous
PSA	particle size analysis
PSII	photosystem II
QA/QC	quality assurance / quality control
RWP	Rookwood Weir Project
TKN	total Kjeldahl nitrogen
TN	total nitrogen
TP	total phosphorous
TSS	total suspended solids
US	upstream of impoundment area
WQO	Water Quality Objectives as scheduled under the Queensland *Environmental Protection (Water and Wetland Biodiversity) Policy*

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Sunwater Review and Approval

Role	Position	Name	Date	Signature
Reviewer	Environmental Manager	Michael Dixon	02/05/2024	Michael Dixon Michael Dixon (May 2, 2024 11:53 GMT+10)
Approver	Project Director	Inaki Goni	02/05/2024	Mark Cope (May 2, 2024 12:16 GMT+10)

Version history

Version number	Purpose/Changes	Authors	Date
1.1	Initial draft for FBA review	Flint, Jones, Rolfe	27/08/2019
1.2	Minor updates to draft for review panel workshop	Flint, Jones, Rolfe	12/09/2019
1.3	Following review panel workshop	Flint, Jones, Rolfe	17/10/2019
1.4	Revised following feedback from Sunwater	Flint, Jones, Rolfe	31/03/2020
1.5	Revised following feedback from FBA	Flint, Jones, Rolfe	06/04/2020
1.6	Revised following further feedback from Sunwater and discussions with Queensland Government	Flint, Jones, Rolfe	15/06/2020
1.7	Revised following further feedback from Sunwater	Flint, Jones, Rolfe	02/12/2020
2.1	New version developed after completion of baseline monitoring, and incorporating review of version 1.7 by the Australian Department of Climate Change, Energy, the Environment and Water (DCCEEW)	Flint, Jones, Rolfe	02/06/2023
2.2	Update following DCCEEW comments on version 2.1	Flint, Jones, Rolfe, Sunwater	05/02/2024
3	Update following DCCEEW comments and material from offset plan	Flint, Jones, Rolfe, Sunwater	11/04/2024
4	Minor DCCEEW edits	Flint, Jones, Rolfe, Sunwater	02/05/2024

Declaration

In making this declaration, I am aware that section 491 of the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed: Chris Delamont (May 2, 2024 13:58 GMT+10)

Full name: Chris Delamont
Organisation: Sunwater
EPBC Referral Number: EPBC 2009/5173
Water Quality Monitoring and Reporting Program
Date: 02/05/2024

1 Background

1.1 Fitzroy Infrastructure Project

The Rookwood Weir Project is a component of the Lower Fitzroy River Infrastructure Project (LFRIP). When approved by the (then) Australian Department of Environment and Energy, in February 2017, (EPBC 2009/5173) the proposal was for: The raising of the existing Eden Bann Weir, construction and operation of a new weir near Rookwood crossing and construction and operation of associated ancillary infrastructure. The scope and staging of the original project was subsequently revised, with Stage 2 in the Environmental Impact Statement (EIS), being the Rookwood Weir component of LFRIP, becoming the focus. This involves the construction of a new weir on the Fitzroy River at adopted middle thread distance (AMTD) 265.3 km to capture and store water for the purposes of supplying water to supplemented water allocation holders.

The proposed Rookwood Weir is located approximately 66 km south-west of Rockhampton within the Fitzroy River catchment of the Fitzroy Basin, in Central Queensland. The Rookwood Weir Project involves constructing a new weir to 46.2 m Australian Height Datum (AHD), as approved on 11 March 2021 by State and Commonwealth Governments. This is less than the original maximum weir height of 49.0 m AHD assessed in the EIS that was approved in February 2017. The 46.2 m AHD full supply level (FSL) impoundment area associated with Rookwood Weir extends up the Fitzroy River to the confluence of the Mackenzie River and the Dawson River, to an upstream limit on the Mackenzie River at 322.4 km AMTD and 11.5 km AMTD on the Dawson River (**Figure 1 and Figure 2**). Following the amendments to the weir height, it is now expected to yield up to 86,000 megalitres (ML) of water. The key components of the Rookwood Weir Project include:

- Constructing a new weir at Rookwood to capture and store water resources to an approximate height of 46.2 m (AHD);
- Constructing fish and turtle passage infrastructure to facilitate the movement of fish and turtles around Rookwood Weir;
- Relocation and recalibration of the existing Riverslea gauging station;
- Replacing the low-level crossing at Riverslea with a new bridge and associated road approaches upstream of the weir;
- Upgrading the low level and existing culvert crossing at Hanrahan's downstream of the weir; and
- Upgrading public roads (State and local) to facilitate construction traffic along Thirsty Creek Road (a local road) from the Capricorn Highway (including the intersection with the State controlled road) at Gogango.

The project does not include water delivery infrastructure (e.g. pipelines) to supply water to users. The construction of Rookwood Weir and subsequent inundation is occurring in two main phases:

- Early works construction including Riverslea Bridge and road upgrade works, access tracks and laydown areas, clearing and grubbing and construction of the weir itself including form and pour of the monoliths, fish passage and turtle passage and abutments; and
- Commissioning of the weir and inundation of land.

During the Project's approval process a series of EIS documents were prepared by the proponent, evaluated, and reported on by the Coordinator-General in December 2016. Baseline water quality data were provided in Volume 1, Chapter 11 Water Quality. Following approval of the LFRIP project, approval conditions were provided by the Commonwealth and variations to these approval conditions were granted on 27 May 2020 and 27 July 2021. Condition 1 of the Australian Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) approval requires a

Water Quality Monitoring and Reporting Program be prepared and submitted to the Minister for approval prior to inundation of the impoundment from construction of the weir. Condition 1 includes monitoring to detect potential water quality changes including in relation to increased levels of nitrogen from decaying inundated vegetation, and potential impacts from the commencement of new agricultural activities.

The commencement of the activity occurred on the 17 July 2020 with notification to the Australian Department of Climate Change, Energy, the Environment and Water (DCCEEW) as per the approval conditions. This work involved the start of construction of the Riverslea Bridge enabling works approximately 10km upstream from the weir site. Early works including site clearing, geotechnical investigations and establishment of temporary construction facilities at the Rookwood Weir site began in December 2020. Works in the river at the Rookwood Weir site began in April 2021. Water quality collection across the Fitzroy catchment commenced in July 2020 in line with version 1.7 of this Water Quality Monitoring and Report Program.

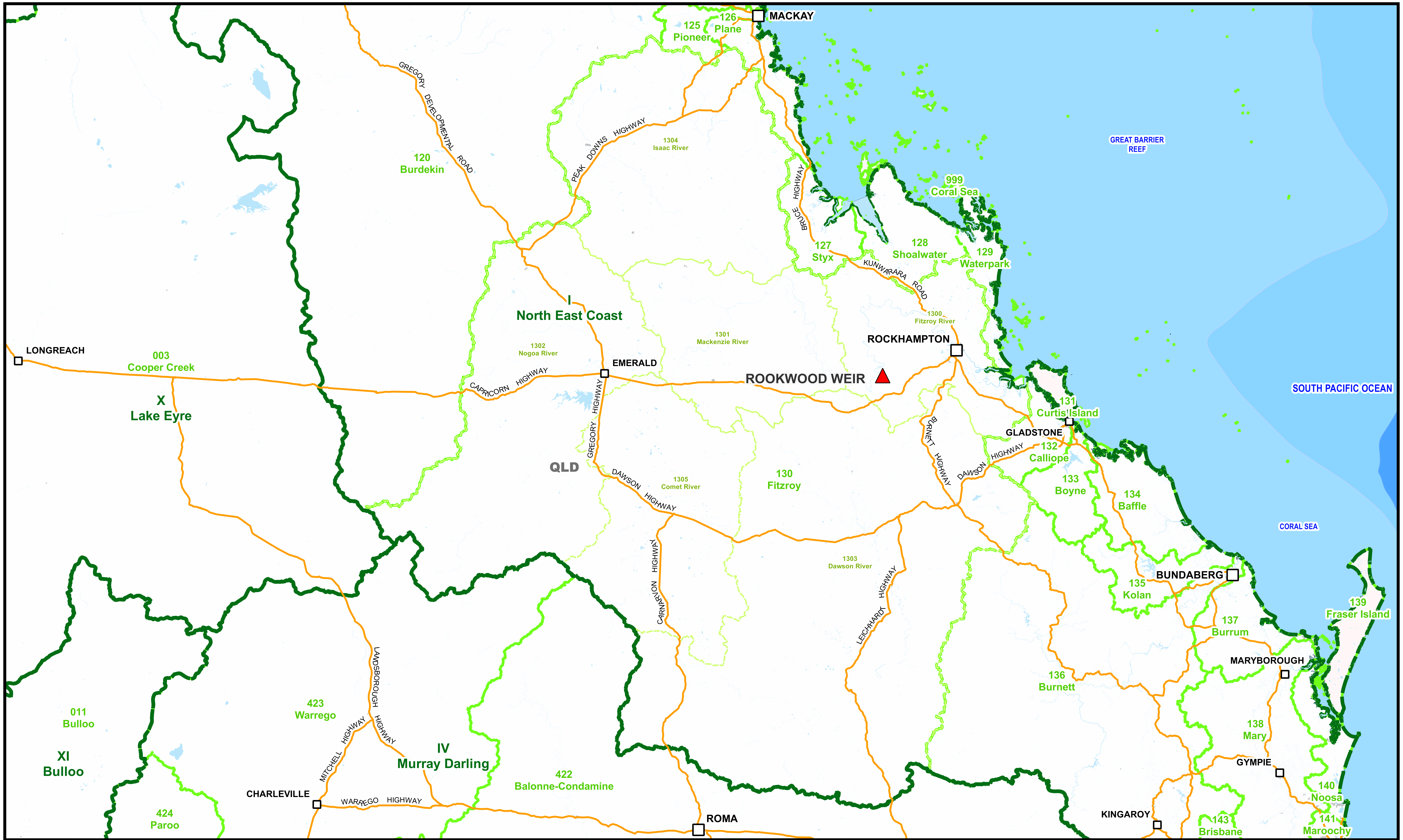


Figure 1: Site Context

0 25 50 75 100 km

Scale @ A3: 1 : 2000000
Date: 26/05/2023
Job: J0234
Drawn: Corey Taylor
CRS: EPSG:7844_GDA2020

N

DATA SOURCE:
QSPATIAL 2023; The State of Queensland (Department of Resources) 2023; Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community;

- Cities / Towns
- Highways / Roads
- Drainage divisions
- Drainage basins
- Drainage Sub Basin
- Watercourse area
- Rookwood Weir Project

BASE/

Figure 2: Inundation Extent

0 1 2 3 4 km

Scale @ A3: 1 : 89425
Date: 26/05/2023
Job: J0234
Drawn: Corey Taylor
CRS: EPSG:7844_GDA2020

N

DATA SOURCE:
QSPATIAL 2023; The State of Queensland (Department of Resources) 2023; Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community;

- DCDB
- Easement / Stock Routes
- Rookwood Weir Project
- State Controlled Roads
- Roads
- Rail
- Inundation Area (for Weir height 46.2m)
- Watercourse / Drainage Features

BASE/

Project Path - (C:\Users\ctayl\BASE Dropbox\BASE Project Folder\Job Folder\J0047 LFRIP (Sunwater)\ROOKWOOD WEIR\GIS\J0047 Rookwood Weir Figures_25052023.qgz); Figures - (C:\Users\ctayl\BASE Dropbox\BASE Project Folder\Job Folder\J0234 Sunwater Approvals and Environmental Support - M Dixon\Outgoing Plans\1. Water Quality Monitoring Figures)

1.2 Approval Conditions

Condition 1 of the EPBC Act approval relates to the Water Quality Monitoring and Reporting Program (as varied on 27 July 2021). The sub-conditions are outlined in Table 1 along with a cross-reference to the sections of the Program where responses can be found.

Table 1 Approval Condition 1

Condition 1: Water Quality Monitoring Program	Relevant Section
a. The approval holder must develop a separate water quality monitoring and reporting program (Program) for each weir that is to be constructed or raised, in consultation with the Great Barrier Reef Marine Park Authority (GBRMPA) and the following Queensland Government departments, that meets current recognised standards for water quality monitoring and reporting: i. Department of Environment and Science (DES); ii. REVOKED; iii. Department of Agriculture and Fisheries (DAF); and iv. Department of Natural Resources, Mines and Energy (DNRME);	This program. Section 2.1 Section 14
b. The Program for each weir must specify the monitoring activities and procedures capable of predicting potential, and detecting actual impacts from the action in respect of the relevant weir on the Great Barrier Reef World Heritage Area and National Heritage place that may result from: i. changes in nutrient concentrations and oxygen levels due to decaying vegetation; and ii. agricultural development facilitated by the action in respect of the relevant weir.	Section 3.3 Section 7 Section 8
c. In order to predict, detect and manage impacts on the Great Barrier Reef World Heritage Area and National Heritage place, the Program for each weir must: i. specify water quality characteristics for: A. the lower Fitzroy River; B. water entering irrigation areas from higher in the sub-catchment; and C. water flowing from irrigated areas, and comparable unirrigated areas; ii. provide details of water sampling and analysis methodologies for detecting and predicting all water impacts on matters of national environmental significance (MNES) from changes in water quality that may be derived from the action in respect of the relevant weir; iii. provide details of reporting requirements, including timeframes; iv. state the reliability of the Program to predict and detect changes to water quality as a result of implementing the action in respect of the relevant weir, and include adaptive implementation and continuous improvement systems to enhance its capacity to predict and detect changes to water quality and impacts on the Great Barrier Reef World Heritage Area andevent National Heritage place; v. outline how monitoring will be conducted during major flood events for the purpose of the Program; vi. provide details of a process for: A. reviewing the effectiveness of the Program; and B. amending and/or terminating the Program;	Section 3.4 Section 4 Section 5 Section 7 Section 8 Section 12

Condition 1: Water Quality Monitoring Program	Relevant Section
vii. provide sufficient information, including the establishment of pre-action baselines, to enable the determination of, and the need for, the water quality offset appropriate to fully offset any residual water quality impacts on the Great Barrier Reef World Heritage Area and National Heritage place for each year in which those impacts occur.	
d. If the monitoring results from the Program for a weir determine that a residual impact to the Great Barrier Reef World Heritage Area and National Heritage place is likely to or has actually occurred, the approval holder must notify the Minister within 20 business days. If and when such notification occurs, a description of actions and timeframes for the provision of water quality offsets in accordance with the Program and the offsets strategy for that weir must be provided to the Minister within 20 business days after notification.	Section 11
e. Prior to inundation of the impoundment from the construction or raising of a weir, the approval holder must submit the Program for that weir for approval by the Minister in writing. No water from the raising of Eden Bann Weir or Rookwood Weir respectively may be used for the purpose of irrigated agriculture until the Program for that weir has been approved by the Minister and the water quality baselines required under condition 1.c) vii. For that weir have been established.	Noted
f. The Program for each weir must be designed to complement relevant existing or future water quality monitoring programs including, but not limited to, the Reef 2050 Integrated Monitoring and Reporting Program.	Noted Section 11 Section 13

2 Scope of water quality monitoring and reporting

The Water Quality Monitoring and Reporting Program relates to surface waters of the Lower Fitzroy Basin, specifically the areas that would be inundated as a result of construction of Rookwood Weir and that may undergo agricultural land use change as a result of the weir's construction. This includes major watercourses (river channels) upstream of the inundation/agricultural areas and downstream of the inundation/agricultural areas. The program is designed to be capable of collecting data that can be used to calculate changes in pollutant loads to the Great Barrier Reef.

Ecological monitoring, including of nesting of freshwater turtles and barriers to fish movement, is not included in the scope of this study. However, two freshwater turtles found in the Fitzroy River are listed as threatened species under the EPBC Act and hence are matters of national environmental significance. These are the Fitzroy River turtle (Rheodytes leukops, listed as Vulnerable) and the White-throated snapping turtle (Elseya albagula, listed as Critically Endangered). The Program includes water quality parameters relevant to these EPBC listed turtle species.

2.1 Objectives of the Water Quality Monitoring and Reporting Program

The broad aim of this proposed monitoring program is to meet Condition 1 of the Project Approval. The following specific water quality monitoring objectives have been developed to help to achieve this aim:

- Conduct and augment baseline monitoring at sites, upstream, within and downstream of the predicted impounded area, within (at least) the major watercourses of the project area, in order to determine the current ambient and event flow concentrations of scientifically appropriate water quality indicators.
- Conduct ambient and event monitoring at sites upstream, within and downstream of the predicted impoundment area in order to detect and report on any measurable changes between these sites, from guideline values and/or from the baseline water quality conditions, during the construction of the impoundment and inundation of vegetation, and as the vegetation degrades over time, until the monitoring program is reviewed.
- Conduct ambient and event monitoring at site(s) directly downstream of the flow of overland water into nearby waterways, from land associated with agricultural development facilitated by extractive water use of the weir, and a combination of a) sites upstream of these agricultural developments, and b) sites near to comparable existing land use areas, in order to determine and report any measurable change in the concentrations of water quality parameters resulting from changes in agricultural land use.
- Conduct monitoring at site(s) directly upstream and progressively downstream of the impoundment, to measure scientifically appropriate water quality indicators, including those specific to current water quality models and the Reef 2050 priority pollutants, in order to detect changes to downstream water quality, compare to relevant guideline values, and provide data to catchment modellers and catchment loads monitoring programs to help predict impacts on the Great Barrier Reef World Heritage Area and National Heritage place.

2.2 Values and potential impacts

2.2.1 Environmental Values

Environmental Values for the Project area and downstream environs (the Fitzroy River catchment) were scheduled by the Queensland Government in 2011, following extensive consultation processes (State of Queensland, 2013). In summary, the main channel above the Fitzroy River barrage provides the following freshwater Environmental Values: aquatic ecosystems, irrigation, farm supply/use, stock water, aquaculture, human consumers (of fish/shellfish), primary and secondary recreation, visual recreation, drinking water, industrial use and cultural and spiritual values. Freshwater tributaries of the Fitzroy River also supply many of these Environmental Values.

Predicted influences of Rookwood Weir on these freshwater Environmental Values include:

- changes to water availability that could potentially have a positive influence on irrigation, farm supply/use, stock water, drinking water, industrial use, and recreation;
- changes to natural system dynamics that could potentially have a negative influence on aquatic ecosystems and cultural and spiritual values; and
- changes in water quality that result in exceedances of specified water quality guidelines for aquatic ecosystems (the focus of this program design), or for drinking water, aquaculture, irrigation, stock watering, farm supply/use, primary contact recreation or secondary contact recreation, would be considered a negative influence.

The estuarine channel of the Fitzroy River and lower estuarine creeks provide Environmental Values including aquatic ecosystems, aquaculture, human consumers (of fish/shellfish), secondary recreation, visual recreation and cultural and spiritual values. Predicted influences of Rookwood Weir on these estuarine Environmental Values include:

- changes to natural system dynamics that could potentially have a negative influence on aquatic ecosystems and cultural and spiritual values; and
- any changes in water quality that result in exceedances of specified water quality guidelines for aquatic ecosystems, aquaculture or recreation, would be considered a negative influence.

Of concern for any new development within Queensland coastal catchments is the potential for impacts on the Environmental Values of the Great Barrier Reef World Heritage Area and coastal marine areas. Priority pollutants for reef water quality include sediment, nutrients and pesticides (Commonwealth of Australia, 2021). Any increases in loads of these pollutants entering the Great Barrier Reef lagoon would impact on the values of the reef and must be offset in line with the conditions of the Project approval.

The Fitzroy River drains to Keppel Bay coastal waters, for which scheduled Environmental Values include: Aquatic ecosystems, aquaculture, human consumers (of fish/shellfish), primary and secondary recreation, visual recreation, industrial use and cultural and spiritual values (State of Queensland, 2013).

Predicted influences of Rookwood Weir on these marine Environmental Values include:

- any changes in water quality that result in greater than baseline exceedances of specified water quality guidelines for aquatic ecosystems, aquaculture or recreation, would be considered a negative influence.

2.2.2 Pressures and potential impacts of the impoundment and agricultural developments

In order to propose scientifically appropriate water quality parameters for monitoring a new weir development, the following impacts have been considered: the general upstream, downstream and impounded area impacts of impoundment construction and vegetation inundation; and the potential impacts of agricultural development facilitated by the action. Potential and actual impacts on the Great Barrier Reef World Heritage Area and impacts on other matters of national environmental significance, including freshwater turtles were also considered.

2.2.3 Impoundment construction and vegetation inundation

The general effects of impoundments include flow alteration, where low or no-flow waters likely experience reduced turbidity (after settling out of particulates), lower dissolved oxygen concentrations (e.g. due to less surface aeration), and decomposing vegetation. Modelling undertaken as part of the Rookwood Weir project demonstrates that the highest risk to water quality from decomposing vegetation is during the first year of operation and decreases for the next six years. The following issues are associated with impoundments:

- Decaying vegetation within the water column releases **nutrients,** causing hypoxia (low **dissolved oxygen** concentrations). Without resuspension of bottom sediments, water may be clearer and light may penetrate waters more easily (lower **turbidity**), increasing the water **temperature**. Weir impoundments also contribute to global carbon cycles, producing higher methane emissions to the atmosphere than downstream waters, although this is currently difficult to measure.
- Algal growth is supported by low flow, increased **nutrient** concentrations and higher **temperatures**, hence algal blooms are often associated with impounded waters, particularly in tropical regions. There is an increased risk in low flow waters of harmful algal blooms. Bloom risk can be detected by monitoring temperature and **chlorophyll-a (chl-a)**, which could trigger additional monitoring for **toxic algae species**.
- When impounded water is deep, stratification of water into layers with different chemical and biological properties may occur. Oxygen concentrations may vary with depth and there is likely to be a thermocline in deep impounded waters. Anoxic conditions, predominantly at depth, can lead to a reduction in biodiversity within impoundments. These conditions can also lead to depth-stratification of freshwater algal communities. If anoxic water is released downstream through uptakes or during flow events, negative impacts on fish and other fauna in receiving environments will occur. Vertical profiling of **temperature** is the best indicator of stratification and could be used to trigger **dissolved oxygen** and **chl-a** monitoring.
- Riparian habitats in impounded areas are submerged, and the ‘new’ riparian habitat that forms at the new waterline may be of lower quality, including through weed proliferation and loss of larger established vegetation. This change decreases the buffering capacity of the riparian zone, potentially increases streambank erosion, and could influence modelling used for reef water quality. **Vegetation** can be monitored at the water line using LiDAR or remote imaging.
- **Total suspended solids** may be increased by lower protection from riparian zones, or conversely decreased by the effects of the impoundment trapping sediment in-flows and settling out at depth.
- Freshwater turtles found in the Fitzroy catchment are listed as threatened, therefore are matters of national environmental significance under the EPBC Act. Bimodally breathing freshwater turtles (including the Fitzroy River turtle and the white-throated snapping turtle) are particularly vulnerable to water quality degradation. When sediments become trapped in impounded waters, there is the potential for increased concentrations of carbonates and other major ions due to dissolution of these components from their parent rock material. Impoundments can increase the risk of metal bioaccumulation in aquatic food chains through increasing exposure of aquatic animals via sediment, vegetation and microbial growth. For this reason, monitoring should include general water quality changes associated with impoundments including **pH**, **total suspended solids, turbidity, electrical conductivity, anions and cations, basic metals (dissolved in water), nutrients** and **chl-a**. Harmful algal blooms are detrimental to freshwater turtles.

2.2.4 Agricultural development facilitated by the action

The main land uses within the Fitzroy Basin include grazing (80%), forestry (6%) and conservation (6%). The Basin is a major contributor to fine sediment loads (Douglas et al. 2006) and dissolved inorganic nitrogen (Wolff et al. 2018) to the Great Barrier Reef, primarily sourced from agricultural land uses including grazing, stream bank erosion and dry land cropping. Currently, the dominant land use in the vicinity of Rookwood weir is grazing native vegetation.

Upstream of the Rookwood weir site, along the Fitzroy River, there are pastures, dryland cropping and some small areas of irrigated crops and/or intensive horticulture. Cropping is a significant land use directly upstream of the confluence of the Fitzroy River with the Mackenzie and Dawson Rivers. As stated in the EIS for the Lower Fitzroy River Infrastructure Project (including both the Rookwood Weir construction and raising Eden Bann Weir), approximately 20,000 ML of high priority water could be used for agricultural development. Up to 6,300 ha of grazing on native vegetation land could become a mix of cattle feedlots (4,000 ha), irrigated cropping (1,600 ha) and irrigated horticulture (700 ha). The following issues may be associated with more intensive or new agricultural developments:

- The use of impounded water to establish and maintain irrigated agriculture can involve increased application of pesticides and fertilisers. Overland flow can then lead to diffuse pollution and increased pesticide and nutrient concentrations in receiving waters.
- Diffuse-source pollution from agricultural land in Great Barrier Reef catchments is the main source of the Reef 2050 priority pollutants: nutrients (dissolved inorganic nitrogen, particulate phosphorus, particulate nitrogen), sediment (fine sediment) and pesticides. In order to determine loads of pollutants, it is necessary to monitor both concentrations and flow.
- Irrigated cropping is also associated with changes in ground cover, with periods of reduced erosion when crops are well established, and periods of increased availability of particulates (and particulate bound contaminants) after harvest. Total suspended solids (TSS) and particle size analysis (PSA; for determination of fine and very fine particle fractions) should be monitored as land use changes. High rainfall events can enhance erosion and sediment runoff from cropping land, leading to periods of increased turbidity, so event monitoring and continuous flow logging are required.
- Cattle feedlots are nutrient sources due to the possibility of waste material (manure) running off in overland flows, and potentially leaching into groundwater. Areas of cleared and regularly disturbed ground with little groundcover (such as feedlots) can be a source of sediments entering river systems. Monitoring needs include nutrient concentrations, total suspended solids, particle size analysis and continuous flow logging. This monitoring would be required to be undertaken by the feedlot operator as stipulated by their ERA licence with DESI.

To predict potential, and detect actual, impacts from the development of the weir on the Great Barrier Reef World Heritage Area, the monitoring program needs to integrate both water quality monitoring and modelling methods.

3 Monitoring requirements

3.1 Rationale

To meet the Objectives of the Water Quality Monitoring and Reporting Program, a range of water quality parameters need to be monitored at different stages of the project, including:

- Pre-action baseline monitoring (pre-construction, pre-inundation and prior to land use change)
- monitoring during construction (pre-inundation, continuing until weir construction is complete)
- monitoring during and following inundation (post-construction, until the monitoring program is reviewed), and
- monitoring of impacts of agricultural land use developments (post-land use change or intensification facilitated by the weir, until the monitoring program is reviewed).

The monitoring program is designed to be consistent with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018), the Environmental Values and Water Quality Objectives of Basin No. 130 (State of Queensland 2013), and the Monitoring and Sampling Manual: Environmental Protection (Water) Policy (State of Queensland 2018). ANZG (2018) provide a Water Quality Management Framework involving 10 steps to help guide the design and establishment of a monitoring and assessment framework (https://www.waterquality.gov.au/anz-guidelines/framework). Among the ten steps, it is important to:

- Define community values and management goals,
- Define relevant indicators,
- Determine water/sediment quality guideline values,
- Define draft water/sediment quality objectives,
- Assess if draft water/sediment quality objectives are met.

Water quality guidelines and objectives are normally based on data from reference sites, apart from contaminants where guidelines are set from toxicity tests. The standard approach set by ANZG (2018) and the State of Queensland (2013) is to use reference data to set water quality objectives, establish the 20th, 50th and 80th percentiles from those guidelines, and test data from monitoring programs against those 20th or 80th percentiles.

This broad approach is replicated in this program. Guideline values have been calculated from the pre-baseline monitoring period, and supplemented where possible with water quality objectives and guidelines relevant to the Fitzroy Basin (State of Queensland 2013, ANZG 2018). The monitoring program is designed to collect data in both baseline and event conditions, and compare those observations to water quality objectives and water quality guidelines. The State of Queensland (2022) sets some criteria for estimating 20th, 50th and 80th percentiles, indicating for 1-2 reference sites that at least 18 observations over a minimum of one year and preferably two years is desirable. For this study the pre-action baseline data collected for the purpose of setting reference guidelines just meets the minimum data requirements for program design. In recognition of this limitation, comparison of the water quality monitoring data against the pre-action baseline values will be set at the more rigorous and precautionary 25th and 75th percentiles (rather than the 20th and 80th percentiles).

3.2 Pre-action Baseline Monitoring data

Pre-action baseline data includes data collected prior to the commencement of the Rookwood Weir construction activities, data from upstream of the construction area (after commencement), and a provided historical dataset (2010 -2018). The action commenced in July 2020 with early works at the Rookwood Weir site occurring between December 2020 and April 2021.

The dataset includes the following sources for across the Fitzroy River:

- Sunwater monitoring July 2020 – April 2021 all sites (see also Appendix 2 and 3).
- Sunwater monitoring July 2020 – December 2022 upstream sites (excludes data from The Gap, and TSS and turbidity data from Riverslea) (see also Appendix 2 and 3).
- 2010 – 2018 historical data from Lower Fitzroy sites, compiled from multiple datasets and provided to Sunwater by the Fitzroy Partnership for River Health. This dataset was utilised to develop pre-action baselines for TSS and turbidity for the Lower Fitzroy (see also Appendix 1).

At the commencement of the action Sunwater developed and commenced a water quality monitoring program specifically for the Rookwood Wier Project. This involved the collection of monthly data at a number of the sites within the Lower Dawson, Mackenzie and Lower Fitzroy catchments. As the project progressed, this sampling program was expanded to include additional sites and parameters. During the analysis of the data, due to the works at Riverslea and the weir site potentially influencing the data collected at Riverslea (just upstream of the weir) and The Gap (located approximately 120km downstream of the weir) sites, a decision was made to take a conservative approach to replace the TSS and turbidity data with historical data, in the pre action baselines. This decision was made to ensure there was no influence of construction on the baseline values that will be used for future water quality comparisons.

The historical dataset was chosen to replace these specific parameters as the next best dataset of information available for the Lower Fitzroy catchment. This had been collected by various monitoring programs over a period of 8 years, and included some of the same sampling sites in the Sunwater monitoring program, such as Riverslea and The Gap, but with lessor range of parameters. The main difference between the historical data and the Sunwater dataset is that the for the latter program each water quality parameter at a particular site was measured at the same time using a planned and structured sampling design as described in this document. The historical water quality data comes from multiple monitoring programs across various dates. The data have been combined into a single dataset supplied by FPRH. As shown in the graphs in Appendix 1 this dataset is based on a less consistent and representative sampling regime, with larger time gaps between data points.

No inundation caused by the impoundment has occurred at Riverslea during the construction phase of the project, with the first inundation occurring during the wet commissioning phase at the end of December 2023. Hence there was no impact of inundation on the Sunwater water quality dataset that was used to develop baselines.

3.3 Baseline and Construction Phase monitoring (pre-inundation and pre-land use change)

Baseline and construction phase water quality monitoring was conducted monthly by Sunwater from July 2020 to December 2022. Early works commenced at Rookwood in December 2020, followed by in-river works at the weir site from April 2021. Monitoring during this phase aimed to record the ambient concentrations of a wide range of water quality parameters. This data (excluding downstream sites) aided in the establishment of pre-action baselines to assess water quality changes that may result from the development. The monitoring schedule was based on version 1.7 of this program design.

3.3.1 Initial Monitoring sites (July 2020 – December 2022)

Five monitoring sites were sampled, upstream, within and downstream of the predicted impoundment area, as follows and as described in Table 1 and Figure 1:

- Mackenzie River at Coolmaringa (gauging station 130105B) – upstream
  - substituted with Mackenzie River at Apis Creek Crossing when inaccessible, which occurred on six occasions (map reference Alt3)
- Dawson River at Beckers (gauging station 130322A) – upstream
  - substituted with Dawson River at Baralaba when inaccessible, which occurred on one occasion
- Don River at Rannes (gauging station 130306B) – upstream
- Fitzroy River at Riverslea (gauging station 130003B) – upstream of weir construction but at the location of Riverlea Bridge enabling works site and within proposed impoundment area (excluded from pre-action baseline data)
- Fitzroy River at the Gap (gauging station 130005A) – downstream of construction and impoundment area. (excluded from pre-action baseline data)

3.3.2 Additional monitoring sites (Sept 2022 – December 2022)

Monitoring increased to include an additional seven sites (construction monitoring) in September 2022, as follows and as described in Table 1 and Figure 1:

- Dawson River at Boolburra;
- Fitzroy River at Yarra Rd;
- Fitzroy River at The Pocket;
- Fitzroy River upstream of weir site;
- Fitzroy River downstream of weir site (excluded from pre-action baseline data);
- Fitzroy River at Hanrahan (excluded from pre-action baseline data);
- Fitzroy River at Glenroy Rd (excluded from pre-action baseline data).

Alternative monitoring sites were identified to continue to gather water quality data if any of the main monitoring sites were inaccessible, for example due to flooding (Table 2). Seven event monitoring sites were selected, incorporating sites upstream, within and downstream of the impoundment, and in proximity to the likely agricultural developments. Water quality data from September 2022 to December 2022 was included in the pre-action baseline data from the Boolburra, Yarra Rd, The Pocket and US weir sites as per Appendix 8.

Table 2: Sites monitored during baseline and construction phase sampling.

*Map references relate to Figure 3. Light green = Mackenzie catchment, dark green = Callide catchment, yellow = Lower Dawson catchment, orange = Fitzroy catchment. Pink = upstream of impoundment (US), teal = within impoundment, blue = downstream of impoundment (DS). * Accessibility of these sites will be reassessed after impoundment, and replaced if needed. ∞ = the seven event monitoring sites.*

Catchment	Location Code (Map reference)	Site No (this Report)	Short Site Name (this Report)	River Influence	Site Type	Number of sample events	Dates Sampled
Main sites							
Mackenzie	130105B	1a	Coolmaringa (initial site)	Mackenzie	Upstream	24	All except: Mar-21, Nov-21, Dec-21, April-22, Oct-22, Nov-22
Callide	130306B	2	Rannes (initial site)	Don	Upstream	30	All (Jul-20 to Dec-22)
Lower Dawson	130322A	3a	Beckers (initial site)	Dawson	Upstream	29	All except: Dec-21
Lower Dawson	#4	4	Boolburra ∞	Dawson	Upstream	4	Sep-22 to Dec-22
Fitzroy	#8	5	Yarra Rd*	Fitzroy	Within impoundment	2	Nov-22 to Dec-22
Fitzroy	#9	6	The Pocket*	Fitzroy	Within impoundment	2	Nov-22 to Dec-22
Fitzroy	130003B	7	Riverslea (initial site)	Fitzroy	Within impoundment	30	All (Jul-20 to Dec-22)
Fitzroy	Weir-US	8b	Weir US∞	Fitzroy	Within impoundment	4	Sep-22 to Dec-22
Fitzroy	Weir-DS	9b	Weir DS∞	Fitzroy	Downstream	4	Sep-22 to Dec-22
Fitzroy	130010A	10	Hanrahan	Fitzroy	Downstream	4	Sep-22 to Dec-22
Fitzroy	#15	11a	Glenroy Rd∞	Fitzroy	Downstream	4	Sep-22 to Dec-22
Fitzroy	130005A	12a	The Gap∞ (initial site)	Fitzroy	Downstream	30	All (Jul-20 to Dec-22)
Alternative sites (may be sampled when main sites are inaccessible)							
Mackenzie	ALT3	1b	Apis Ck Rd ∞	Mackenzie	Upstream	6	Mar-21, Nov-21, Dec-21, April-22, Oct-22, Nov-22
Lower Dawson	ALT6	3b	Baralaba	Dawson	Upstream	1	Dec-21
Fitzroy	RWP	8or9a	At Rookwood	Fitzroy	Within	5	Apr-22 to Aug-22
Fitzroy	#14	11b	Craiglee Rd	Fitzroy	Downstream	0	none
Fitzroy	ALT5	12b	Etna Ck	Fitzroy	Downstream	0	none
Fitzroy	Rock-hampton	12c	Fitzroy at FRW∞	Fitzroy	Downstream	0	none

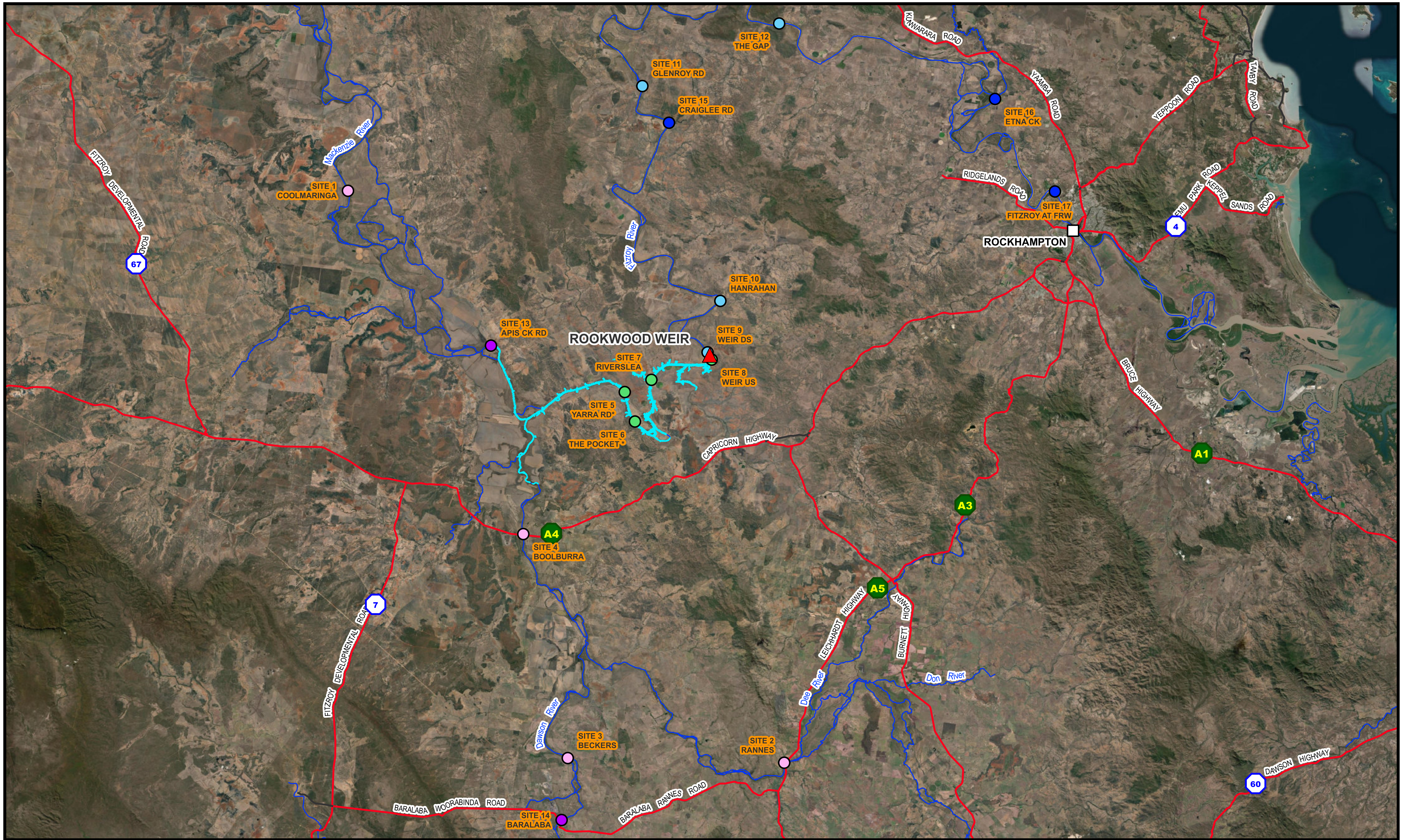


Figure 3: Monitoring Sites

0 5 10 15 20 km

Scale @ A3: 1 : 408000
Date: 26/05/2023
Job: J0234
Drawn: Corey Taylor
CRS: EPSG:7844_GDA2020

N

DATA SOURCE:
QSPATIAL 2023; The State of Queensland (Department of Resources) 2023; Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community;

- Rookwood Weir Project
- State Controlled Roads
- Roads
- Rail
- Innundation Area (46.2 m)
- Watercourse / Drainage Features

Montioring Sites

- Downstream
- Downstream (Alternative Sites)
- Upstream
- Upstream (Alternative Sites)
- Within impoundment

BASE

3.3.3 Baseline monitoring schedule

Monitoring was conducted monthly for the parameters described in Table 3, in accordance with the Queensland Monitoring and Sampling Manual (State of Queensland 2018). Site photos and records of field conditions were also requested for each sampling event. Event monitoring was not conducted during this monitoring period. Some Water Quality Objectives (WQOs) differ by catchment (sub-basin) in the Fitzroy Basin; the WQOs for each of the monitored catchments are provided in Table 4. A total of 193 pesticides were also monitored bimonthly (six times per year), commencing in July 2020 (see Appendix 4).

Table 3: Parameters measured during baseline monitoring, including limits of analytical reporting and toxicant Default Guideline Values (DGV, for metals) from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018), and Fitzroy Sub-Basin Water Quality Objectives (WQOs) from State of Queensland (2013). n/a = DGV or WQO are not available.

Water quality parameter (measurement unit)	Measurement type	Limit of Analytical Reporting (LOR)	Toxicant Default Guideline Value (DGV) (ANZG, 2018)	Fitzroy Sub-basin Environmental Values and Water Quality Objectives (WQO) (State of Queensland, 2013)
Oxidation-Reduction Potential (mV)	In-situ	n/a	n/a	n/a
Temperature (°C)	In-situ	n/a	n/a	n/a
Dissolved oxygen (mg/L)	In-situ	n/a	n/a	n/a
Total Dissolved Solids (mg/L)	In-situ	n/a	n/a	n/a
Dissolved oxygen % Saturation (Field) (%)	In-situ	n/a	n/a	85-110
Electrical Conductivity (µS/cm)	In-situ	n/a	n/a	445 (Base Flow) 250 (High Flow)
pH	In-situ	n/a	n/a	6.5-8.5
Turbidity (NTU)	In-situ	n/a	n/a	50
Ammonia as N (mg/L)	Lab	0.01	0.9	0.02
Chloride (mg/L)	Lab	1	n/a	n/a
Chlorophyll-a (mg/L)	Lab	0.001	n/a	0.005
Aluminium (filtered) (mg/L)	Lab	0.01	0.055	n/a
Copper (filtered) (mg/L)	Lab	0.001	0.0014	n/a
Iron (filtered) (mg/L)	Lab	0.05	n/a	n/a
Manganese (filtered) (mg/L)	Lab	0.001	1.9	n/a
Zinc (filtered) (mg/L)	Lab	0.005	0.008	n/a
Hardness as CaCO3 (mg/L)	Lab	1	n/a	n/a
Ionic Balance (%)	Calculation	0.01	n/a	n/a
Cations Total (meq/L)	Calculation	0.01	n/a	n/a
Anions Total (meq/L)	Calculation	0.01	n/a	n/a
Calcium (filtered) (mg/L)	Lab	1	n/a	n/a
Magnesium (filtered) (mg/L)	Lab	1	n/a	n/a
Potassium (filtered) (mg/L)	Lab	1	n/a	n/a
Sodium (filtered) (mg/L)	Lab	1	n/a	n/a
Sodium Absorption Ratio (filtered)	Calculation	0.01	n/a	n/a
Nitrate (as N) (mg/L)	Lab	0.01	n/a	n/a
Nitrite + Nitrate as N (mg/L) (Dissolved inorganic N, DIN)	Lab	0.01	n/a	0.06
Nitrite (as N) (mg/L)	Lab	0.01	n/a	n/a
Sulfate as SO4 – Turbidimetric (filtered) (mg/L)	Lab	1	n/a	15
Total Suspended Solids (Lab) (mg/L)	Lab	5	n/a	85
Total Dissolved Solids (Lab) (mg/L)	Lab	10	n/a	n/a
Kjeldahl Nitrogen Total (mg/L) (TKN, Total organic N)	Lab	0.1	n/a	n/a

Water quality parameter (measurement unit)	Measurement type	Limit of Analytical Reporting (LOR)	Toxicant Default Guideline Value (DGV) (ANZG, 2018)	Fitzroy Sub-basin Environmental Values and Water Quality Objectives (WQO) (State of Queensland, 2013)
Total Nitrogen (mg/L) (TN)	Lab	0.1	n/a	0.5
Total Phosphorus as P (mg/L) (TP)	Lab	0.01	n/a	0.05
Phosphorous Reactive (as P) (mg/L) (FRP, dissolved inorganic P, DIP)	Lab	0.01	n/a	0.02
Alkalinity (Bicarbonate as CaCO3) (mg/L)	Lab	1	n/a	n/a
Alkalinity (Carbonate as CaCO3) (mg/L)	Lab	1	n/a	n/a
Alkalinity (Hydroxide) as CaCO3 (mg/L)	Lab	1	n/a	n/a
Alkalinity (total) as CaCO3 (mg/L)	Lab	1	n/a	n/a
Electrical Conductivity (Lab) (µS/cm)	Lab	1	n/a	n/a
Fluoride (mg/L)	Lab	0.1	n/a	n/a
pH (Lab) (pH Unit)	Lab	n/a	n/a	n/a

Table 4: Fitzroy Basin, Sub-basin Water Quality Objectives to protect moderately disturbed aquatic ecosystem environmental values, for each of the four catchments (sub-basins) sampled (State of Queensland 2013).

Water quality parameter (measurement unit)	Mackenzie River Sub-basin fresh waters	Fitzroy River Sub-basin fresh waters	Lower Dawson River Sub-basin fresh waters	Callide Creek Catchment fresh waters
Dissolved Oxygen (% Saturation)	85-110	85-110	85-110	85-110
Turbidity (NTU)	<50	<50	<50	<50
Suspended Solids (mg/L)	<110	<85	<10	<30
pH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Electrical Conductivity (base flow) (µS/cm)	<310	<445	<340	<1150
Electrical Conductivity (high flow) (µS/cm)	<210	<250	<210	<600
Sulphate (mg/L)	<10	<15	<25	<20
Ammonia N (µg/L)	<20	<20	<20	<20
Oxidised N (µg/L)	<60	<60	<60	<60
Organic N (µg/L)	<420	<420	<420	<420
Total Nitrogen (µg/L)	<775	<500	<500	<500
Filterable Reactive Phosphorus (µg/L)	<20	<20	<20	<20
Total Phosphorus (µg/L)	<160	<50	<50	<50
Chlorophyll-a (µg/L)	<5.0	<5.0	<5.0	<5.0

3.3.4 Monitoring schedule during construction

The monitoring schedule during construction continued monthly as per previous monitoring, but expanded to include an additional seven monitoring sites from September 2022. Total nitrogen (filtered), total Kjehdahl nitrogen and total phosphorus as P (filtered) were also incorporated into the monitoring schedule at this time, as described in Table 5. The addition of these three measurements allowed for the calculation of particulate nitrogen (PN) and particulate phosphorus (PP).

Table 5: Additional parameters measured from September 2022, including limits of analytical reporting. n/a = DGV or WQO are not available.

Water quality parameter	Measurement type	Limit of Analytical Reporting (LOR)	Toxicant Default Guideline Value (DGV) (ANZG, 2018)	Fitzroy Sub-basin Environmental Values and Water Quality Objectives (WQO) (State of Queensland, 2013)
Total Nitrogen (filtered) (mg/L)*	Lab	0.1	n/a	n/a
Kjeldahl Nitrogen Total (filtered) (mg/L)* (Dissolved organic N, DON)	Lab	0.1	n/a	n/a
Total Phosphorus as P (filtered) (mg/L)*	Lab	0.01	n/a	n/a
Particulate N (PN) calculated from [TN] - [TN-filtered] *	Calculated from provided data	n/a	n/a	n/a
Particulate P (PP) Calculated from [TP] – [TP-filtered] *	Calculated from provided data	n/a	n/a	n/a

This monitoring schedule continued until June 2023 and the submission of version 2.1 of this Water Quality Monitoring and Reporting Program to DCCEEW, although data was only included in the program up until December 2022. At this time construction monitoring ended to be replaced by the inundation monitoring schedule following the commissioning of the weir. No major flood events specifically in the form of a 'major' flood event as defined by the Bureau of Meteorology (BOM) have occurred during the baseline and construction monitoring period, so event monitoring did not occur.

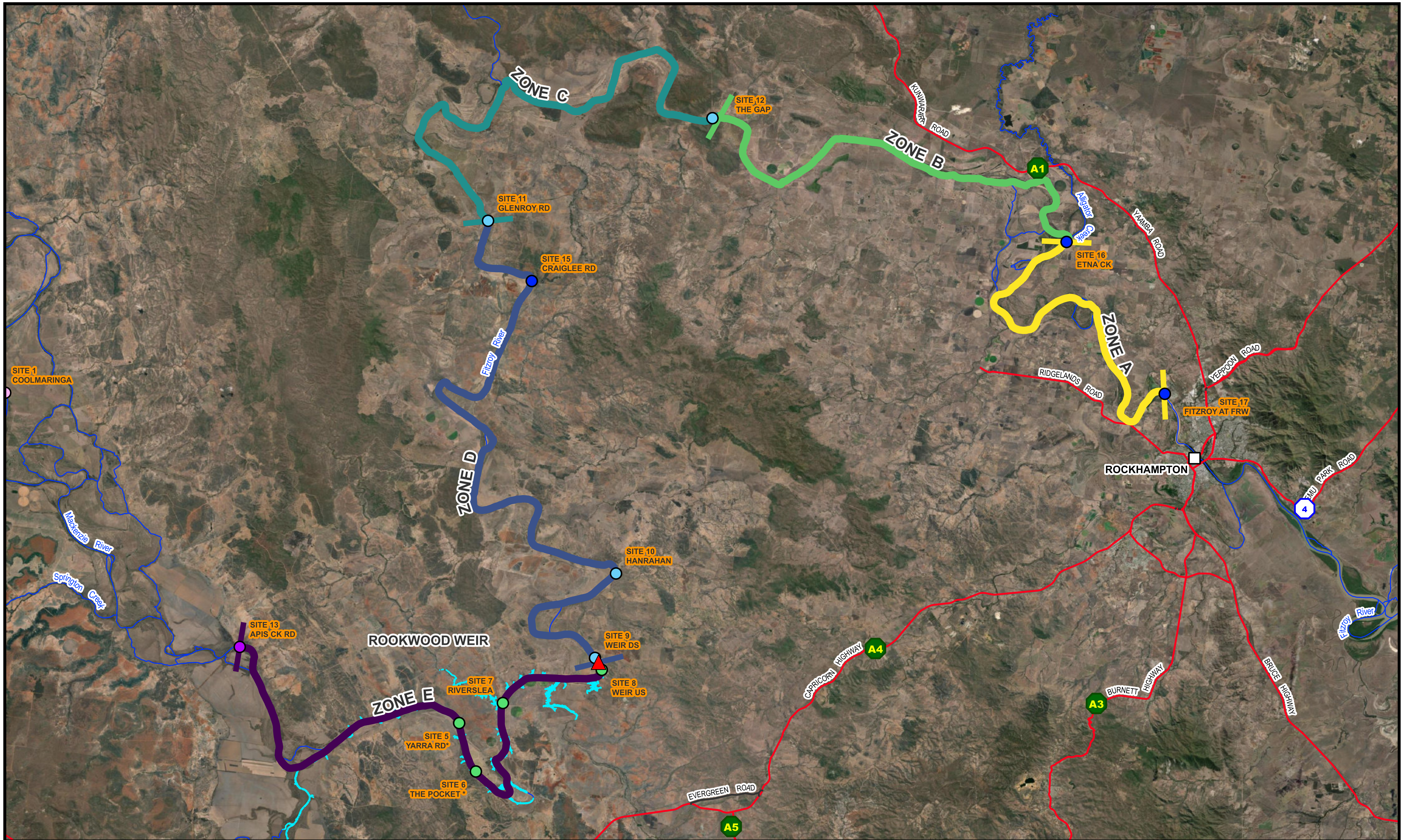


Figure 4: Water Quality Monitoring Zones - Agricultural Operations

0 2.5 5 7.5 10 km

Scale @ A3: 1 : 250000
Date: 29/05/2023
Job: J0234
Drawn: Corey Taylor
CRS: EPSG:7844_GDA2020

N

DATA SOURCE:
QSPATIAL 2023; The State of Queensland (Department of Resources) 2023; Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community;

- Rookwood Weir Project
- State Controlled Roads
- Roads
- Rail
- Inundation Area (46.2 m)
- Watercourse / Drainage Features

Montioring Sites

- Downstream
- Downstream (Alternative Sites)
- Upstream
- Upstream (Alternative Sites)
- Within impoundment

Water Quality Monitoring Zones

- Zone A
- Zone B
- Zone C
- Zone D
- Zone E

BASE/

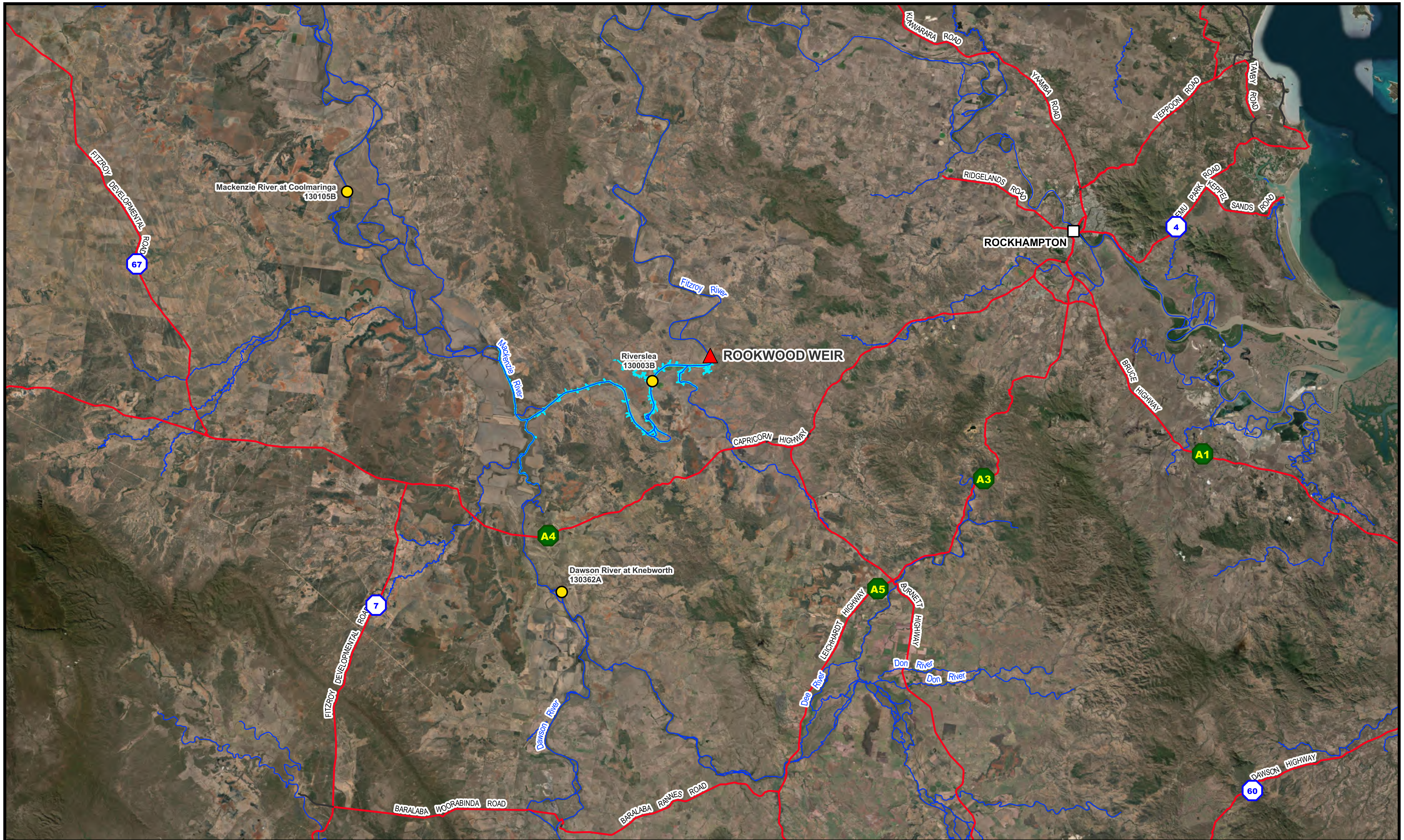


Figure 5: Gauging Stations

0 5 10 15 20 km

Scale @ A3: 1 : 408408
Date: 02/06/2023
Job: J0234
Drawn: Corey Taylor
CRS: EPSG:7844_GDA2020

N

DATA SOURCE:
QSPATIAL 2023; The State of Queensland (Department of Resources) 2023; Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community;

- Rookwood Weir Project
- State Controlled Roads
- Roads
- Rail
- Innundation Area (46.2 m)
- Watercourse / Drainage Features
- Gauging Stations

BASE/

Project Path - (C:\Users\ctayl\BASE Dropbox\BASE Project Folder\Job Folder\J0047 LFRIP (Sunwater)\ROOKWOOD WEIR\GIS\J0047 Rookwood Weir Figures_25052023.qgz); Figures - (C:\Users\ctayl\BASE Dropbox\BASE Project Folder\Job Folder\J0234 Sunwater Approvals and Environmental Support - M Dixon\Outgoing Plans\1. Water Quality Monitoring Figures)

3.4 Results and discussion of baseline and construction monitoring

Data collected during baseline and construction monitoring from July 2020 to December 2022 have been analysed, to aid in the establishment of pre-action baselines to assess water quality changes that may result from the development. Correlations between flow and water quality parameters were calculated, as flow is a recognised driver of changes in water quality in downstream waterways like the Lower Fitzroy River. The time series of monitoring results for key parameters are discussed in separate sections 3.4.2 through to 3.4.5, below, and these results as well as results for other monitored parameters are provided together in Appendix 2.

3.4.1 Correlations between stream flow and water quality

Data collected by Sunwater at the five baseline monitoring sites from July 2020 to December 2022 were analysed using Pearson's correlation analysis. The aim of this analysis was to undertake a preliminary investigation of correlations between stream flow and some of the water quality parameters sampled. Unlike the calculation of pre-action baseline water quality values (that didn't include data from downstream sites once construction had commenced), this analysis included all samples collected from July 2020 to December 2022. This analysis is separate from the data analysis performed to determine the pre-action baseline values and was not used in the determination of these numbers. Sampling data from the Sunwater monitoring program were matched to stream flow data for the relevant gauging stations, from the Queensland Government's online Water Monitoring Information Portal (https://water-monitoring.information.qld.gov.au/).

At each sampling site and time, flow data was categorised as either low flow or high flow, using the thresholds for each catchment described in the Queensland Government's Water Quality Objectives (WQOs) for Fitzroy Basin sub-Basins, as scheduled under the Environmental Protection (Water and Wetland Biodiversity) Policy in 2011 (EPP) (Table 6). The correlation coefficient (r) is a measure of the extent to which each water quality variable changes with flow. The level of statistical significance (p) is also provided for each correlation with <0.05 the significance level adopted by the project.

As flow was usually low during the 2.5 years of monitoring data analysed, limited high flow sampling data was available for analysis (see Appendix 5).

Table 6: Break points between high and low flow adopted for each gauging station / sampling site

Catchment (sub-Basin)	Gauging station / site name	Site type	Gauging station number	Flow regime break-points (m^3/s)
Callide	Don River at Rannes Recorder	Upstream	130306B	11
Lower Dawson	Dawson River at Beckers	Upstream	130322A	16
Mackenzie	Mackenzie River at Coolmaringa	Upstream	130105B	42
Fitzroy	Fitzroy River at Riverslea	Within impoundment area; upstream of construction	13003B	41
Fitzroy	Fitzroy River at The Gap	Downstream	13005A	41

Don River at Rannes: Only two sampling events occurred during high flow (> 11 m3/s), so it was not possible to analyse data from high flow events separately. The 27 sampling events that occurred during low flow were analysed separately, and then with high flow data included (Table 7). Significant correlations between stream flow and turbidity and total suspended solids were evident in both low flow conditions and low-high flow combined. There was a significant correlation between stream flow and total dissolved solids during low flows, and significant correlations between stream flow and the two pesticides (Atrazine and Tebuthiuron) when low-high flow data were combined.

Table 7: Results of stream flow correlation analysis for Don River at Rannes,

*During low flow (n = 27) and all flow conditions (n = 30). *, **, *** = significant at p < 0.1, p < 0.05 and p < 0.01 levels.*

Water quality parameter	Discharge < 11 m^3/s (low flow)		All data including high flow	
	Correlation Coefficient (r)	p- value	Correlation Coefficient (r)	p- value
Dissolved oxygen (mg/L)	0.018	0.929	-0.022	0.911
Total Dissolved Solids (mg/L)	0.138	0.492	-0.157	0.418
Dissolved oxygen saturation (%)	0.050	0.806	0.220	0.251
Electrical Conductivity (µS/cm)	0.085	0.674	-0.086	0.656
pH	-0.314	0.111	-0.233	0.224
Turbidity (NTU)	0.442	0.021**	0.313	0.098*
Chlorophyll-a (mg/L)	-0.124	0.536	-0.088	0.648
Total Suspended Solids (Lab) (mg/L)	0.795	0.000***	0.364	0.052*
Total Dissolved Solids (Lab) (mg/L)	0.394	0.042**	0.190	0.325
Total Nitrogen (mg/L)	0.210	0.294	0.187	0.332
Total Phosphorus as P (mg/L)	0.236	0.236	0.173	0.369
Atrazine (mg/L)	-0.192	0.337	0.342	0.070*
Tebuthiuron (mg/L)	0.113	0.574	0.342	0.070*

Data source: Sunwater data July 2020 – December 2022

Dawson River at Beckers: As only five sampling events occurred during high flow (> 16 m3/s), it was not possible to analyse data from high flow events separately. The 25 sampling events that occurred during low flow were analysed separately, and then with high flow data included (Table 8). Significant correlations between stream flow and chl-a, total suspended solids, total dissolved solids and total nitrogen were evident in both low flow conditions and low-high flow combined. There was also a significant correlation between stream flow and pH when low-high flow data were combined.

Table 8: Results of stream flow correlation analysis for Dawson River at Beckers (inc alt site Baralaba),

*During low flow (n = 25) and all flow conditions (n = 30). *, **, *** = significant at p < 0.1, p < 0.05 and p < 0.01 levels.*

Water quality parameter	Discharge < 11 m^3/s (low flow)		All data including high flow	
	Correlation Coefficient (r)	p-value	Correlation Coefficient (r)	p-value
Dissolved oxygen (mg/L)	0.007	0.974	-0.074	0.704
Total Dissolved Solids (mg/L)	-0.032	0.883	-0.114	0.558
Dissolved oxygen saturation (%)	-0.118	0.584	-0.191	0.320
Electrical Conductivity (µS/cm)	0.270	0.202	-0.159	0.409
pH	-0.344	0.100	-0.393	0.035**
Turbidity (NTU)	0.152	0.477	0.301	0.113
Chlorophyll-a (mg/L)	0.549	0.005***	0.549	0.002***
Total Suspended Solids (Lab) (mg/L)	0.556	0.005***	0.592	0.001***
Total Dissolved Solids (Lab) (mg/L)	0.371	0.075*	0.320	0.091*

Water quality parameter	Discharge < 11 m^3/s (low flow)		All data including high flow	
	Correlation Coefficient (r)	p-value	Correlation Coefficient (r)	p-value
Total Nitrogen (mg/L)	0.396	0.055*	0.443	0.016***
Total Phosphorus as P (mg/L)	0.291	0.168	0.220	0.251
Atrazine (mg/L)	-0.144	0.502	-0.171	0.374
Tebuthiuron (mg/L)	0.037	0.862	0.196	0.309

Data source: Sunwater data July 2020 – December 2022

Mackenzie at Coolmaringa: As only three sampling events occurred during high flow (> 42 m3/s), it was not possible to analyse data from high flow events separately. The 27 sampling events that occurred during low flow were analysed separately, and then with high flow data included (Table 9). Significant correlations between stream flow and dissolved oxygen saturation, total suspended solids, total dissolved solids, total nitrogen and total phosphorus were evident in both low flow conditions and low-high flow combined. There were also significant correlations between stream flow and pH and Atrazine when low-high flow data were combined, and between stream flow and dissolved oxygen concentration and Tebuthiuron during low flow.

Table 9: Results of stream flow correlation analysis for Mackenzie at Coolmaringa,

*During low flow (n = 27) and all flow conditions (n = 30). *, **, *** = significant at p < 0.1, p < 0.05 and p < 0.01 levels.*

Water quality parameter	Discharge < 11 m^3/s (low flow)		All data including high flow	
	Correlation Coefficient (r)	p-value	Correlation Coefficient (r)	p-value
Dissolved oxygen (mg/L)	-0.484	0.010**	-0.246	0.198
Total Dissolved Solids (mg/L)	-0.128	0.524	0.014	0.943
Dissolved oxygen saturation (%)	-0.478	0.012**	-0.337	0.073*
Electrical Conductivity (µS/cm)	-0.105	0.602	-0.266	0.164
pH	-0.242	0.224	0.617	0.000***
Turbidity (NTU)	-0.262	0.187	-0.020	0.916
Chlorophyll-a (mg/L)	0.141	0.484	0.145	0.453
Total Suspended Solids (Lab) (mg/L)	0.880	0.000***	0.733	0.000***
Total Dissolved Solids (Lab) (mg/L)	0.749	0.000***	0.413	0.026**
Total Nitrogen (mg/L)	0.642	0.000***	0.870	0.000***
Total Phosphorus as P (mg/L)	0.812	0.000***	0.900	0.000***
Atrazine (mg/L)	0.209	-0.296	0.987	0.000***
Tebuthiuron (mg/L)	0.704	0.000***	0.164	0.394

Data source: Sunwater data July 2020 – December 2022

Fitzroy River at Riverslea: Only five sampling events occurred during high flow (> 41 m^3/s), so it was not possible to analyse data from high flow events separately. The 25 sampling events that occurred during low flow were analysed separately, and then with high flow data included (Table 10). A significant correlation between stream flow and turbidity was evident in both low flow conditions and low-high flow combined. Significant correlations were also identified between streamflow and pH, chl-a, and Tebuthiuron in low flow conditions. There were significant correlations between stream flow and dissolved oxygen concentration dissolved oxygen saturation, total suspended solids and total nitrogen, when low-high flow data were combined.

Table 10: Results of stream flow correlation analysis for Fitzroy River at Riverslea,

*During low flow (n = 25) and all flow conditions (n = 30). *, **, *** = significant at p < 0.1, p < 0.05 and p < 0.01 levels.*

Water quality parameter	Discharge < 11 m^3/s (low flow)		All data including high flow	
	Correlation Coefficient (r)	p-value	Correlation Coefficient (r)	p-value
Dissolved oxygen (mg/L)	-0.195	0.360	-0.428	0.021**
Total Dissolved Solids (mg/L)	-0.299	0.155	-0.286	0.132
Dissolved oxygen saturation (%)	-0.202	0.344	-0.497	0.006***
Electrical Conductivity (µS/cm)	-0.264	0.213	-0.250	0.191
pH	-0.394	0.057*	-0.227	0.235
Turbidity (NTU)	0.495	0.014**	0.595	0.001***
Chlorophyll-a (mg/L)	-0.092	0.014**	-0.092	0.637
Total Suspended Solids (Lab) (mg/L)	-0.052	0.671	0.502	0.006***
Total Dissolved Solids (Lab) (mg/L)	0.157	0.809	0.293	0.122
Total Nitrogen (mg/L)	-0.042	0.465	0.413	0.026**
Total Phosphorus as P (mg/L)	0.110	0.847	0.232	0.226
Atrazine (mg/L)	0.873	0.608	0.078	0.687
Tebuthiuron (mg/L)	0.955	0.000***	0.085	0.662

Data source: Sunwater data July 2020 – December 2022

Fitzroy River at the Gap: seven sampling events occurred during high flow (> 41 m^3/s), so it was not possible to analyse data from high flow events separately. The 23 sampling events that occurred during low flow were analysed separately, and then with high flow data included (Table 11). Significant correlations between stream flow and dissolved oxygen concentration, pH, turbidity, total suspended solids, total dissolved solids, Atrazine and Tebuthiuron were evident in both low flow conditions and low-high flow combined. A significant correlation between stream flow and total phosphorus was identified only during low flow conditions. There were also significant correlations between stream flow and dissolved oxygen saturation and total nitrogen, when low-high flow data were combined.

Table 11: Results of stream flow correlation analysis for Fitzroy River at The Gap

*During low flow (n = 23) and all flow conditions (n = 30). *, **, *** = significant at p < 0.1, p < 0.05 and p < 0.01 levels.*

Water quality parameter	Discharge < 11 m^3/s (low flow)		All data including high flow	
	Correlation Coefficient (r)	p-value	Correlation Coefficient (r)	p-value
Dissolved oxygen (mg/L)	-0.390	0.060*	-0.514	0.004***
Total Dissolved Solids (mg/L)	-0.233	0.274	0.097	0.617
Dissolved oxygen saturation (%)	-0.339	0.105	-0.492	0.007***
Electrical Conductivity (µS/cm)	-0.150	0.483	0.124	0.521
pH	-0.564	0.004***	-0.312	0.099*
Turbidity (NTU)	0.522	0.009***	0.443	0.016**

Water quality parameter	Discharge < 11 m^3/s (low flow)		All data including high flow	
	Correlation Coefficient (r)	p-value	Correlation Coefficient (r)	p-value
Chlorophyll-a (mg/L)	0.114	0.597	-0.213	0.267
Total Suspended Solids (Lab) (mg/L)	0.506	0.012**	0.702	0.000***
Total Dissolved Solids (Lab) (mg/L)	0.648	0.001***	0.326	0.084*
Total Nitrogen (mg/L)	0.290	0.170	0.451	0.014**
Total Phosphorus as P (mg/L)	0.506	0.012**	0.039	0.842
Atrazine (mg/L)	0.860	0.000***	-0.450	0.014**
Tebuthiuron (mg/L)	0.857	0.000***	0.548	0.002***

Data source: Sunwater data July 2020 – December 2022

3.4.2 Total suspended solids and stream flow

Sediment loads are one of the main reef water quality concerns for the Fitzroy Basin and correlations between streamflow and both turbidity and total suspended solids were identified across multiple baseline sites. Bivariate plots of total suspended solids (mg/L) and stream flow were prepared using low flow data from each of the five sites (Figure 6), to further investigate this relationship. The plots illustrate that the strength of the relationship between sediment and stream flow varies between sites during low flow conditions and that sediment concentrations can vary widely even when there is no flow (0 m^3/s).

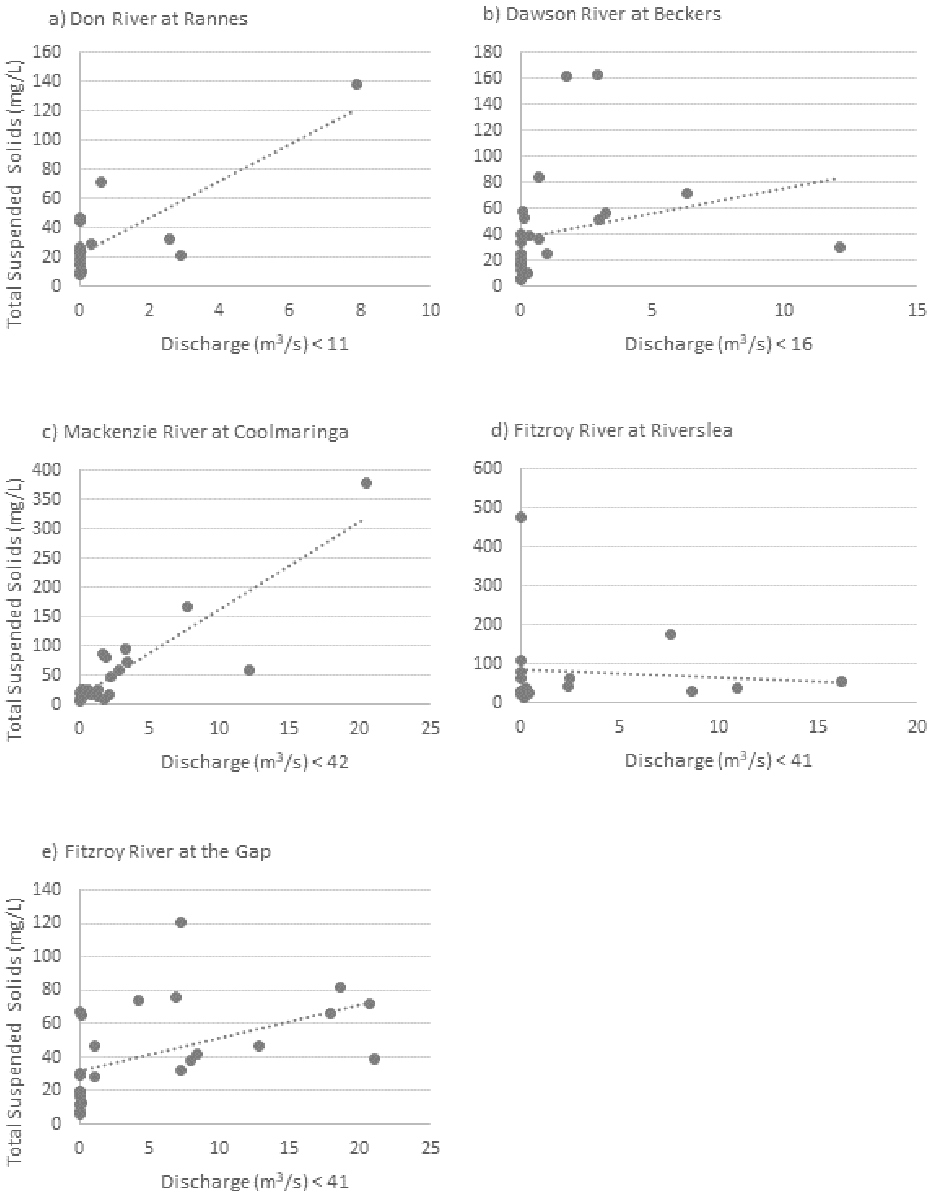


Figure 6 Concentration of total suspended solids vs stream flow (discharge) during low flow conditions, at each of the five initial Sunwater monitoring sites. Data source: Sunwater data July 2020 – December 2022

3.4.3 Summary of correlations between stream flow and water quality

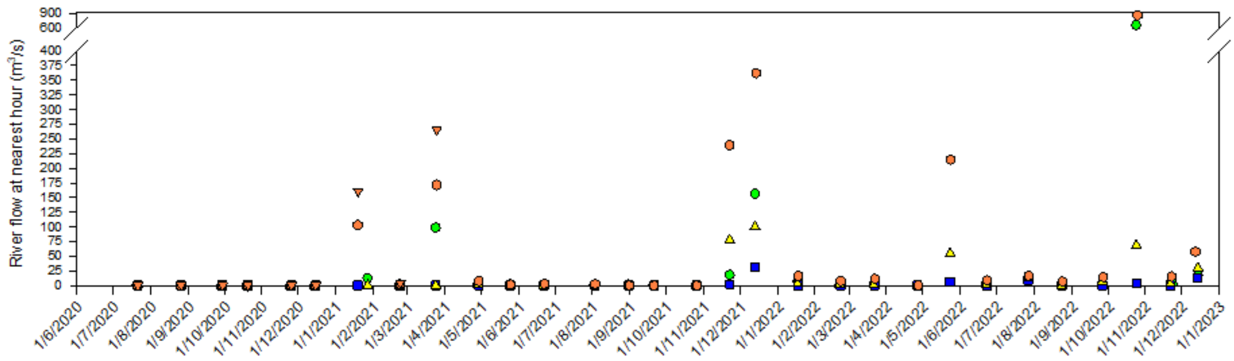
Stream flow was frequently correlated with turbidity (at three sites), total suspended solids (four sites), total dissolved solids (three sites) and pesticide concentrations (three sites) during low flows. Correlations with dissolved oxygen and nutrients (total nitrogen and total phosphorus) were less frequently recorded. However, it is relevant to note that few high flow events occurred in the Fitzroy Basin during monitoring (Appendix 5), and flow events are typically associated with higher loads of the three key reef pollutants (nutrients, sediments and pesticides) (Douglas et al. 2006, Bainbridge et al. 2012; Baird et al. 2017, 2021). Despite this limitation, the baseline monitoring results demonstrate that stream flow is still influencing concentrations of key pollutants during low flow periods, but with high variability.

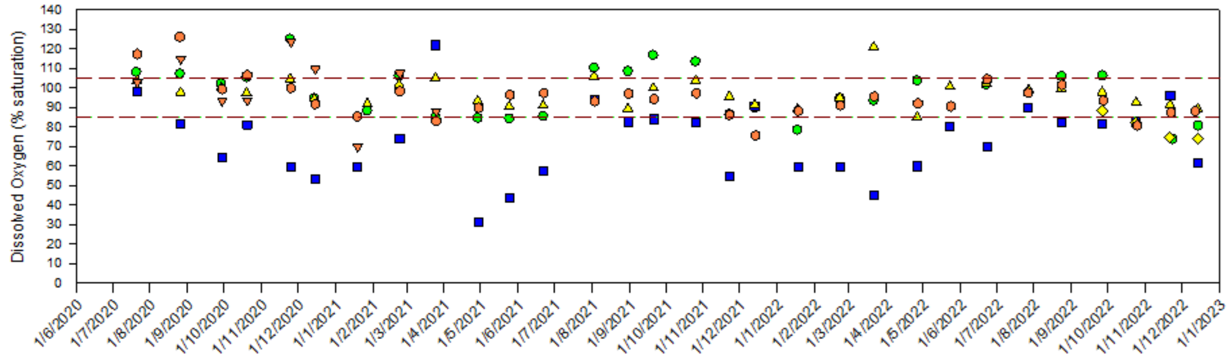
3.4.4 Baseline Results for Dissolved Oxygen, Temperature, pH and Electrical Conductivity

These four physicochemical parameters could be affected by the impoundment, through altered flow. In low and no-flow waters, particulate matter settles with the sediment, reducing turbidity and allowing greater light penetration, which in turn increases water temperature. Low flow and higher temperatures also support algal growth (discussed further in the Nutrients and chlorophyll-a section 3.4.4, below).

Deep impoundments may result in stratification of water into layers with different chemical properties. At depth, hypoxic or anoxic waters (low or no dissolved oxygen, respectively) may lead to a reduction in biodiversity. Stratification can also affect freshwater algal communities at different depths. If released downstream, hypoxic water can have impacts on fish and other fauna in receiving environments. Vertical profiling of temperature provides an indicator of stratification and can be used to trigger more extensive dissolved oxygen and chl-a monitoring. Hypoxia, high electrical conductivity and acidic/alkaline waters (indicated by pH) can also be detrimental to freshwater turtles. Because dissolved oxygen concentrations are also affected by algal growth triggered by high nutrient concentrations, dissolved oxygen monitoring is also relevant to changes in agricultural land use.

Results for dissolved oxygen, temperature, pH and electrical conductivity are provided in Figure 7. Dissolved oxygen saturation (%) was frequently measured above and below the maximum (105%) and minimum (85%) guideline values at most sites. pH was sometimes higher than the maximum guideline value (8.5), particularly in the Mackenzie and Fitzroy sites, but seldom lower than the minimum guideline value (6.5). Electrical conductivity was also sometimes elevated above the relevant guideline values for baseline conditions, in each catchment, with the exception of the Don River (Callide catchment) site which has a much higher guideline value than the other catchments (1150 µS/cm).





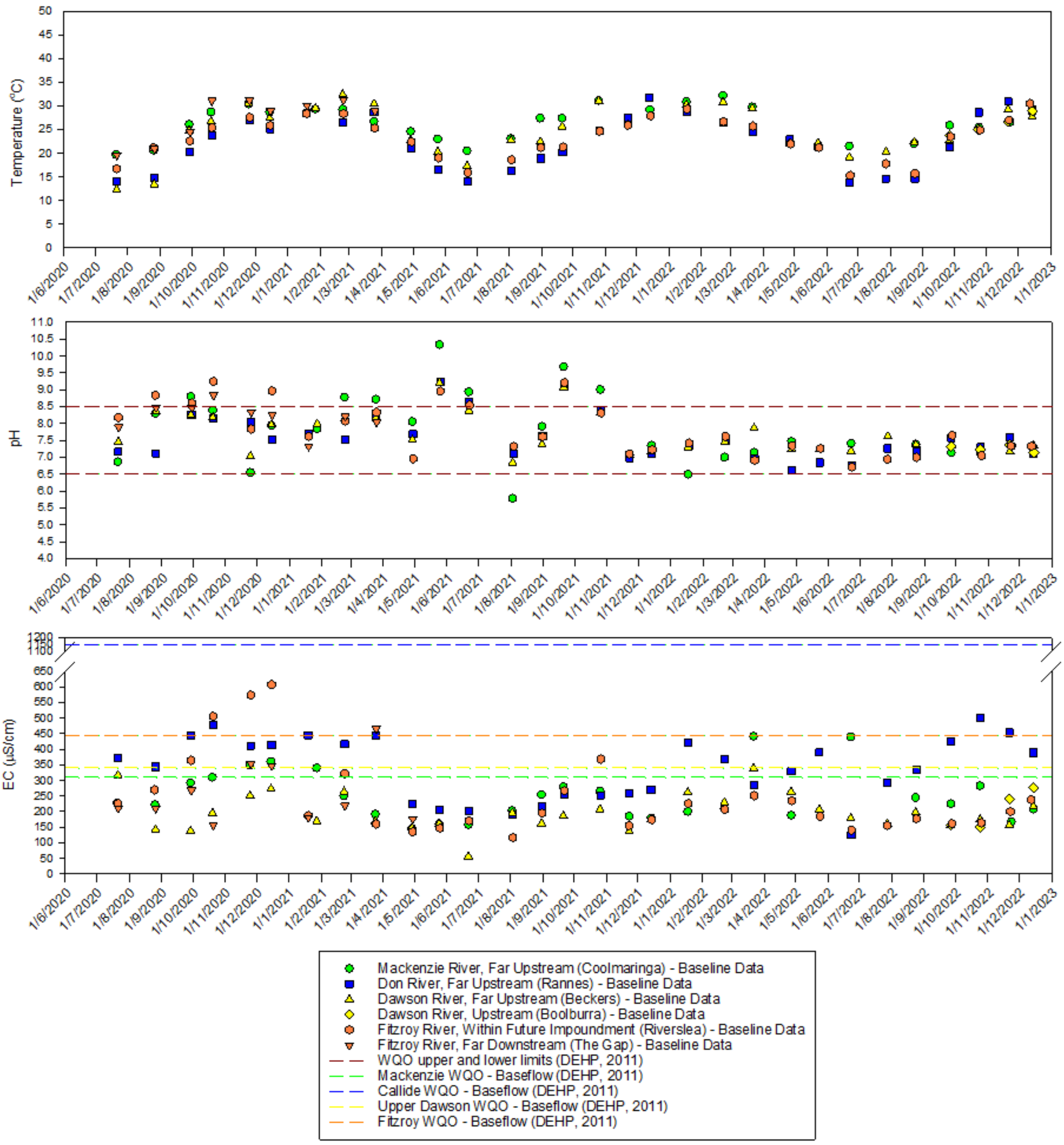


Figure 7: Monitoring results for dissolved oxygen, temperature, pH and electrical conductivity (EC) during baseline monitoring (for all sites) and construction monitoring (for sites upstream of construction works, only). Data source: Sunwater data July 2020 – December 2022

3.4.5 Turbidity and Total Suspended Solids

Fine sediments are a key pollutant affecting the health of the Great Barrier Reef. Turbidity and total suspended solids may be reduced by the impoundment, as reduced flow results in lower resuspension of bottom sediments. Conversely, total suspended solids may be increased as a result of the impoundment, through reduced protection of the riparian buffer zones that will be inundated.

As reported in the Reef 2050 Long-Term Sustainability Plan 2021-25, the main source of sediments to the reef is agricultural land uses (Commonwealth of Australia, 2021). It is anticipated that land use in the vicinity of Rookwood weir may shift from grazing on native pastures, to irrigated cropping (particularly tree crops) and cattle feedlots. It is possible that these activities could influence the amount of sediment runoff into adjacent waterways and the Fitzroy River.

The baseline monitoring results for turbidity and total suspended solids are provided in Figure 8. Turbidity was frequently above the guideline value (50 NTU) at all sites, with higher concentrations sometimes aligning with higher flow, as also indicated in the Correlations between stream flow and water quality section, above. Total suspended solids were also often measured at higher concentrations than the relevant guideline values for each catchment. At the Fitzroy River site of Riverslea, which is located upstream of the construction zone and within the area of the impoundment, turbidity reached a maximum of 800 NTU and total suspended solids reached over 400 mg/L. The Mackenzie River site at Coolmaringa, upstream of the impoundment area, showed similarly high turbidity and TSS. This is an important consideration in the development of relevant baselines.

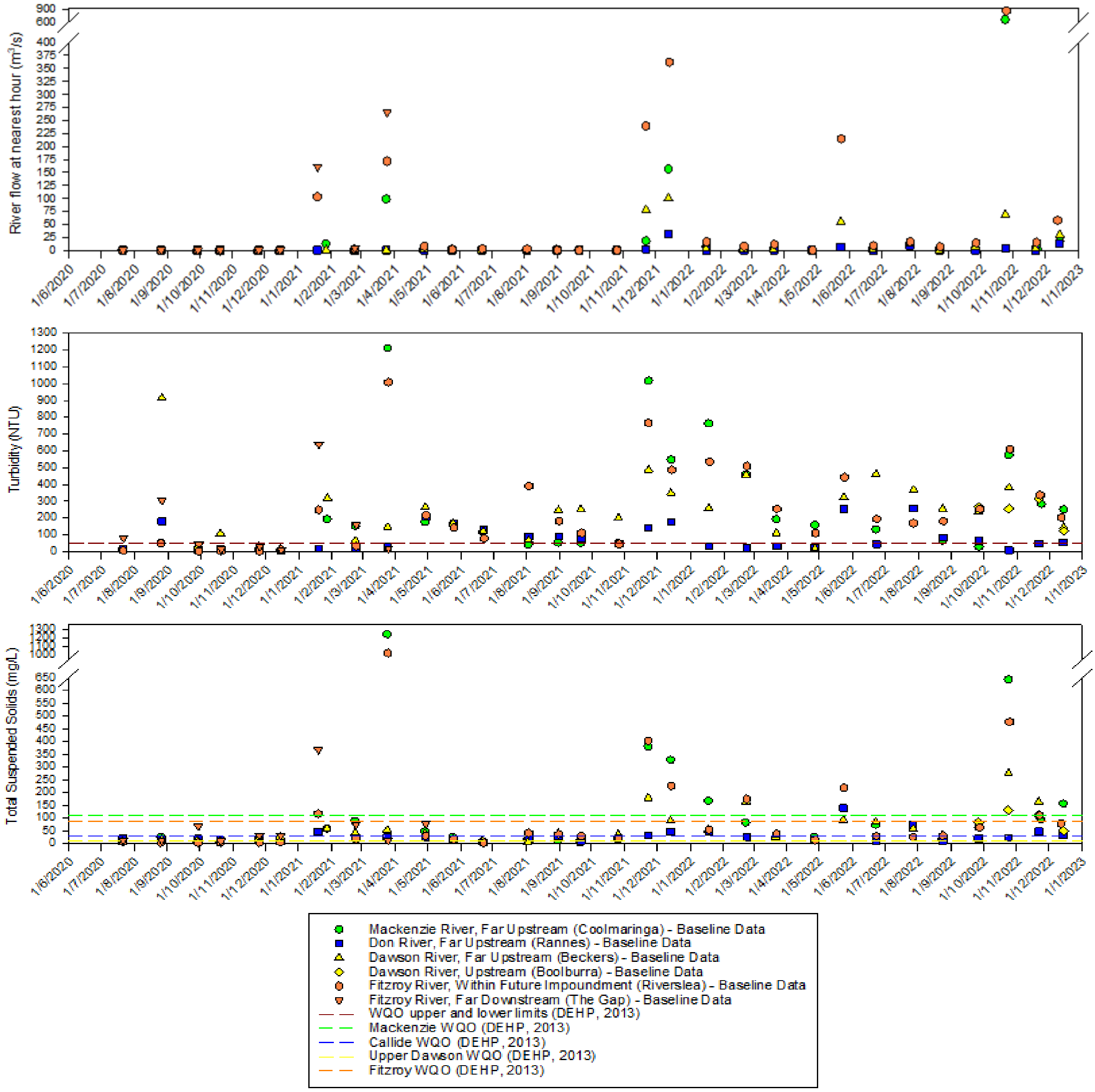


Figure 8: Monitoring results for turbidity and total suspended solids during baseline monitoring (for all sites) and construction monitoring (for sites upstream of construction works, only). Data source: Sunwater data July 2020 – December 2022

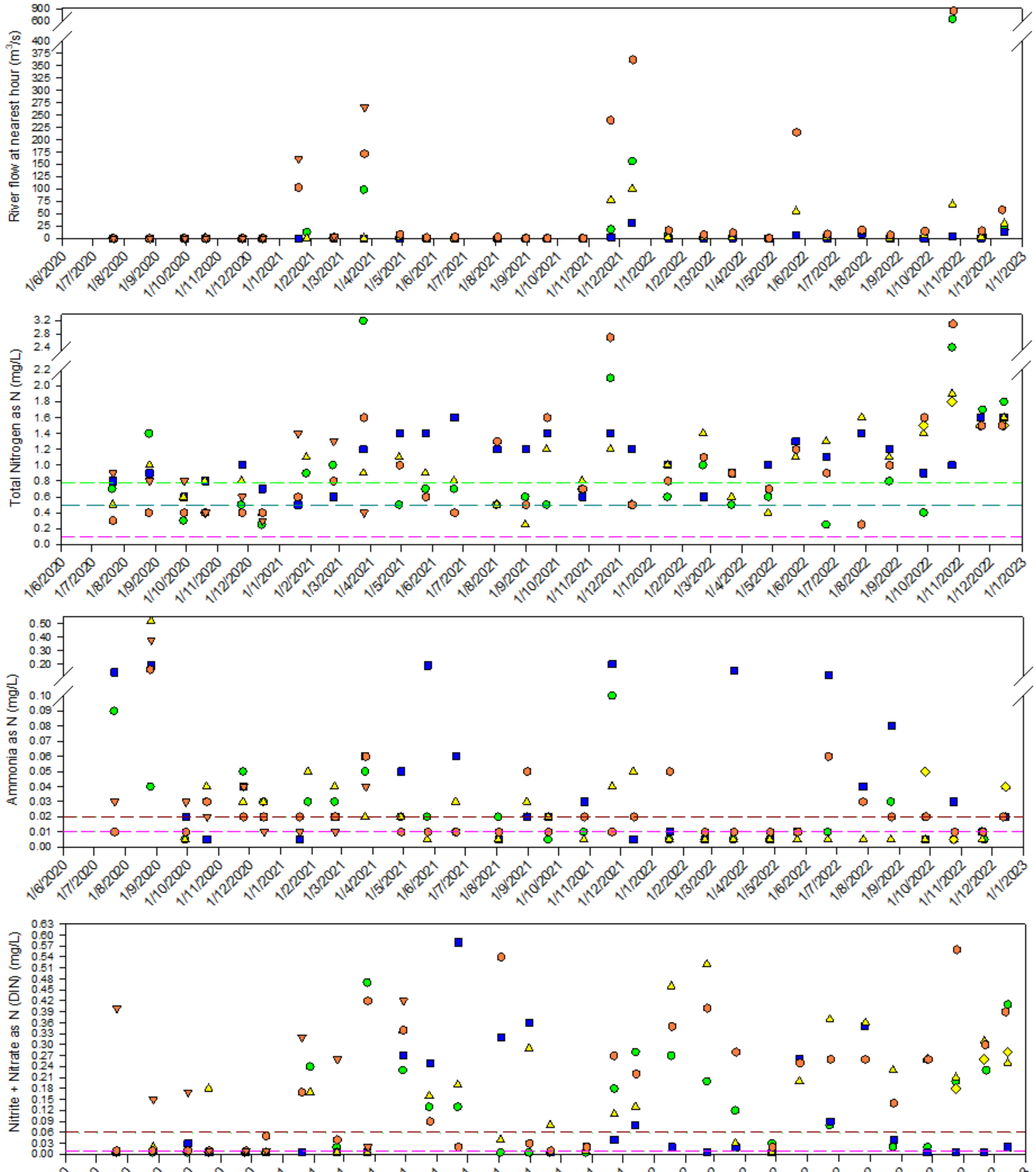
3.4.6 Nutrients and Chlorophyll-a

Nutrients are one of the three key reef water quality pollutants and also impact on waterway health in rivers and freshwater wetlands. Increases in nutrient concentrations are a likely impact of the inundation phase and a possible impact following changes in agricultural land use as a result of the weir development.

During and following impoundment, submerged vegetation decays and releases nutrients into the water column, lowering the oxidation-reduction potential of the water and dissolved oxygen saturation (Goldman, 1977). In the transitional period directly following impoundment, there is also a higher risk of algal blooms (indicated by increased chl-a concentrations).

Nutrient loads in the Great Barrier Reef lagoon are influenced by agricultural land uses in catchment areas (Commonwealth of Australia, 2021) and the Fitzroy Basin is presents a high risk of dissolved inorganic nitrogen exposure to the reef due to the extent of its flood plumes (Wolff et al. 2018). As land use in the vicinity of Rookwood weir may shift from grazing on native pastures, to irrigated cropping (particularly tree crops) and cattle feedlots, there is a possibility of increased nutrient loads to the reef via the Fitzroy River.

Baseline monitoring results for nutrients with guideline values available are provided in Figure 9. All nutrients were frequently above the guideline value at all sites, with higher concentrations sometimes aligning with higher river flow, as also indicated in the Correlations between stream flow and water quality section, above. The results for the Fitzroy River sites and for sites in the catchments upstream of the Lower Fitzroy, indicate that the WQOs for nutrients are already being exceeded, prior to inundation or agricultural land use development. This is an important consideration in the development of relevant baselines to monitor changes in water quality. The WQO for chl-a was also often exceeded across the range of monitored sites, though in the Fitzroy River sites this was less frequent than nutrient exceedances.


River flow at nearest hour (m^3/s)
Total Nitrogen as N (mg/L)
Ammonia as N (mg/L)
Nitrite + Nitrate as N (DIN) (mg/L)

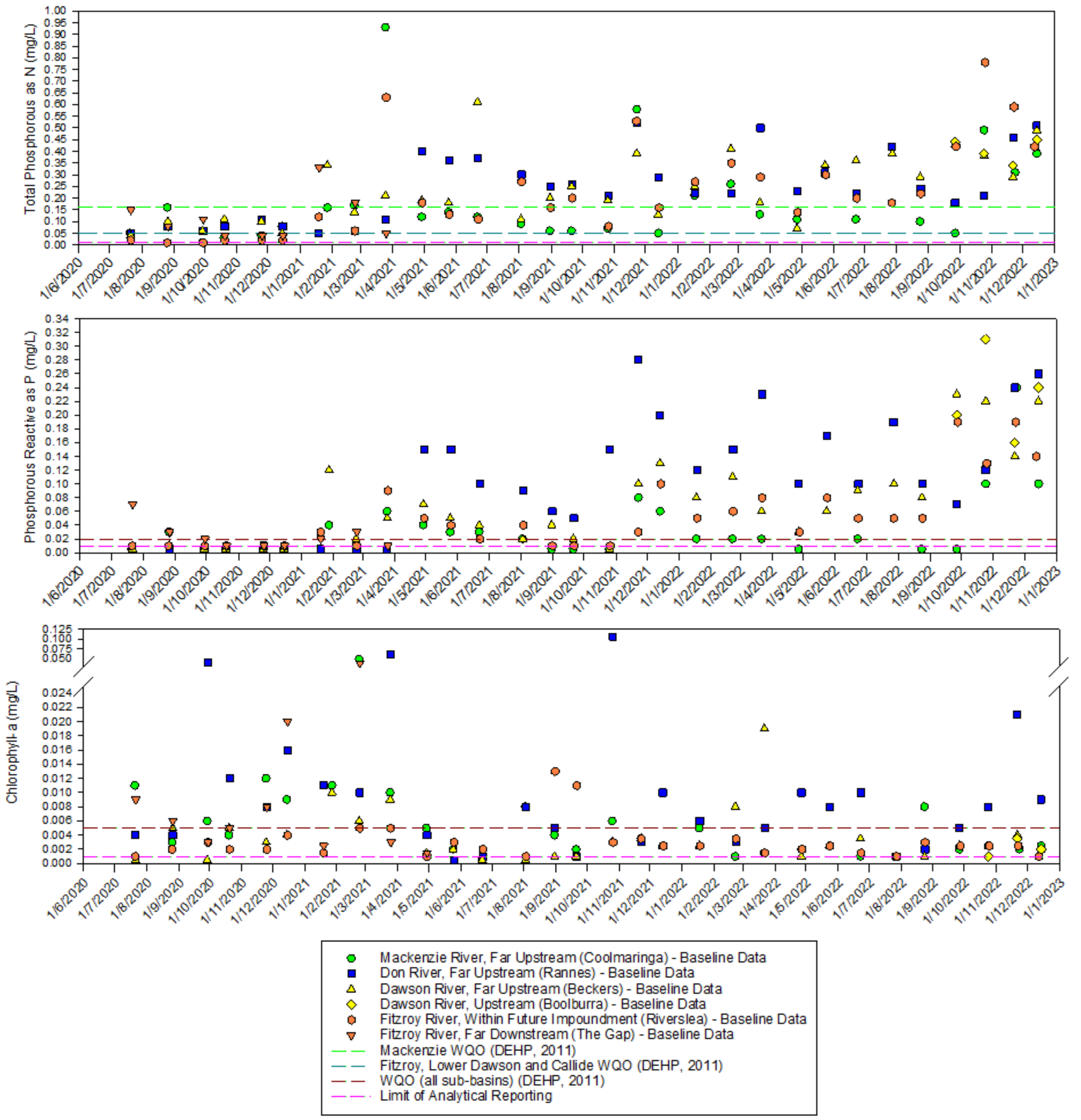


Figure 9: Monitoring results for selected nutrients and chlorophyll-a during baseline monitoring (for all sites) and construction monitoring (for sites upstream of construction works, only). Data source: Sunwater data July 2020 – December 2022

3.4.7 Pesticides

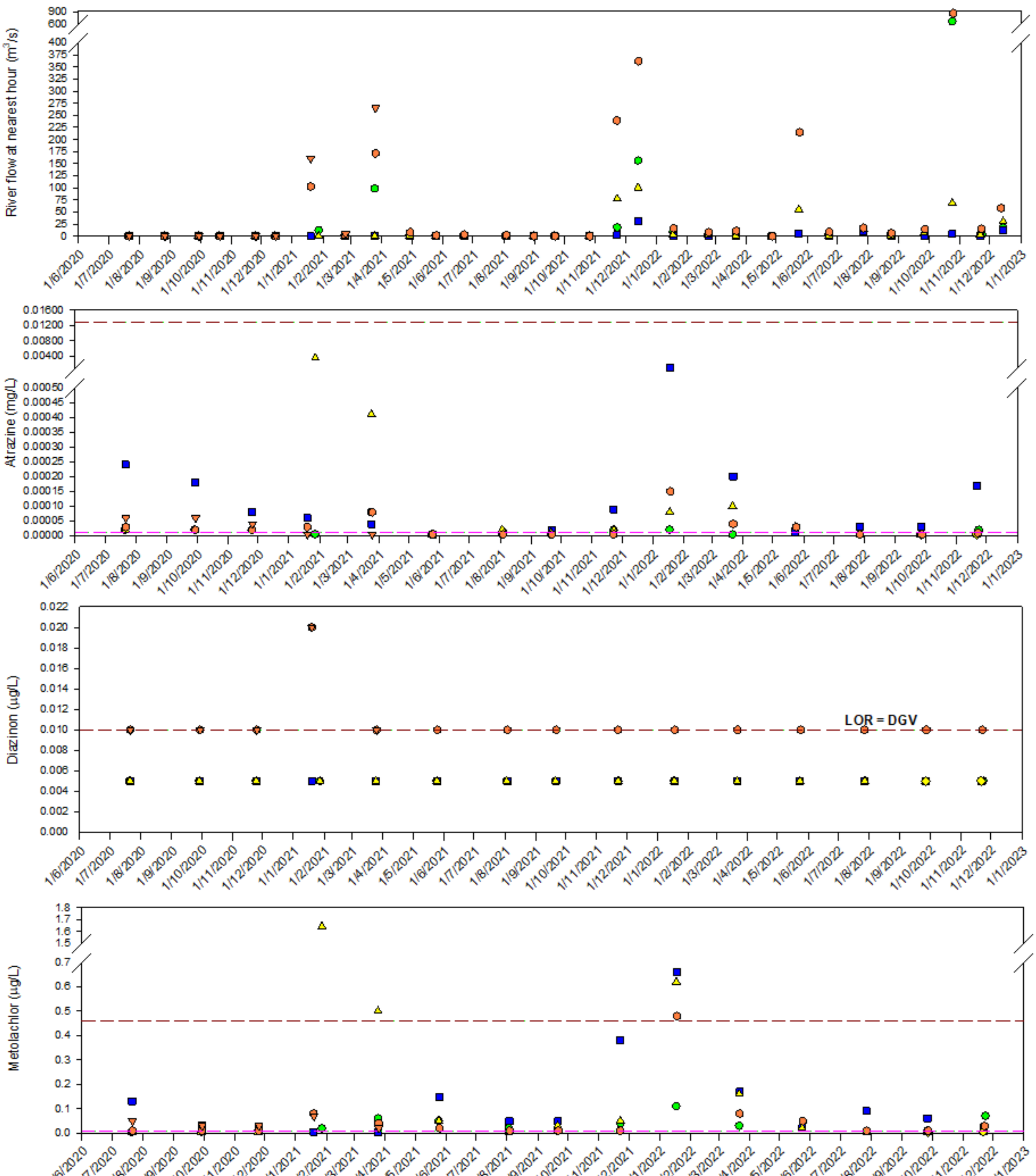
Diffuse-source pollution from agricultural land is the main source of pesticides to the Great Barrier Reef. As pesticide transport to river systems is usually via overland flow, higher pesticide loads are associated with rainfall and stream flow, along with factors such as the timing of pesticide applications (Waterhouse et al. 2017). The change in land use from grazing to irrigated cropping and feedlots could result in increased pesticide loads from the Fitzroy Basin, unless application is carefully managed. This makes the utilisation of effective Farm Plans accredited to the Land Management Code of Practice an important aspect of water quality management for Rookwood weir (see Section 11 Assessment, Adaption and Reporting below).

Baseline monitoring detected a total of 19 pesticides (Table 12), of which five have DVGs (Figure 10). Diazonon, Metalachlor and Tebuthiuron were detected at concentrations higher than their respective DVGs, including at Riverslea which is within the future impoundment area. Importantly, no major flood events were recorded during baseline and construction monitoring, when pesticide concentrations are expected to be highest, though some limited high flow data points were able to be collected. Higher pesticide concentrations appeared to be associated with periods of higher mean daily discharge (see hydrograph with overlaid sampling dates in Appendix 5).

Table 12: Pesticides for which measured concentrations were higher than the limit of reporting.

Pesticide	Mackenzie River (number of measurable results/ total rounds of sampling^)	Dawson River (number of measurable results/ total rounds of sampling^)	Don River (Callide Catchment) (number of measurable results/ total rounds of sampling^)	Fitzroy River (number of measurable results/ total rounds of sampling^)
Diketonitrile (DKN) (µg/L)	9% (1/11)	-	-	12% (3/25)
Imazapic (µg/L)	-	-	17% (2/12)	8% (2/25)
Fluproponate (mg/L)	45% (5/11)	-	-	24% (6/25)
Atrazine (mg/L)	55% (6/11)	92% (11/12)	92% (11/12)	72% (18/25)
Diazinon (µg/L)	-	-	-	8% (2/25)
Hexazinone (µg/L)	8% (1/12)	33% (4/12)	17% (2/12)	12% (3/25)
Metolachlor (µg/L)	82% (9/12)	67% (8/12)	83% (10/12)	84% (21/25)
Imidacloprid (mg/L)	-	8% (1/12)	-	8% (2/25)
Propazine (mg/L)	-	8% (1/12)	-	-
Simazine (mg/L)	-	8% (1/12)	17% (2/12)	12% (3/25)
Tebuthiuron (mg/L)	91% (10/11)	100% (12/12)	100% (12/12)	100% (25/25)
Terbutylazine (mg/L)	27% (3/11)	-	-	32% (8/25)
Atrazine-desethyl (µg/L)	-	8% (1/12)	8% (1/12)	4% (1/25)

Data source: Sunwater data July 2020 – December 2022


River flow at nearest hour (m^3/s)
Atrazine (mg/L)
Diazinon (µg/L)
LOR = DGV
Metolachlor (µg/L)

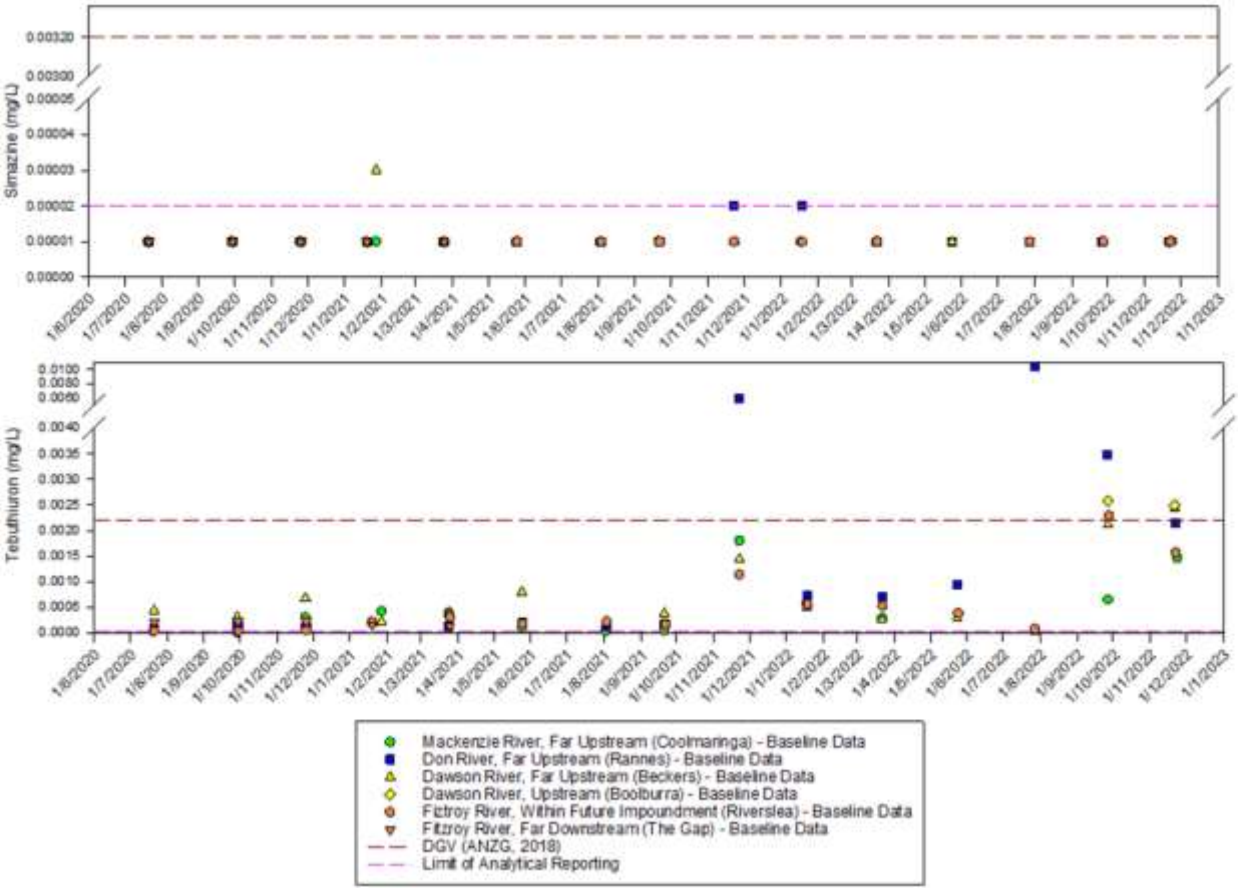


Figure 10: Monitoring results for selected pesticides during baseline monitoring (for all sites) and construction monitoring . Data source: Sunwater data July 2020 – December 2022

4 Pre-action Baselines

Based on the above information the following pre-action baselines have been established by the project. Historical data (2010-18) was only available for some monitoring sites and not for all parameters (Appendix 1). It does not, for example, include any pesticide data or the full nutrient suites. This dataset was provided as a 'baseline' in the previous version 1.7 of the Program (drafted in 2020) because it was the only pre-action data available at the time of writing. Since then, Sunwater has conducted comprehensive baseline monitoring across the full range of parameters following the Program's recommendations, as described above. This monitoring has produced the 2020-22 pre-action baseline dataset used in the current version of the Program.

As the Sunwater monitoring was more spatially and temporally representative and included a much wider range of parameters than the historical dataset, this dataset is more suitable for use as a 'baseline'. For each site, pre-action baselines have been established at the 75th percentile for each parameter (and/or the 25th percentile in the case of pH and DO), calculated from the more extensive and representative monitoring data that was collected by Sunwater between July 2020 and December 2022 (Appendix 3). Statistical summaries of those data pertaining to wet season (Nov-April) or dry season (May-Oct) sampling were also tabulated (Appendix 3). Data from The Gap site which is downstream of the activity in the Fitzroy catchment was excluded once construction commenced in the river in April 2021. Upstream of the activity in the Mackenzie and Lower Dawson catchments, all water quality parameters would not be affected by construction and are included in the pre-action baseline. An exception to this being turbidity and TSS data at Riverslea which had the potential to have been influenced by the bridge construction works for the enabling project at this location. For these sediment parameters only, the historical data (2010-18) has been used for pre-action baseline values in the Fitzroy catchment, in recognition of the potential for construction activities to have impacted on them at some sites. Refer to Appendix 8 for a graphical representation of the pre-action baseline datasets in relation to the Sunwater monitoring.

Data was combined from each of the following monitoring sites to determine a pre-action baseline for each of the sub-catchments:

- Mackenzie: Coolmaringa, Apis Ck Rd
- Lower Dawson: Beckers, Boolburra, Baralaba
- Lower Fitzroy: Riverslea, The Gap

Table 13 provides pre-action baselines for all parameters, in each monitored catchment. In the table 'wet' refers to water quality during the wet season of November to April and 'dry' refers to water quality during the dry season during the months of May to October.

Table 13: Pre-action baselines for selected water quality parameters, by catchment

Water quality parameter (measurement unit)	Measurement type	Limit of Analytical Reporting (LOR)	Fitzroy Sub-basin Environmental Values and Water Quality Objectives (WQO)	Pre-Action Baseline (Sunwater Water Quality Monitoring and Reporting Program) (75^{th}%ile unless indicated as a range)								
				Mackenzie[1]			Lower Dawson[1]			Fitzroy[2]		
				Combined	Wet	Dry	Combined	Wet	Dry	Combined	Wet	Dry
Temperature (°C) Min – Max range	In-situ	n/a	NA	19.7-32.2	22.0-32.2	19.7-31.1	12.3-32.4	22.1-32.4	12.3-31.0	15.3-31.3	22.0-31.3	15.3-31.1
DO Saturation (Field) (%) WQO – lower-upper objectives Baseline - lower 25^{th} %ile - upper 75^{th} %ile	In-situ	n/a	85-110	86-107	85-95	102-109	91-101	89-97	92-101	89-101	87-97	94-104
Electrical Conductivity (µS/cm)	In-situ	n/a	Base flow / high flow): 445/250 (Fitz) 310/210 (Mac) 340/210 (Low Daw)	285	318	282	238	264	196	269	335	268
pH WQO - lower – upper objectives Baselines – lower 25^{th} %ile - upper 75^{th} %ile	In-situ	n/a	6.5-8.5	7.1-8.5	7.1-7.9	7.2-8.9	7.1-8.0	7.2-7.9	7.3-8.3	7.3-8.4	7.3-8.1	7.3-8.7
Turbidity (NTU) (FPRH Historical Dataset)	In-situ	n/a	50							190.5 / 141[3]		
Turbidity (NTU)	In-situ	n/a	50	259	526	105	321	320	310			
Ammonia as N (mg/L)	Lab	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.02	0.03
Chlorophyll-a (mg/L)	Lab	0.001	0.005	0.008	0.010	0.006	0.004	0.007	0.002	0.004	0.004	0.004
Nitrite + Nitrate as N (mg/L) (Dissolved inorganic N, DIN)	Lab	0.01	0.06	0.21	0.26	0.06	0.26	0.29	0.25	0.29	0.33	0.26
Total Suspended Solids (Lab) (mg/L)	Lab	5	85 (Fitz) 110 (Mac) 110 (Low Daw)							109.75 / 137[3]		

Water quality parameter (measurement unit)	Measurement type	Limit of Analytical Reporting (LOR)	Fitzroy Sub-basin Environmental Values and Water Quality Objectives (WQO)	Pre-Action Baseline (Sunwater Water Quality Monitoring and Reporting Program) (75^{th}%ile unless indicated as a range)								
				Mackenzie[1]			Lower Dawson[1]			Fitzroy[2]		
				Combined	Wet	Dry	Combined	Wet	Dry	Combined	Wet	Dry
(FPRH Historical Dataset)												
Total Suspended Solids (Lab) (mg/L)	Lab	5	85 (Fitz) 110 (Mac) 110 (Low Daw)	91	164	24	84	94	79			
Total Nitrogen (mg/L) (TN)	Lab	0.1	0.5 (Fitz) 0.775 (Mac) 0.5 (Low Daw)	1.00	1.53	0.07	1.40	1.42	1.38	1.25	1.35	1.05
Total Phosphorus as P (mg/L) (TP)	Lab	0.01	0.05 (Fitz) 0.16 (Mac) 0.05 (Low Daw)	0.18	0.30	0.12	0.39	0.35	0.39	0.28	0.34	0.20
Phosphorous Reactive (as P) (mg/L) (FRP, dissolved inorganic P, DIP)	Lab	0.01	0.02	0.04	0.06	0.03	0.13	0.13	0.10	0.05	0.07	0.05

Notes:

1- Pre-action baseline determined from Sunwater dataset July 2020 – December 2022

2 – Pre-action baseline determined from Sunwater dataset combined The Gap July 2020 – April 2021 and Riverslea July 2020 – December 2022 (except [3])

3 – Pre-action baseline determined from FPRH Fitzroy River at Riverslea data 2010 – 2018. Numbers represent individual sites Riverslea / The Gap

Table 14: Pre-action baselines for selected pesticide concentrations, by catchment

Water quality parameter (measurement unit)	Measurement type	Limit of Analytical Reporting (LOR)	ANZECC Default Guideline Values	Mackenzie (75^{th}%ile)	Lower Dawson (75^{th}%ile)	Fitzroy (75^{th}%ile)
Pesticide – Priority Pesticides						
Imazapic (µg/L)	Lab	0.01	NA	0.005	0.005	0.005
Isoxaflutole (µg/L)	Lab	0.01	NA	0.005	0.005	0.005
Atrazine (µg/L)	Lab	0.01	13	0.02	0.03	0.04
Diuron (µg/L)	Lab	0.02	0.2	0.01	0.01	0.01
Hexazinone (µg/L)	Lab	0.02	NA	0.01	0.03	0.01
Metolachlor (µg/L)	Lab	0.1	0.46	0.05	0.05	0.05
Imidacloprid (µg/L)	Lab	0.01	NA	0.005	0.005	0.005

Water quality parameter (measurement unit)	Measurement type	Limit of Analytical Reporting (LOR)	ANZECC Default Guideline Values	Mackenzie (75th%ile)	Lower Dawson (75th%ile)	Fitzroy (75th%ile)
Simazine (µg/L)	Lab	0.01	3.2	0.01	0.01	0.01
Tebuthiuron (µg/L)	Lab	0.02	2.2	0.57	1.44	1.67
Tebutylazine (µg/L)	Lab	0.01	NA	0.02	0.05	0.02
Chlorpyrifos (µg/L)	Lab	0.02	0.01	ND	ND	ND
2,4-D (µg/L)	Lab	0.01	280	ND	ND	ND
MCPA (µg/L)	Lab	10	1.4	ND	ND	ND
Metasulfuron-methyl (µg/L)	Lab	5	0.018	ND	ND	ND
Fipronil (µg/L)	Lab	0.01	0.018	ND	ND	ND
Haloxyfop (µg/L)	Lab	0.1	NA	ND	ND	ND
Pendimethalin (µg/L)	Lab	0.05	NA	ND	ND	ND
Ametryn (µg/L)	Lab	0.01	NA	ND	ND	ND
Terbutryn (µg/L)	Lab	0.01	NA	ND	ND	ND
Metribuzin (µg/L)	Lab	0.02	NA	ND	ND	ND
Fluroxypyr (µg/L)	Lab	10	NA	ND	ND	ND
Triclopyr (µg/L)	Lab	0.01	NA	ND	ND	ND
Other Pesticides						
Diketonitrile (µg/L)	Lab	0.01	NA	0.005	0.005	0.02
Diazinon (µg/L)	Lab	0.01	0.01	0.005	0.005	0.005
Fluproponate (µg/L)	Lab	0.1	NA	0.2	0.05	0.05
Thiamethoxam (µg/L)	Lab	0.02	NA	0.01	0.01	0.01
Propazine (µg/L)	Lab	0.01	NA	0.005	0.005	0.005
Propiconazole (µg/L)	Lab	0.05	NA	0.025	0.025	0.025
Tebuconazole (µg/L)	Lab	0.01	NA	0.005	0.005	0.005
Atrazine-desethyl (µg/L)	Lab	0.1	NA	0.05	0.05	0.05
Chlorantraniliprole (µg/L)	Lab	0.1	NA	0.05	0.05	0.05

4.1 Pre Action Baseline Load Monitoring

Flow weighted loads for key pollutants are currently calculated by Queensland DESI for the Fitzroy catchment as an end of catchment load prior to discharge to the GBRMP. This location is at Fitzroy River Water site upstream of the Fitzroy Barrage. The following table shows the approximate load data for the period from 2008 to 2022 and for most years demonstrates the correlation between flow in the river and pollutant loads.

Table 15: Fitzroy Catchment Loads (approximate)

Year	Flow (GL)	Total Suspended Solids (kt)	Total Suspended Solids (t/km^2)	Total Nitrogen (t)	Total Nitrogen (kg/km^2)	Total Phosphorus (t)	Total Phosphorus (kg/km^2)	Pesticides (% spp affected)
2007-08	12,000	4,900	35	16,000	42	5,800	42	No data
2008-09	2,200	470	3.4	2,100	5.1	710	5.1	No data
2009-10	11,000	3,600	26	13,000	38	5,300	38	No data
2010-11	39,000	7,000	50	36,000	110	15,000	110	No data
2011-12	7,200	1,300	9.5	6,400	19	2,700	19	No data
2012-13	9,500	2,500	18	9,300	27	3,700	27	No data
2013-14	1,600	52	0.37	1,000	1.2	160	1.2	No data
2014-15	2,700	1,900	6.5	3,200	9.2	1,300	9.2	No data
2015-16	2,300	670	4.8	3,300	6.5	910	6.5	1.7
2016-17	7,400	2,200	16	8,300	25	3,500	25	2.0
2017-18	970	410	16	1,400	4.2	590	4.2	3.4
2018-19	1,300	83	2.9	1,100	1.4	200	1.4	2.1
2019-20	2,900	930	6.7	4,200	8.3	1,200	8.3	*TBA
2020-21	390	16	0.11	340	0.48	66	0.48	*TBA
2021-22	3,500	2,000	14	6,100	15	2,100	15	*TBA

Source: Great Barrier Reef Catchment Loads Monitoring Program (Queensland Department of Environment, Science and Innovation)

*TBA: Pesticide data collected however no calculation on % species affected currently available on the DESI Pesticide Dashboard

Note: Pesticide data based on the DESI 22 priority pesticides

Following the commencement of the operation of Rookwood Weir, monitoring data collected through the WQMRP will be shared with DESI and input into the Great Barrier Reef Catchment Loads Monitoring Program (GBRCLMP) flow weighted modelling. This will assist to validate and calibrate the catchment water quality models that track progress towards the Reef 2050 water quality targets. As this GBRCLMP helps track long term trends in water quality on the GBR, it will be able to give an indication to changes in pollutant loads in the Fitzroy River over the life of the weir.

5 Agricultural vs non-agricultural discussion for pre-action baselines

The pre-action baselines do not differentiate between irrigated and non-irrigated areas of the Lower Fitzroy catchment. Prior to the development of Rookwood Weir there were no distinct areas of irrigation whereby water quality sampling could be undertaken to demonstrate a separate baseline. Although small pockets of irrigation do occur within the Lower Fitzroy, these are not homogenous areas and include large areas of non-irrigated land that influence the water quality data. Following the development of Rookwood Weir this will be representative of the Lower Fitzroy catchment as well, with a mixture of irrigated and non-irrigated operations interspersed between the weir and the Fitzroy Barrage. Hence only one pre-action baseline is required for comparison to operational baselines.

6 Continuous Monitoring Locations

Currently there are a number of locations within the Fitzroy Basin where continuous water quality monitoring is conducted, associated with river gauging stations (Table 16). Whilst parameters are currently limited, there is an opportunity to expand these to other water quality parameters that can be measured using in situ sensors.

Table 16: Parameters measured at existing continuous monitoring sites

Site Name	Location Code (Map reference)	Coordinates (Lat, Long)	River Flow	Rainfall	Temperature	Electrical Conductivity
Coolmaringa	130105B	-23.317992, 149.524431	✓	✓	✓	
Hanrahan's	130010A	-23.469388, 150.027484	✓	✓	✓	✓
The Gap	130005A	-23.088950, 150.116800	✓	✓	✓	✓
Beckers	130322A	-24.088203, 149.821813	✓	✓	✓	✓

While continuous monitoring would be preferred in certain circumstances, some water quality parameters of high importance to the monitoring program cannot yet be reliably measured with in situ instruments, including total suspended solids, nutrients and pesticides. For this reason, human access to sites to take grab samples for laboratory analysis is still required.

7 Monitoring water quality impacts from inundation

Inundation of vegetation in the weir pool has the potential to release nitrogen and impact MNES. This has been determined through modelling to have the greatest impact for the first six years of the operation of the weir with up to 45% within the first year. The data collected will be assessed to determine the offset as per Condition 4 of the approval to confirm the estimated amount of nitrogen. The Water Quality Monitoring and Reporting Program may conclusively determine the nitrogen amount is less than initially modelled, in which case this offset amount will be revised down upon approval from DCCEEW.

Water quality monitoring conducted during and after inundation will aim to identify changes resulting from the impoundment of waters, including changes in nutrient and dissolved oxygen concentrations due to decaying vegetation (see Pressures and potential impacts of the impoundment and agricultural developments section, above). The combination of higher nutrients, and higher temperatures resulting from lower turbidity and higher light penetration in still water, supports algae growth potentially including toxic algae species. Stratification of the water column often occurs in impoundments, with lower temperatures and hypoxia potentially occurring at depth. Additional triggers for toxic algae and stratification monitoring are provided in the Inundation monitoring triggers section 7.3, below. While cations, anions and metals aren't generally considered problematic for reef water quality, these parameters will continue to be monitored periodically, due to the risk of metal bioaccumulation in aquatic food chains through increasing exposure of aquatic animals (including freshwater turtles) via sediment, vegetation and microbial growth.

7.1 Inundation Monitoring Sites

Monitoring sites for the effects of inundation are similar to the sites for baseline and construction monitoring, with an additional site further downstream at the Fitzroy River Barrage, called Fitzroy River at Fitzroy River Water (FRW) (Table 17). The FRW site has the benefit of an automatic sampler maintained by Queensland DESI, allowing for safe and timely collection of water samples during flood events. This site also represents an 'end of catchment' monitoring point for calculating pollutant loads.

Table 17: Sites to be monitored for inundation of the weir.

Map references relate to Figure 3. Light green = Mackenzie catchment, dark green = Callide catchment, yellow = Lower Dawson catchment, orange = Fitzroy catchment. Pink = upstream of impoundment (US), teal = within impoundment, blue = downstream of impoundment (DS).

Catchment	Location Code (Map reference)	Coordinates (Lat, Long)	Site No (this Report)	Short Site Name (this Report)	River Influence	Site Type
	Main sites					
Mackenzie	130105B	-23.317992, 149.524431	1a	Coolmaringa	Mackenzie	Upstream
Callide	130306B	-24.098355, 150.115224	2	Rannes	Don	Upstream
Lower Dawson	130322A	-24.088203, 149.821813	3a	Beckers	Dawson	Upstream
Lower Dawson	#4	-23.732093, 149.777099	4	Boolburra	Dawson	Upstream
Fitzroy	#8	-23.590272, 149.899135	5	Yarra Rd	Fitzroy	Within impoundment
Fitzroy	#9	-23.637759, 149.920073	6	The Pocket	Fitzroy	Within impoundment
Fitzroy	130003B	-23.574210, 149.934844	7	Riverslea	Fitzroy	Within impoundment
Fitzroy	Weir-US	-23.546591, 150.017184	8b	Weir US	Fitzroy	Within impoundment
Fitzroy	Weir-DS	-23.536490, 150.011641	9b	Weir DS	Fitzroy	Downstream
Fitzroy	130010A	-23.469388, 150.027484	10	Hanrahan	Fitzroy	Downstream
Fitzroy	#15	-23.175149, 149.924039	11a	Glenroy Rd	Fitzroy	Downstream
Fitzroy	Rockhampton	-23.317520, 150.481930	12c	Fitzroy at FRW	Fitzroy	Downstream

Catchment	Location Code (Map reference)	Coordinates (Lat, Long)	Site No (this Report)	Short Site Name (this Report)	River Influence	Site Type
	Alternative sites (may be sampled when main sites are inaccessible)					
Mackenzie	ALT3	-23.528290, 149.713540	1b	Apis Ck Rd	Mackenzie	Upstream
Lower Dawson	ALT6	-24.171630, 149.813930	3b	Baralaba	Dawson	Upstream
Fitzroy	RWP	-23.541080, 150.015420	8or9a	At Rookwood	Fitzroy	Within
Fitzroy	#14	-23.225800, 149.960170	11b	Craiglee Rd	Fitzroy	Downstream
Fitzroy	ALT5	-23.191580, 150.403850	12b	Etna Ck	Fitzroy	Downstream
Fitzroy	130005A	-23.088950, 150.116800	12a	The Gap	Fitzroy	Downstream

7.2 Inundation Monitoring Schedule

Monitoring during inundation will be similar to the schedule for baseline and construction monitoring. Site photos and field conditions will be recorded for each sampling event and site. Monthly monitoring will continue for most parameters, with metal(loid)s, hardness and alkalinity reverting to bimonthly monitoring to align with monitoring of pesticides (Table 18). Sufficient pre-action baseline and construction monitoring data will have been collected to categorise the natural variation of these parameters in the Lower Fitzroy. Metal(loid)s are not considered to pose a high risk to the Great Barrier Reef. Bimonthly monitoring will be sufficient to ensure no deleterious changes have occurred, with triggers to increase monitoring if indicated (see Inundation monitoring triggers section 7.3, below).

The pesticides to be monitored consist of the reference pesticides that are currently used to calculate the Reef catchment loads monitoring Pesticide Risk Metric, including insecticides, PSII herbicides and non-PSII herbicides (Table 19; Australian and Queensland governments 2020). Queensland DESI is currently updating the metric and the number of pesticides included may increase. Particle size analysis (PSA) is required to calculate the fine (< 16 µm) sediment fraction, which can move further into the marine environment and pose the highest risk to the condition of the Great Barrier Reef (Waterhouse et al. 2017).

The water quality monitoring requirements outlined in Section 7.3 and 7.4 below are included schematically in Appendix 7. For inundation monitoring refer to Charts A to F.

Table 18: Parameters to be measured for inundation monitoring

*Frequency of monitoring, limits of analytical reporting and toxicant guideline values (for metals) from the Australian Water Quality Guidelines (ANZG, 2018) and Fitzroy Sub-Basin Water Quality Objectives (WQOs) from State of Queensland (2013). n/a = not available. *at the four within-impoundment sites, provide a temperature depth profile of 1m intervals from the surface to the 0.5m from the bottom of the impoundment.*

Water quality parameter (measurement unit)	Measurement type	Monitoring frequency	Limit of Analytical Reporting (LOR)	Toxicant Default Guideline Value (DGV) (ANZG, 2018)	Fitzroy Sub-basin Environmental Values and Water Quality Objectives (WQO) (State of Queensland, 2013)
Oxidation-Reduction Potential (mV)	In-situ	Monthly	n/a	n/a	n/a
Temperature (°C)*	In-situ	Monthly	n/a	n/a	n/a
Dissolved oxygen (mg/L)	In-situ	Monthly	n/a	n/a	n/a
Total Dissolved Solids (mg/L)	In-situ	Monthly	n/a	n/a	n/a
Dissolved oxygen % Saturation (Field) (%)	In-situ	Monthly	n/a	n/a	85-110
Electrical Conductivity (µS/cm)	In-situ	Monthly	n/a	n/a	445 (Base Flow) 250 (High Flow)
pH	In-situ	Monthly	n/a	n/a	6.5-8.5
Turbidity (NTU)	In-situ	Monthly	n/a	n/a	50
Ammonia as N (mg/L)	Lab	Monthly	0.01	0.9	0.02
Chlorophyll-a (mg/L)	Lab	Monthly	0.001	n/a	0.005
Aluminium (filtered) (mg/L)	Lab	Bimonthly	0.01	0.055	n/a
Copper (filtered) (mg/L)	Lab	Bimonthly	0.001	0.0014	n/a
Iron (filtered) (mg/L)	Lab	Bimonthly	0.05	n/a	n/a
Manganese (filtered) (mg/L)	Lab	Bimonthly	0.001	1.9	n/a
Zinc (filtered) (mg/L)	Lab	Bimonthly	0.005	0.008	n/a
Hardness as $CaCO_3$ (mg/L)	Lab	Bimonthly	1	n/a	n/a
Nitrate (as N) (mg/L)	Lab	Monthly	0.01	n/a	n/a
Nitrite + Nitrate as N (mg/L) (Dissolved inorganic N, DIN)	Lab	Monthly	0.01	n/a	0.06
Nitrite (as N) (mg/L)	Lab	Monthly	0.01	n/a	n/a
Total Suspended Solids (Lab) (mg/L)	Lab	Monthly	5	n/a	85
Particle Size Analysis (PSA)	Lab	Monthly	n/a	n/a	n/a
Total Dissolved Solids (Lab) (mg/L)	Lab	Monthly	10	n/a	n/a
Kjeldahl Nitrogen Total (mg/L) (TKN, Total organic N)	Lab	Monthly	0.1	n/a	n/a
Total Nitrogen (mg/L) (TN)	Lab	Monthly	0.1	n/a	0.5
Total Phosphorus as P (mg/L) (TP)	Lab	Monthly	0.01	n/a	0.05
Phosphorous Reactive (as P) (mg/L) (FRP, dissolved inorganic P, DIP)	Lab	Monthly	0.01	n/a	0.02
Total Nitrogen (filtered) (mg/L)	Lab	Monthly	0.1	n/a	n/a
Kjeldahl Nitrogen Total (filtered) (mg/L) (Dissolved organic N, DON)	Lab	Monthly	0.1	n/a	n/a
Total Phosphorus as P (filtered) (mg/L)	Lab	Monthly	0.01	n/a	n/a
Particulate N, PN) Calculated from [TN]- [TN-filtered]	Calculated from detected concentration	Monthly	n/a	n/a	n/a

Water quality parameter (measurement unit)	Measurement type	Monitoring frequency	Limit of Analytical Reporting (LOR)	Toxicant Default Guideline Value (DGV) (ANZG, 2018)	Fitzroy Sub-basin Environmental Values and Water Quality Objectives (WQO) (State of Queensland, 2013)
Particulate P (PP) Calculated from [TP] – [TP-filtered]	Calculated from detected concentration	Monthly	n/a	n/a	n/a
Alkalinity (Bicarbonate as CaCO3) (mg/L)	Lab	Bimonthly	1	n/a	n/a
Alkalinity (Carbonate as CaCO3) (mg/L)	Lab	Bimonthly	1	n/a	n/a
Alkalinity (Hydroxide) as CaCO3 (mg/L)	Lab	Bimonthly	1	n/a	n/a
Alkalinity (total) as CaCO3 (mg/L)	Lab	Bimonthly	1	n/a	n/a
Pesticides included in the catchment loads monitoring pesticide risk metric (Table 14)	Lab	Bimonthly	n/a	Table 19	n/a

Table 19: The 22 reference pesticides that are currently included in the catchment loads monitoring Pesticide Risk Metric (source: Australian and Queensland governments 2020, Table 2).

Reference pesticide	Pesticide type	Mode of Action
Chlorpyrifos	Insecticide	Acetylcholine esterase (AChE) inhibitor
Fipronil	Insecticide	Gamma-aminobutyric acid (GABA) gated chloride channel blocker
Imidacloprid	Insecticide	Nicotinic receptor agonist
Haloxyfop	Herbicide	Acetyl-coenzyme A carboxylase (ACCase) inhibitor
Imazapic	Herbicide	Acetolactate synthase (ALS) inhibitor
Metsulfuron-methyl	Herbicide	
Pendimethalin	Herbicide	Microtubule synthesis inhibitor
Metolachlor	Herbicide	Acetolactate synthase (ALS) inhibitor
Ametryn	Herbicide	PSII inhibitor
Atrazine	Herbicide	
Terbuthylazine	Herbicide	
Tebuthiuron	Herbicide	
Simazine	Herbicide	
Diuron	Herbicide	
Terbutryn	Herbicide	
Hexazinone	Herbicide	
Metribuzin	Herbicide	
2,4-D	Herbicide	Auxin mimic (Phenoxy-carboxylic acid auxins)
MCPA	Herbicide	
Fluroxypyr	Herbicide	Auxin mimic (Pyridine-carboxylic acid auxins)
Triclopyr	Herbicide	
Isoxaflutole	Herbicide	4-hydroxyphenylpyruvate dioxygenase (4-HPPD) inhibitor

7.3 Inundation Monitoring Triggers

To ensure adaptive implementation of the inundation monitoring program, a series of monitoring triggers have been developed to initiate additional investigations, in the event of certain scenarios during the inundation phase that could indicate water quality declines. Triggers refer to comparisons to both the relevant guideline values (see Tables 3 and 4) and concentrations recorded during baseline sampling (see Table 13). These triggers are designed to collect more detailed information rapidly and focus on issues that present higher ecological risks. Further details of water quality assessment requirements are provided in Section 11 Assessment, Adaption and Reporting below.

7.3.1 Algal blooms

Algal blooms: there is an increased risk in low flow waters of algal (cyanobacteria) blooms. This risk may be particularly high following the closure of the weir and inundation, when submerged vegetation is decaying. Bloom risk is higher during summer temperatures and are most effectively detected by monitoring chl-a.

- If the chl-a concentration measured during monthly sampling is above both the relevant guideline values (i.e., the WQO for the Lower Fitzroy) and the 75th percentile of highest baseline concentrations recorded at a Fitzroy River site before inundation (Table 13), at any of the four within-impoundment monitoring sites (Fitzroy River at Riverslea, Fitzroy River at Yarra Road, Fitzroy River at the Pocket, Weir-Upstream), then
- additional monitoring for algae species is triggered. Sunwater will arrange for fortnightly grab samples of water to be collected at affected sites, and analysed for chl-a and algae (species identification and enumeration), and
- complementary temperature, DO (concentration and saturation), total nitrogen and total phosphorus will also be collected to provide a broader picture of the water quality conditions, and
- additional monitoring will cease when chl-a concentrations fall to below the WQO for the Lower Fitzroy. Results for all of the above parameters will also be included in the monitoring data for that site and assessed as described in Section 11 Assessment, Adaption and Reporting below.

7.3.2 Stratification of the water column

Stratification of the water column: stratification can occur in deep impoundments, with lower temperatures, hypoxia and algal growth potentially occurring at depth. Depth profiling of temperature at 1 m intervals, from the surface to 0.5 m from the bottom of the impoundment, is required in within-impoundment sites as part of the monthly monitoring program (see Table 18).

- If stratification in temperature is identified in a depth profile during any monthly monitoring event, the monitoring team will immediately measure dissolved oxygen concentration and saturation through the same depth profile of 1 m intervals from the surface to 0.5m from the bottom of the impoundment, and
- Collect water samples at 1 m intervals from the surface to 0.5m from the bottom, for chl-a, analysis (note: the results may trigger additional monitoring as per trigger 7.3.1, above with a grab sample required to be taken at any of the four impoundment sites that are triggered), and
- The depth profile of temperature, dissolved oxygen concentration and saturation, and chl-a will be included in the monitoring data for that site and assessed as described in Section 11 Assessment, Adaptation and Reporting below.

7.3.3 Progressive declines in water quality parameters measured bimonthly

Progressive declines in water quality parameters measured bimonthly: during and following the inundation of the weir, metal(loid)s, hardness, and alkalinity will revert to a bimonthly (six times a year) monitoring schedule (see Table 18), aligning with the current pesticide monitoring schedule.

- If a progressive decline in any of these water quality parameters occurs over three sampling events (six months), at any of the four within-impoundment sites, as defined by repeatedly exceeding guideline values (where available) and baseline concentrations recorded at the Fitzroy River sites before inundation (Table 13) and that the influence is not coming from upstream of the impoundment (ie not from the irrigated area utilising water from Rookwood Weir), then
- The frequency of monitoring the affected water quality parameters will be increased to monthly and results will be included in the monitoring data for that site and assessed as described in Section 11 Assessment, Adaption and Reporting below, and
- If metal(loid) concentrations exceed guideline and baseline concentrations, then hardness, alkalinity and an anion and cation suite (i.e., total cations, total anions, chloride, calcium, magnesium, potassium, sodium, sodium absorption ratio, and sulfate) will also be monitored monthly, in order to calculate the bioavailable fraction, and
- Additional monitoring will cease when analysis of the affected parameters shows that concentrations are lower than guideline values, and/or that elevated metal(loid) concentrations are not bioavailable.

7.4 Inundation event monitoring schedule

Event monitoring will commence on approval of this program and continue until agricultural land use developments begin. At this time, event monitoring will change to the schedule described in the Agricultural land use event monitoring schedule section 8.2.1, below.

7.4.1 Trigger flows to commence event monitoring:

Event monitoring will be triggered by river heights at any of the following three sites upstream of the weir with Queensland Government gauging stations and Bureau of Meteorology Flood Warning stations:

- **Mackenzie at Coolmaringa** (gauging station number 130105B / flood station number 535173). Estimated travel time to lower Fitzroy ~ 4 days. **Trigger flow:** commence monitoring when flow reaches **100 cumecs** on the first flush. For subsequent events, commence monitoring when flow reaches **200 cumecs**.
- **Dawson at Knebworth.** Estimated travel time to lower Fitzroy – 3 to 4 days. **Trigger flow:** commence monitoring when flow reaches **100 cumecs**. For subsequent events, commence monitoring when flow reaches **200 cumecs**.
- **Fitzroy at Riverslea** (gauging station number 130003B / flood station number 539041). Estimated travel time to lower Fitzroy – 2 days (Douglas et al. 2008). **Trigger flow:** commence monitoring when flow reaches **100 cumecs**. For subsequent events, commence monitoring when flow reaches **200 cumecs**.

7.4.2 Frequency of event monitoring:

The first flush of rainfall over agricultural lands is generally understood to produce the highest inputs of sediment, nutrients and pesticides, with lower inputs in subsequent events (Howley et al. 2018, Sinclair Knight Merz 2013). Because the first flush is recognised as the highest contributor of reef pollutants, the first three flow events are the most critical monitoring points in the season. The reasons for selecting three events are:

a. there will be a substantial amount of monitoring within each high flow event and it is important that this comprehensive first flush monitoring takes higher priority instead of monitoring more events with less scrutiny on each,

b. it is unlikely that information will change much after more than three events,

c. there will still be monitoring for each event at Fitzroy at FRW (by DESI), and

d. limiting the monitoring to the first three events will maintain cost-effectiveness.

A fourth (and subsequent) monitoring event/s will be undertaken in the same wet season, only if this event is classified as a major flood (using the BOM definition, http://www.bom.gov.au/qld/flood/brochures/fitzroy/fitzroy.shtml). Hence, event sampling will be undertaken during the first flush event after winter each year, and during the two events following (a maximum total of three events per year), unless a major flood event occurs after the first three sampling events.

7.4.3 Sampling schedule during the event:

The trigger sites at the Mackenzie and Dawson Rivers provide several days warning of flood waters moving towards the Fitzroy. The Fitzroy at Riverslea site is included to allow any localised rainfall and flood events not affecting upstream rivers, to also be detected and monitored. However, due to its location in proximity to the weir, gauged flows may be irregular at this site and this will need to be considered in interpreting the commencement of an event flow, and calculating loads.

In line with the sampling approach used at the site Fitzroy River at Fitzroy River Water (FRW) by Queensland DESI, sampling will target: minimum of three samples on the rise, one on the peak and four on the fall of the hydrograph. Seven sites have been identified for event monitoring as indicated by ∞ in Table 2.

- The first sample will be collected from the furthest upstream of the seven event monitoring sites nominally within 48hrs (due to 3-4 day travel time as per above) at the start of the event (defined by the identification of the trigger flows at each of the three stations) and then at each of the sites as the flow progressively moves downstream. Samples will be collected twice a day for the first two days, then
- once a day until the peak is sampled, then
- once every two days for up to three sampling days, then
- (if the event is still in progress) two samples a week until either the end of the event ie once the river has returned to below the trigger flow of 100 cumecs for the first flush and 200 cumecs for subsequent events, or for a maximum of two weeks, whichever comes first.

The primary aim of event monitoring is to measure concentrations of the three Great Barrier Reef pollutants, sediments, nutrients and pesticides (Table 20), to allow for the calculation of pollutant loads.

Table 20: Parameters to be measured during inundation event monitoring

Water quality parameter (measurement unit)	Measurement type	Limit of Analytical Reporting (LOR)
Oxidation-Reduction Potential (mV)	In situ	n/a
Temperature (°C)*	In situ	n/a
Dissolved oxygen (mg/L)	In situ	n/a
Total Dissolved Solids (mg/L)	In situ	n/a
Dissolved oxygen % Saturation (Field) (%)	In situ	n/a
Electrical Conductivity (µS/cm)	In situ	n/a
pH	In situ	n/a
Turbidity (NTU)	In situ	n/a
Ammonia as N (mg/L)	Lab	0.01
Nitrate (as N) (mg/L)	Lab	0.01
Nitrite + Nitrate as N (mg/L) (Dissolved inorganic N, DIN)	Lab	0.01
Nitrite (as N) (mg/L)	Lab	0.01
Total Suspended Solids (Lab) (mg/L)	Lab	5
Particle Size Analysis (PSA)	Lab	n/a
Kjeldahl Nitrogen Total (mg/L) (TKN, Total organic N)	Lab	0.1
Total Nitrogen (mg/L) (TN)	Lab	0.1
Total Phosphorus as P (mg/L) (TP)	Lab	0.01
Phosphorous Reactive (as P) (mg/L) (FRP, dissolved inorganic P, DIP)	Lab	0.01
Total Nitrogen (filtered) (mg/L)	Lab	0.1
Kjeldahl Nitrogen Total (filtered) (mg/L) (Dissolved organic N, DON)	Lab	0.1
Total Phosphorus as P (filtered) (mg/L)	Lab	0.01
[TN]- [TN-filtered] (particulate N, PN)	Calculated from provided data	n/a
[TKN] – [TKN-filtered] (particulate Organic N, PON)	Calculated from provided data	n/a
[TP] – [TP-filtered] (particulate P, PP)	Calculated from provided data	n/a
Pesticides included in the catchment loads monitoring pesticide risk metric (Table 14)	Lab	

8 Monitoring Agricultural Land Use Developments

Monitoring for agricultural land use developments will aim to identify any water quality changes resulting from the agricultural development facilitated by the action in respect of the weir. As such, it will not commence until water from Rookwood weir has been purchased and utilised. The primary water quality impacts that can result from changes in agricultural land use include increases in concentrations of the three reef water quality pollutants, fine sediments, nutrients and pesticides (see **Pressures and potential impacts of the impoundment and agricultural developments** section, above). These parameters are the focus of this aspect of the monitoring program. Impacts on Great Barrier Reef pollutant loads are more likely during high rainfall events over the new agricultural areas, when overland runoff carries sediments and chemicals off farming lands.

The monitoring strategy includes two types of sites – river sites within and upstream of the Fitzroy River to assess impacts of high flow events; and creek sites which will be located upstream and downstream of new agricultural land uses facilitated by Rookwood weir, once these are known.

The water quality monitoring requirements outlined in Sections 8.2 and 8.3 below are included schematically in Appendix 7. For agricultural land use monitoring refer to Charts B, F, G and H.

8.1 Agricultural Land Use Monitoring Sites – River and Creek Sites

Monitoring sites for the effects of changes in agricultural land use have been selected to provide data from a full transect of the freshwaters of the Fitzroy River, from upstream sites in the Mackenzie and Dawson Rivers through to the end-of-catchment site at the Fitzroy River Barrage (21, Figure 3). These 10 monitoring sites encompass all areas of expected water use from Rookwood weir by land holders, including for irrigated crops and feedlots, splitting the river into a series of eight monitoring zones that can be more closely investigated in the event of a water quality concern (Figure 4).

In addition, two sets of upstream/downstream creek sites (i.e., four monitoring sites) will be selected, to be determined after the locations of agricultural land use changes in respect of the weir are known (Table 21).

Table 21: Sites to be monitored for agricultural land use.

Map references relate to Figure 3. Site names in bold font are also monitored for effects of inundation. Light green = Mackenzie catchment, yellow = Lower Dawson catchment, orange = Fitzroy catchment. Pink = upstream, teal = within, blue = downstream of land use change. TBD = location to be determined. US = upstream of impoundment, DS = downstream of impoundment. ∞ = the seven river event monitoring sites. Creek sites will also be monitored during events as described below.

Catchment	Location Code (Map reference)	Site No (this Report)	Short Site Name (this Report)	River Influence	Site Type
Fitzroy River transect sites					
Mackenzie	ALT3	1b	Apis Ck Rd ∞	Mackenzie	Upstream of land use change
Lower Dawson	**#4**	**4**	**Boolburra ∞**	Dawson	Upstream of land use change
Fitzroy	**130003B**	**7**	**Riverslea**	Fitzroy	Within and downstream
Fitzroy	**Weir-US**	**9a**	**Weir US ∞**	Fitzroy	Within and downstream
Fitzroy	**Weir-DS**	**9b**	**Weir DS ∞**	Fitzroy	Within and downstream
Fitzroy	**130010A**	**10**	**Hanrahan**	Fitzroy	Within and downstream
Fitzroy	**#15**	**11a**	**Glenroy Rd ∞**	Fitzroy	Within and downstream
Fitzroy	130005A	12a	The Gap ∞	Fitzroy	Within and downstream
Fitzroy	ALT5	12b	Etna Ck	Fitzroy	Within and downstream
Fitzroy	**Rockhampton**	**12c**	**Fitzroy at FRW ∞**	Fitzroy	Downstream of land use change
Creek sites at high intensity agricultural areas					

Catchment	Location Code (Map reference)	Site No (this Report)	Short Site Name (this Report)	River Influence	Site Type
Fitzroy	Creek site 1 – upstream			TBD	Upstream of land use change
Fitzroy	Creek site 1 – downstream			TBD	Downstream of land use change
Fitzroy	Creek site 2 – upstream			TBD	Upstream of land use change
Fitzroy	Creek site 2 – downstream			TBD	Downstream of land use change

8.2 Agricultural Land Use Monitoring Schedule – River and Creek Sites

Once agricultural land use developments begin, this schedule will commence at the 14 identified monitoring sites (Table 21). While monthly monitoring for the effects of inundation is underway (see Inundation monitoring schedule section, above) that schedule will also cover the seven sites that are common to agricultural land use monitoring (Dawson River at Boolburra, Fitzroy River at Riverslea, Weir-Upstream, Weir-Downstream, Fitzroy River at Hanrahan, Fitzroy River at Glenroy Rd, Fitzroy River at FRW). For the remaining three river sites (Mackenzie at Apis Ck Rd, Fitzroy River at Etna Creek and Fitzroy River at the Gap) and the four creek sites, additional monitoring will be undertaken as described in Table 22. Also as described for inundation monitoring, pesticide monitoring will include (at a minimum) the pesticides that are used to calculate the Reef catchment loads monitoring Pesticide Risk Metric (Australian and Queensland governments 2020), and PSA will be monitored to calculate the fine sediment fraction.

8.2.1 Agricultural Event Monitoring - River Sites

Trigger flows to commence event monitoring at river sites: event monitoring will be triggered by river heights at any of the following three sites upstream of the weir with Queensland Government gauging stations and Bureau of Meteorology Flood Warning stations (Figure 4):

- **Mackenzie at Coolmaringa** (gauging station number 130105B / flood station number 535173). Estimated travel time to lower Fitzroy ~ 4 days. **Trigger flow:** commence monitoring when flow reaches **100 cumecs** on the first flush. For subsequent events, commence monitoring when flow reaches **200 cumecs**.
- **Dawson at Knebworth.** Estimated travel time to lower Fitzroy – 3 to 4 days. **Trigger flow:** commence monitoring when flow reaches **100 cumecs**. For subsequent events, commence monitoring when flow reaches **200 cumecs**.
- **Fitzroy at Riverslea** (gauging station number 130003B / flood station number 539041) Estimated travel time to lower Fitzroy – 2 days (Douglas et al. 2008). **Trigger flow:** commence monitoring when flow reaches **100 cumecs**. For subsequent events, commence monitoring when flow reaches **200 cumecs**.

Frequency of event monitoring at river sites: As previously described in section 7.4, the first flush of rainfall over agricultural lands is generally understood to produce the highest inputs of sediment, nutrients and pesticides, with lower inputs in subsequent events. Hence, the first three flow events are the most critical monitoring points in the season. As for inundation monitoring, a fourth (and subsequent) monitoring event/s will be undertaken in the same wet season, only if this event is classified as a major flood using the BOM definition.

Sampling schedule at river sites during the event: The trigger sites at the Mackenzie and Dawson Rivers provide several days warning of flood waters moving towards the Fitzroy. The Fitzroy at Riverslea site is included to allow any localised rainfall and flood events not affecting upstream rivers, to also be detected and monitored. However, due to its location in proximity to the weir, gauged flows may be irregular at this site and this will need to be considered in interpreting the commencement of an event flow, and calculating loads.

In line with the sampling approach used at the site Fitzroy River at FRW by the Queensland DESI, sampling will target: a minimum of three samples on the rise, one on the peak and four on the fall of the hydrograph. Seven river sites have been identified for event monitoring as indicated in Table 22. The sequence of event monitoring will be:

- The first sample will be collected from the furthest upstream of the seven event monitoring sites nominally within 48hrs (due to 3-4 day travel time as per above) at the start of the event (defined by the trigger flows at each of the three stations) and at each of the sites as the flow progressively moves downstream. Samples will be collected twice a day for the first two days, then
- once a day until the peak is sampled, then
- once every two days for up to three sampling days, then
- (if the event is still in progress) two samples a week until either the end of the event ie. once the river has returned to below the trigger flow of 100 cumecs for the first flush and 200 cumecs for subsequent events, or for a maximum of two weeks whichever comes first.

The primary aim of event monitoring is to measure concentrations of the three Great Barrier Reef pollutants, sediments, nutrients and pesticides (Table 22), to allow for the calculation of pollutant loads.

8.2.2 Agricultural Rainfall Monitoring - Creek Sites

Trigger rainfalls to commence event monitoring at creek sites: Sampling at creek sites aims to identify the loads of pollutants contributed by overland flow, in discrete areas of agricultural land use change facilitated by Rookwood weir. The trigger to commence sampling at these sites will be high rainfall (>75mm in 24hrs) at Bureau of Meteorology weather stations. The closest rain gauge or weather station to each of the creek sites, once identified, will be used to trigger event monitoring. For example:

- if Gogango Creek is being monitored, the nearest weather stations are:
  (a) Westwood (39349) and
  (b) Riverslea (39044)
- if Alligator Creek is being monitored then the nearest weather stations are:
  (a) Yaamba (33076) and
  (b) South Yaamba (33310).

Frequency of event monitoring at creek sites: As described for river sites, above, event sampling at creek sites will be undertaken during the first flush event after winter each year, and the two events following (total of three events per year). If any major flood/s occur subsequent to the first three events, these will also be monitored.

Sampling schedule at creek sites during the event: Creek sampling may need to begin at short notice if rainfall is sudden and heavy over the areas of agricultural land use change. Sampling will commence as soon as possible after being triggered (and within 24 hours following the high rainfall trigger being identified). Sampling will be conducted twice a day unless not practicable, until the rain event subsides, which is defined as the time when there has been no rain measured for 48 hours. The primary aim of event monitoring is to measure concentrations of the three Great Barrier Reef pollutants, sediments, nutrients and pesticides (Table 22).

Table 22: Parameters to be measured during event monitoring for agricultural land use changes (for both river and creek sites).

Water quality parameter (measurement unit)	Measurement type	Limit of Analytical Reporting (LOR)
Oxidation-Reduction Potential (mV)	In situ	n/a
Temperature (°C)*	In situ	n/a
Dissolved oxygen (mg/L)	In situ	n/a
Total Dissolved Solids (mg/L)	In situ	n/a
Dissolved oxygen % Saturation (Field) (%)	In situ	n/a
Electrical Conductivity (µS/cm)	In situ	n/a
pH	In situ	n/a
Turbidity (NTU)	In situ	n/a
Ammonia as N (mg/L)	Lab	0.01
Nitrate (as N) (mg/L)	Lab	0.01
Nitrite + Nitrate as N (mg/L) (Dissolved inorganic N, DIN)	Lab	0.01
Nitrite (as N) (mg/L)	Lab	0.01
Total Suspended Solids (Lab) (mg/L)	Lab	5
Particle Size Analysis (PSA)	Lab	n/a
Kjeldahl Nitrogen Total (mg/L) (TKN, Total organic N)	Lab	0.1
Total Nitrogen (mg/L) (TN)	Lab	0.1
Total Phosphorus as P (mg/L) (TP)	Lab	0.01
Phosphorous Reactive (as P) (mg/L) (FRP, dissolved inorganic P, DIP)	Lab	0.01
Total Nitrogen (filtered) (mg/L)	Lab	0.1
Kjeldahl Nitrogen Total (filtered) (mg/L) (Dissolved organic N, DON)	Lab	0.1
Total Phosphorus as P (filtered) (mg/L)	Lab	0.01
Particulate N (PN) Calculated from [TN]- [TN-filtered]	Calculated from provided data	n/a
Particulate P (PP) Calculated from [TP] – [TP-filtered]	Calculated from provided data	n/a
Pesticides included in the catchment loads monitoring pesticide risk metric (Table 14)	Lab	

8.3 Agricultural Land Use Monitoring Triggers

As for inundation monitoring, monitoring triggers have been developed to ensure adaptive implementation of the agricultural land use monitoring program. These triggers initiate additional investigations, in the event of certain scenarios resulting from the change in agricultural land use. Triggers refer to comparisons to both the relevant guideline values and concentrations recorded during baseline sampling (Table 13). These triggers are designed to collect more detailed information rapidly and focus on issues that present higher ecological risks. Further details of water quality assessment requirements are provided in Section 11 Assessment, Adaption and Reporting below.

8.3.1 Sudden, large increase in concentrations of agricultural pollutants:

The primary concern surrounding changes in agricultural land uses in respect of the weir is the potential for additional inputs of the three priority Great Barrier Reef pollutants – sediment, nutrients and pesticides. The monitoring schedule allows for monthly sampling of sediment and nutrients (12 times a year), and bimonthly sampling of pesticides (six times a year), at 14 sites, plus event sampling at 11 sites. Any gradual increases in these parameters will be assessed, reported and addressed using the process described in Section 11 Assessment, Adaption and Reporting below. However, a sudden large increase in the concentration of any of these pollutants within or downstream of the new agricultural land uses will trigger additional investigations, to short-circuit the development of large scale water quality declines.

- If large increases in any agricultural pollutants (as listed in Table 22) are identified in samples from monitoring sites within or downstream of the new agricultural land uses occurs, (where a large increase is defined as above both the relevant guideline for the pollutant (where available) and the maximum concentration measured during baseline sampling at Fitzroy River sites (Appendix 2 and 3)), then
- Further investigation by Sunwater will be triggered, as follows:
    - Concentrations of the pollutant from samples collected at upstream sites will be checked to determine whether there is a pollutant source upstream of the changes in agricultural land use in respect of the weir. If the concentrations of the pollutant at upstream sites are not higher than previously recorded at those sites during baseline and construction monitoring, and are not higher than at the site of concern, then:
    - Identify the affected sites within or downstream of the area with changed agricultural land use. Investigate whether water used at properties within the affected area is from Rookwood weir. If yes, then:
        - Review the Farm Plans accredited to the Land Management Code of Practice of properties within the affected area, to determine whether the Plans reveal potential driver/s of the increase. If yes, then discuss with relevant landholders to address the issue, and,
        - Increase frequency of monitoring of the affected pollutant/s to fortnightly, until concentrations return to less than the maximum recorded during baseline monitoring, then resume normal monitoring, and
        - Include detailed information of all investigations in reports to DCCEEW (as described in Section 11 Assessment, Adaption and Reporting below).

9 QA/QC and data management

Quality assurance and quality control (QA/QC) for all field and laboratory methods should continue to follow the Queensland Monitoring and Sampling Manual (State of Queensland, 2018) or future updated versions.

Instruments must be stored, calibrated, maintained and used as per manufacturer's instructions, and detailed records of calibration and maintenance must be kept (State of Queensland, 2018). Instructions for taking readings with multi-parameter water quality meters are provided in the Monitoring and Sampling Manual (State of Queensland, 2018). Quality control guidance for water and sediment sampling is provided by the Monitoring and Sampling Manual (State of Queensland, 2018), including the following blanks and duplicates:

- Container blank – one per trip;
- Field blank – one per field team per trip (or one per 20 samples);
- Rinsate/Equipment blank – one per field team per trip;
- Duplicates – one per 10 water samples for primary laboratory, one per 20 samples to the second laboratory; one per 20 sediment/soil samples;
- Certified reference material – one per large sampling project.

Data quality assurance and quality control practices should be followed (State of Queensland, 2018):

- Provision of clear documentation;
- Use of standard definitions and classifications;

- Maintenance of metadata (and data quality attributes);
- Appropriate data storage.

The *Monitoring and Sampling Manual* (State of Queensland, 2018) recommends the development of a structured data management system that provides secure data storage for reliable access and reporting. High frequency data are collected by continuous monitoring techniques, so specific quality assurance protocols and procedures are generally required in these cases. Erroneous data should be removed from the dataset before use, but any data corrections must be based on documented procedures and be defensible. Sunwater will need to ensure that monitoring data is effectively managed and securely stored, and to report on the QA/QC and data management processes annually, as per Section 11.3.2 below.

Prior to commencement of the monitoring program, a risk assessment will be undertaken to assess the conditions and potential hazards at each monitoring site If it transpires that any sites are not able to be be monitored or techniques described in this Program are not able to be used due to a risk to human safety, evidence of this will be documented in the monitoring reports and reports to DCCEEW (providing photos and a detailed field condition report) and alternative options will be proposed where practicable.

10 Short Term Impacts on MNES

During the inundation and establishment of the impoundment there is potential for poor water quality impacts on MNES other than the Great Barrier Reef, such as freshwater turtles. As described in Section 2 above, increased nutrient concentrations and low dissolved oxygen levels may occur in the first year of operation and may impact on turtle populations. Through the implementation of this water quality monitoring program Sunwater will be able to identify changes in water quality in the impoundment area with triggers discussed in Section 11 below, such as increased nutrient or sediment levels, or stratification and harmful algal blooms, requiring further investigation.

As part of the operation of the weir, Sunwater has developed a number of plans to monitor and manage freshwater turtles including EPBC Act listed species:

- Operational Species Management Plan;
- Turtle Management and Conservation Summary Report;
- White Throated Snapping Turtle Nest Protection Plan;
- Fitzroy River Turtle Nest Protection Plan; and
- Expanded Feral Pest Animal Management Plan.

These plans should be read in conjunction with this Water Quality Monitoring and Reporting Program in regards to minimising impacts and enhancing nesting habitat for the species. Additionally, the project has a Resource Operation Licence (ROL) granted by the Queensland Department of Regional Development, Manufacturing and Water (DRDMW) that requires inspections to be undertaken for bank stability within the weir pool to identify areas of erosion. The ROL will identify sites that may impact water quality through increased sediment levels.

Where further investigation is required due to a water quality or fauna related incident, Sunwater will utilise the existing corporate ISO14001 accredited Environmental Management System to manage and undertake corrective actions. Mitigation actions will be determined on a case by case basis but may include:

- additional water quality monitoring;
- management of water release from a particular height depending on storage levels and flow conditions; and
- inspections of the weir pool for the presence of distressed fauna and potential relocation.

11 Assessment, Adaptation and Reporting

Water quality data collected during inundation and agricultural land use monitoring will be assessed as per the Approval Conditions, to identify any change in water quality from background levels and investigate the origin of the change. As described in the sections **Inundation monitoring triggers**, and **Agricultural land use monitoring triggers** above, changes that present a higher ecological risk will be addressed immediately through pre-determined investigations. The results of these investigations will be included in monthly assessments, along with information described in this section. Smaller, gradual and lower risk changes will be assessed using a stepped approach (Figure 11), ensuring adaptive implementation of the monitoring program.

Assessment of water quality will be undertaken by Sunwater as per the following:

- Immediately following an incident with the potential to cause environmental harm;
- Following monitoring conducted for a trigger event;
- Monthly review of data including against the rolling median; and
- Annual water quality assessment.

Information collected from the Water Quality Monitoring and Reporting Program will be utilised to:

- Indicate whether the nitrogen released from the inundation and subsequent decomposition of vegetation in the weir impoundment will impact on the Great Barrier Reef. This data will be compared to the modelling undertaken for the Water Quality (Nitrogen) Offset Management Plan for the expected release during the first six years of operation. This may also be utilised to conclusively demonstrate that the amount of nitrogen released is less than the predicted modelling. Where this is the case further discussion are to be undertaken with DCCEEW in regards to the project’s water quality offset requirements.
- Indicate whether there has been any increase in nutrients, sediments or farm chemicals from the use of water from Rookwood Weir for irrigated agriculture in the Lower Fitzroy River which has the potential to impact the Great Barrier Reef. Where this is identified as a potential issue the Rookwood Weir Offset Strategy will be referred to for any offset requirements.

11.1 Assessment of water quality data and adaptive implementation

Water quality guidelines for the Fitzroy Basin are available for most monitored parameters in the Fitzroy Basin Water Quality Objectives (State of Queensland 2013) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). A pesticide metric assessing the total toxicity (multi-substance potentially affected fraction; msPAF) has also recently been developed (Australian and Queensland Governments 2020). It is important to note that as the development is occurring within an already modified and moderately impacted catchment, frequent exceedances of available guideline values are already recorded, as evidenced in the baseline monitoring data (Appendices 2 and 3). To determine whether a future water quality impact on the Great Barrier Reef occurs as a result of the development, or was pre-existing, measured results must also be compared to pre-action baseline water quality monitoring data in addition to the water quality guidelines (Table 13).

The first step in the assessment process to be conducted monthly by Sunwater, is a comparison of the 12-month rolling median of the corresponding parameter against the relevant guideline value/range (Figure 11). A 12-month rolling median must be used for this assessment, as individual measurements should not be compared to guideline values. As described in the Guideline Environmental Protection (Water and Wetland Biodiversity) Policy(State of Queensland (2022)) it is recommended the median value of at least five independent samples should not exceed the water quality objective. Hence, where for the first year a 12 month rolling median is not able to be determined for comparison, it can be conducted after 5 months of data is collected. This will include water quality data collected by Sunwater following construction in November 2023 but prior to operation of the weir to facilitate the early establishment of a rolling median value.

If an exceedance is identified, the monitoring results will be compared to the pre-action baseline results using the 25th or 75th percentiles, as appropriate for the parameter in question (see Table 13, and further detail in Appendix 3). If the monitoring results exceed these pre-action baseline values, it will be necessary to investigate results from upstream sites, to determine whether the exceedance was caused by an activity upstream of the inundation/agricultural change area. The Coolmaringa (Mackenzie) and Beckers (Lower Dawson) sites upstream of the Lower Fitzroy catchment are control monitoring locations that are not influenced by agricultural operations related to Rookwood Weir. There are no agricultural change areas anticipated upstream of the inundation area. The operations using Rookwood water are within or downstream of the weir impoundment area.

If the exceedance does not appear to be derived from upstream, additional checks will be undertaken to determine the source of the exceedance and notification to the Minister if required (Figure 11).

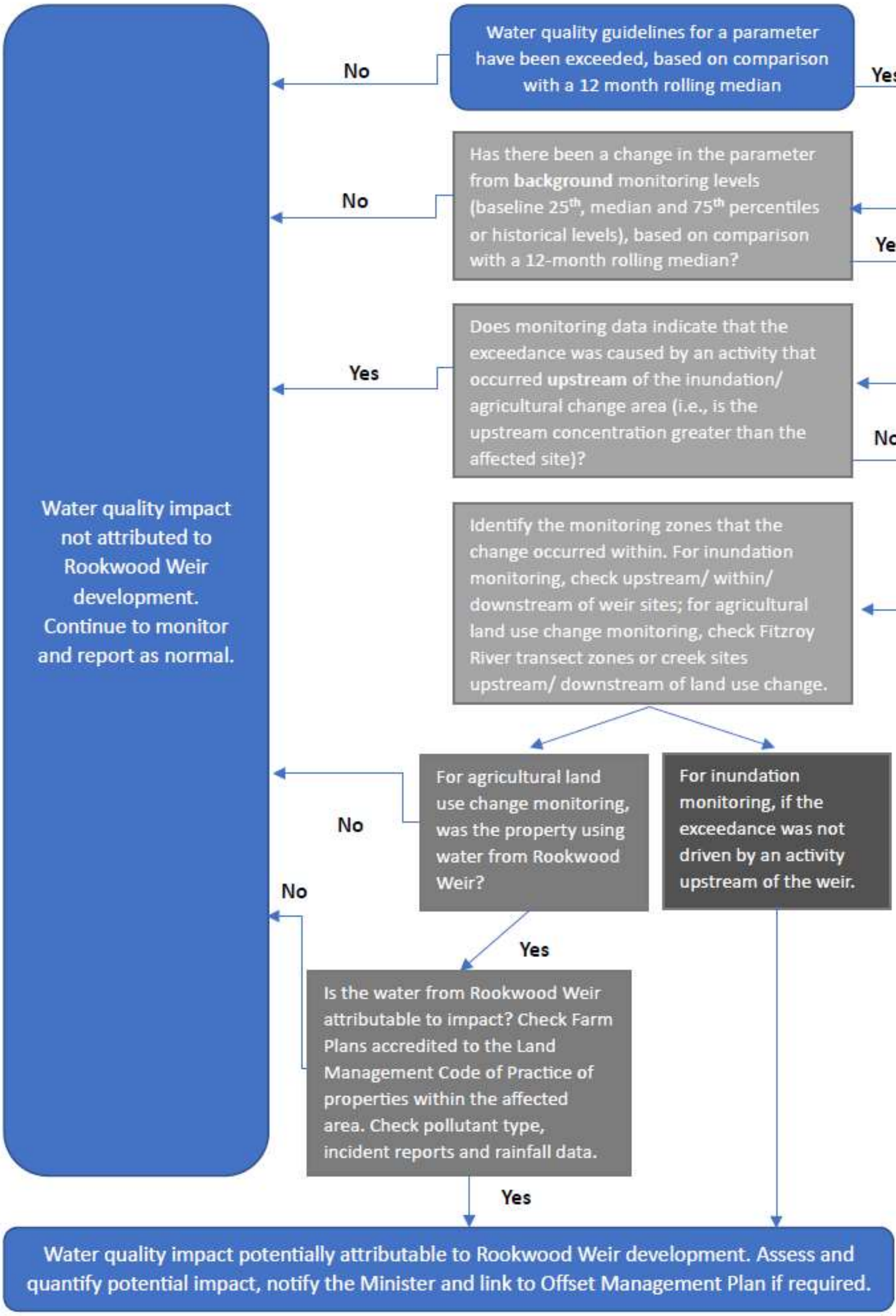


Figure 11: Assessment process for water quality monitoring data.

11.2 Water Quality Offset Assessment

The determination of whether there has been an increase in water quality pollutants that is likely or has actually resulted in a residual impact on the Great Barrier Reef will be undertaken on an annual basis. This will involve analysis of 12 months of data by a suitably qualified person with experience in water quality assessment and include data from:

- Monthly inundation / agricultural land use monitoring;
- Inundation trigger monitoring (algal blooms, stratification, progressive decline in water quality);
- Inundation and agricultural land use event based monitoring (triggered by high flow, rainfall);
- Incident investigations;
- BOM rainfall stations;
- Stream gauging and river flow.

Where increased levels have been observed these will then be assessed as to whether they are attributed to agricultural practices associated with the operation of Rookwood Weir. A Water Quality Assessment Report will form part of the Water Quality Monitoring Report as per Section 11.4.2 below.

This will be conducted to address whether an offset is required for one or more of the parameters:

- Nutrients - Nutrients for the purpose of this plan include the water quality parameters nitrogen and phosphorus. These are measured as total nitrogen and total phosphorus. The primary source of nutrients in agricultural operations is the application of fertilizer to crops in the form of dissolved inorganic nitrogen. Additionally some nutrient load can be attributed to particulate nitrogen associated with soil erosion and sediment transport.
- Sediment - Particulate sediment is one of the key pollutants in the Fitzroy Basin with respect to potential impacts on the Great Barrier Reef. These are measured as total suspended solids (and particle size analysis is also conducted), and can be also correlated with turbidity in the waterway.
- Farm chemicals - A range of different farm chemicals attributed to specific types of agriculture are currently utilised in the Fitzroy Basin. A pesticides metric assessing the total toxicity in the form of the multi-substance potentially affected fraction (msPAF) will be utilised. This represents the 22 pesticides currently included in the catchment loads monitoring method for the Reef Water Quality Report card. The types of chemicals being utilised by agricultural operations associated with Rookwood Weir will be known through the requirements of the Land Management Code of Practice and associated auditing regime. The list of pesticides utilised at agricultural operations and those included in the pesticide metric are likely to vary over time.
- Other - Water quality monitoring has been conducted for a number of other parameters as well. Where these are determined to pose a risk to the Great Barrier Reef the need for offsets will be investigated.

11.3 Water Quality Offset Program

If the decision procedure outlined in Figure 11 above, from either an incident observed through the monthly review of data or the annual assessment, determines that a residual impact to the GBRWHA is likely or has actually occurred as a result of increased agricultural operations utilising Rookwood Weir water, Sunwater will determine the offset required for the particular parameter.

Following the determination by Sunwater the notification to the DCCEWW (Minister) will be taken within 20 business days as per EPBC Condition 1d. Following notification to DCCEEW, Sunwater will provide an offset program to the DCCEEW (Minister) within 20 business days outlining the description of actions and timeframes as per Condition 1d. The start of the delivery of the offset in the program will be as soon as practicable in the year following the acceptance of the program by DCCEEW.

This offset program will include, but not limited to:

- Details of the particular parameter(s) that is (are) requiring offsetting due to impact on the GBR
- The impact amount ie tonnes and corresponding offset quantum
- Methodology of delivery of the offset program – ie location, timeframe, project management and responsibility
- Method of calculation of offset delivery and completion criteria
- Monitoring and reporting regime for the offset program
- Potential risks to successful implementation and contingency measures

The offset program including the method to determine the quantum of impact will be agreed with DCCEEW on a case by case basis and be based on the latest available methodology depending on the current regulatory tools and industry accepted determinations.

11.3.1 Offset Monitoring Program

Monitoring of all offset programs will be undertaken on a regular basis by Sunwater to ensure compliance and delivery of pollutant load reduction to the Great Barrier Reef. Sunwater will employ a dedicated team of environmental professionals to oversee the delivery of each of the offset programs. As part of their role they will undertake a monitoring regime tailored to the timeframes and requirements of each of the programs to offset water quality parameters by Sunwater. The monitoring requirements for each offset program will be detailed at the time of the offset being triggered as per above. Overall monitoring of offsets a result of an increase in pollutant load impacting the Great Barrier Reef attributed to Rookwood Weir agricultural activities will be included in the annual report as per Section 11.3.2 below.

11.4 Reporting

11.4.1 Non-Compliance Reporting

Throughout the course of the water quality monitoring program Sunwater will review the data on a monthly basis as per Section 11.1 above to observe trends and potential non-compliances. Should the data indicate issues related to Rookwood Weir operations Sunwater will undertake further investigations as outlined above. Where it is deemed necessary Sunwater will report a non-compliance as per Condition 19 of the project approval.

Condition 19 requires that Sunwater:

must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in approved plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify:

- *any condition which is or may be in breach;*
- *a short description of the incident and/or non-compliance; and*
- *the location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, provide the best information available.*

Condition 20 requires that Sunwater:

must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in an approved plan as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying:

- *any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;*
- *the potential impacts of the incident or non-compliance; and*
- *the method and timing of any remedial action that will be undertaken by the approval holder.*

It should be noted that where an individual water quality sample that is recorded outside of the WQOs or pre-action baseline does not necessarily constitute a requirement to notify DCCEEW immediately. As described above, Sunwater will undertake an investigation into the results to determine if it was related to the operation of Rookwood Weir or caused by either:

- upstream influences,
- environmental circumstances e.g., flood, drought, or
- non-Rookwood Weir agricultural (or other) operations located in the Lower Fitzroy catchment.

Only once this has been determined Sunwater will follow the reporting requirements as per Condition 19. The intent of this is to ensure DCCEEW is not inundated with excessive reporting and is notified only of those instances that are attributed to the action.

11.4.2 Annual Reporting

Sunwater, its successors or assigns, will, as per Condition 10 of the approval, provide an Annual Compliance Report each year following the date of the commencement of the action for the period of the approval (Table 23). This is provided to DCCEEW as well as on the Rookwood Weir Project website.

Following the commencement of the operation of the weir an Annual Water Quality Monitoring Report describing water quality monitoring data over the relevant 12-month period will be prepared until the end of the EPBC Approval (i.e. until 2046). This report will contain records substantiating all activities relevant to the implementation and management of monitoring program, in keeping with the requirements of Condition 10 of the Approval.

The annual report will also include the assessment of water quality data with respect to:

- The nitrogen levels generated from inundation of the weir and the potential for impacts on the Great Barrier Reef with respect to the modelling target as described in the Water Quality (Nitrogen) Offset Management Plan.
- Determining if there has been any increase to nutrient, sediment or farm chemical loads from the use of water for irrigated agriculture that may cause a residual impact the GBRWHA.

The water quality assessment will be undertaken by a suitably qualified person (SQP) with respect to water quality on behalf of Sunwater and provided to DCCEEW as per the timeframes in Table 23 below. Where the first year of operation of the weir begins in the six months prior to July, the first assessment report will be completed in the following year and include the partial year and first full year. From this assessment, if it is determined that an offset is required Sunwater will undertake steps as per Section 11.2 above.

Water quality results presented in each annual report will be accompanied by hydrographs that plot the timing of monitoring events, to allow for interpretation of effects of flow conditions on water quality. Appendix 5 provides an example of hydrographs with the baseline sampling dates overlaid.

Sunwater, its successors or assigns, will publish the annual compliance reports, of which the Water Quality Monitoring Report form a part, on the website within three months of the relevant 12-month period. Sunwater, its successors or assigns, will supply documentary evidence showing proof of the date of publication of the compliance report will be supplied to DCCEEW at the same time that the compliance report is published. These commitments ensure that Condition 10 of the approval is being met.

Table 23. Reporting details, periods and due dates in relation to the Program.

Report Details to DCCEEW	Reporting period	Submission due date
Initial Water Quality Review Report compiling all water quality data collected from the monitoring program prior to the operation of the weir.	4-year period from commencement of the project up to the first annual reporting date – 17 July 2020 to 17 July 2024	3 months following 17 July 2024
Annual Water Quality Monitoring Report, which contributes to the Annual Compliance Report as per Approval Condition 10. This includes the Water Quality Assessment Report based on the annual data collected.	Annual Water Quality Monitoring Report – Every 12 months following commencement of the action, as per approval Condition 10.	3 months following 17 July every year for the duration of the approval
Compliance Report detailing compliance with approval conditions under the EPBC Act, including compliance with the offset conditions, as detailed in this Program. This will be provided at https://www.sunwater.com.au/projects/rookwood-weir-project/environment/	Every 12 months following commencement of the action, as per approval Condition 10.	3 months following 17 July every year for the duration of the approval

This approach will be reviewed along with the monitoring program, as described in the review procedures, in section 13.

12 Reliability of the Program to predict and detect changes

The implementation of this comprehensive Water Quality Monitoring and Reporting Program will allow for the prediction and detection of any changes to water quality as a result of implementing the action in respect of Rookwood weir. It includes adaptive implementation and continuous improvement systems to enhance its capacity to predict and detect changes to water quality and impacts on the Great Barrier Reef World Heritage Area and National Heritage place. The Program has been designed to monitor effects on water quality of both the inundation of the impoundment and changes in agricultural land uses associated with the weir. Reviews and reporting are scheduled on a regular basis, as described in the following section, to ensure adaptive and responsive monitoring is able to be conducted, and changes to water quality reported and managed.

Event monitoring during the baseline collection period of July 2020 to December 2022 was not undertaken specifically as a 'major' flood event as defined by the Bureau of Meteorology did not occur during this time. Regardless sampling did occur during period of increased flow as demonstrated in the hydrographs in Appendix 5 with six samples taken when flow was above 100 cumecs with four of these above 200 cumecs. As described in Section 3.4.1, it is noted that few high flow events occurred in the Fitzroy Basin during monitoring, and flow events are typically associated with higher loads of the three key reef pollutants (nutrients, sediments and pesticides) (Douglas et al. 2006, Bainbridge et al. 2012; Baird et al. 2017, 2021). Despite this limitation, the baseline monitoring results demonstrated that stream flow is still influencing concentrations of key pollutants during low flow periods, but with high variability. For the operation of the weir event monitoring is planned to occur above 100 cumecs for the first post winter flow and 200 cumecs for subsequent flows. These detailed monitoring events will provide robust data in relation to key pollutants in the river that may impact the GBR.

13 Review procedures

The monitoring program will be reviewed at least annually for the first three years after commencement, and then at least once every three years, or more frequently if warranted. These reviews will ensure the continuous improvement of the monitoring program, to enhance its capacity to predict and detect changes to water quality and impacts on the Great Barrier Reef. This version of the monitoring program takes a precautionary approach, requiring regular and intensive monitoring of a wide range of water quality parameters. The monitoring sites, parameters and schedule may be able to be streamlined as the monitoring program progresses.

Further, there remain some limitations in this version of the monitoring program due to knowledge gaps. In particular, the details of new agricultural developments that will commence in the proposed development area are not yet fully understood. Once information on when, where or how these developments will take place are confirmed, the risks to Great Barrier Reef water quality arising from the project can be more accurately predicted through the collection of monitoring data, and modelling approaches. Regular reviews of the monitoring program will help to manage the potential risks associated with inundation and agricultural development associated with Rookwood Weir and will ensure that the monitoring program is fit for purpose as more information becomes available (Figure 12).

Program reviews may be conducted by a suitably qualified independent person/ organisation, or carried out by Sunwater and then assessed and approved by a suitably qualified independent person/ organisation. The reviews will collate current science and data, and will recommend any amendments to the Program in relation to new knowledge, to ensure best practice. The independent reviewer will report and provide recommendations to Sunwater and DCCEEW.

Years 1-3

- Undertake reviews of water quality monitoring at the end of years 1, 2 and 3
- Review agricultural land use monitoring sites in relation to the locations of new agricultural developments
- Review inundation monitoring site locations in relation to accessibility, any overlap between sites
- Consider the possibility of alignment with other monitoring programs
- Review triggers and consider whether these require any amendments
- Review event monitoring to ensure data gathered provide sufficient coverage of runoff following rainfall
- Investigate advances in available monitoring technologies that may make continuous or automatic monitoring more cost effective
- Update models used for load calculations to current best practice as necessary
- Consider whether reporting to the Minister is sufficiently frequent.

Year 6

- Review the full monitoring program at the end of year 6
- Conduct data analysis including a comparison of pre-inundation and agricultural land use change (baseline) water quality, with post-change (inundation; changed in agricultural land use) water quality
- Consider continued relevance of the monitoring program in relation to:
  - parameters monitored
  - monitoring sites
  - frequency of monitoring for each parameter and site
  - event monitoring protocols
  - QA/QC
  - triggers and assessment of water quality
  - reporting schedule
  - continued relevance to Farm Plans accredited to the Land Management Code of Practice
- Investigate advances in available monitoring technologies that may make continuous or automatic monitoring more cost effective

Year 9

- Review the full monitoring program at the end of year 9
- Conduct data analysis including a comparison of pre-inundation and agricultural land use change (baseline) water quality, with post-change (inundation; changed in agricultural land use) water quality
- Consider continued relevance of the monitoring program in relation to:
  - parameters monitored
  - monitoring sites
  - frequency of monitoring for each parameter and site
  - event monitoring protocols
  - QA/QC
  - triggers and assessment of water quality
  - reporting schedule
  - continued relevance to Farm Plans accredited to the Land Management Code of Practice
- Investigate advances in available monitoring technologies that may make continuous or automatic monitoring more cost effective
- Determine review schedule for years 10+

Year 10+

- Review schedule to be detemined at the end of year 9

Figure 12: Review schedule for the water quality monitoring and reporting program.

14 Consultation on the water quality monitoring and reporting program

To ensure the monitoring program meets current recognised standards for water quality monitoring and reporting, regular consultation and discussions with water quality experts and stakeholders have been undertaken throughout its development. As specified in the approval conditions, this includes: the Queensland Department of Environment and Science (note name change since approval conditions were released); Queensland Department of Agriculture and Fisheries; Queensland Department of Natural Resources, Mines and Energy (note name change since approval conditions were released); and the Great Barrier Reef Marine Park Authority. Details of these consultation activities are provided in Appendix 6.

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Appendix 1 – Historical Data Monitoring Data 2010 -2018

Appendix 1 – Historical Monitoring Data 2010- 2018

In 2019, historical data from sites within the study area were provided by the Fitzroy Partnership for River Health (FPRH). The historical WQ data comes from one or more programs sampled on various dates combined into a single dataset supplied by FPRH. Tables 3 and 4 represent the data collected for Riverslea and The Gap. These datasets have been combined to generate a 75^{th}%ile number that has been utilised as the pre-action baseline for Turbidity and TSS.

A data summary, and comparison to earlier data analyses included in the Draft EIS, are provided in Tables 1-5, below. A comparison of water quality upstream and downstream of an existing weir in the Fitzroy Basin is available using data for Eden Bann Weir. Data from “Fitzroy River at the Gap” (Eden Bann Weir Headwaters) and “Fitzroy River at Wattlebank” (Eden Bann Weir Tailwaters) were examined, using the six available parameters (pH, EC, temperature, DO, TN and TP) (Figure 1). Mann-Whitney U tests were used to test for statistical differences between the two sites. No statistical difference was found between the pH, EC, temperature, DO, TN or TP concentrations reported in datasets from the headwaters (red triangle) and tailwaters (black circles) of the Eden Bann Weir. This Weir was built in 1994 and possibly represents the type of conditions that may eventually be experienced at Rookwood Weir, once initial nutrient loads associated with decaying vegetation subside, and excluding the potential impacts of new agricultural developments.

Nitrogen and phosphorus concentrations at three Eden Bann weir sites (upstream, headwater and tailwater) were also compared (Figure 2). For this comparison, raw data were accessed from: https://www.sunwater.com.au/customer/water-quality/. A Kruskal-Wallis One-Way ANOVA on Ranks was done to test for differences in median values among the three sites (treatment groups). For total nitrogen, differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.597). For total phosphorus, differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.777).

Table 1. Summary statistics for Mackenzie River at Coolmaringa (13/7/10-5/6/18).

Note: data were provided with results that were less than the limit of reporting (LOR) already converted to half the LOR; hence calculations have included an unknown amount of censored data and should be interpreted with caution.

Column	n	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	25%	75%	Skewness	Kurtosis	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Electrical Conductivity @ 25C (µS/cm)	27	404.259	145.086	27.922	57.394	481	663	182	**364**	283	559	0.379	-1.301	0.178	0.029	0.911	0.025	10915	4959785
Electrical Conductivity @ 25C Field	19	382.789	150.401	34.504	72.491	506	680	174	**322**	265	564	0.653	-0.866	0.183	0.093	0.906	0.062	7273	3191195
EC combined (µS/cm)	40	399.25	154.077	24.362	49.276	506	680	174	**333**	268.75	564	0.397	-1.363	0.192	<0.001	0.893	0.001	15970	7301876
Turbidity (NTU)	26	55.846	74.948	14.699	30.272	277	278	1	**13.5**	4.75	97.25	1.662	2.358	0.275	<0.001	0.746	<0.001	1452	221520
Turbidity (NTU) field	23	62.304	73.776	15.383	31.903	271	277	6	**20**	9	96	1.632	2.334	0.239	0.001	0.773	<0.001	1433	209025
Turbidity (NTU) Combined	43	54.14	67.714	10.326	20.839	276	277	1	**19**	8	96	1.654	2.451	0.251	<0.001	0.759	<0.001	2328	318616
Water Temperature (deg C) field	23	26.087	4.432	0.924	1.916	15.1	31.7	16.6	**27.2**	22.2	29.3	-0.963	0.0207	0.178	0.058	0.884	0.012	600	16084.28
pH (pH units)	26	7.958	0.271	0.0531	0.109	1	8.38	7.38	**7.995**	7.757	8.13	-0.421	-0.498	0.127	0.334	0.965	0.498	206.92	1648.599
pH (pH units) field	23	7.9	0.472	0.0984	0.204	1.6	8.7	7.1	**7.8**	7.5	8.3	0.102	-1.045	0.149	0.2	0.953	0.344	181.7	1440.33
pH Combined	34	7.894	0.415	0.0712	0.145	1.6	8.7	7.1	**7.81**	7.582	8.22	0.087	-0.694	0.1	0.488	0.976	0.646	268.4	2124.475
Total Alkalinity as $CaCO_3$ (mg/L)	26	99.385	30.252	5.933	12.219	120	164	44	**98**	76.25	112.75	0.512	-0.177	0.12	0.413	0.962	0.427	2584	279690
Bicarbonate as HCO_3 (mg/L)	26	119.192	35.937	7.048	14.515	144	197	53	**118**	91.25	136	0.506	-0.156	0.113	0.501	0.964	0.473	3099	401663
Total Suspended Solids (mg/L)	26	221.692	73.297	14.375	29.605	237	346	109	**17**	162	301.5	0.428	-1.285	0.177	0.035	0.901	0.016	5764	1412144
Calcium as Ca soluble (mg/L)	19	45.105	57.173	13.116	27.557	187	188	1	**20**	7	65	1.781	2.592	0.242	0.005	0.735	<0.001	857	97493
Chloride as Cl (mg/L)	26	20.708	6.807	1.335	2.749	26.6	36	9.4	**45.5**	15.75	24.25	0.648	-0.0834	0.157	0.099	0.954	0.28	538.4	12307.36
Magnesium as Mg soluble (mg/L)	26	58.077	30.689	6.019	12.396	97	120	23	**11**	32.75	87.25	0.603	-1.061	0.191	0.015	0.886	0.008	1510	111242
Total Nitrogen (mg/L)	26	13.104	5.904	1.158	2.385	19	24	5	**0.405**	7.975	19.25	0.463	-1.278	0.178	0.034	0.901	0.016	340.7	5336.01
Nitrate+nitrite as N soluble (mg/L)	24	0.438	0.182	0.0371	0.0767	0.73	0.9	0.17	**0.0065**	0.313	0.595	0.645	0.173	0.126	0.395	0.955	0.344	10.52	5.37
Ammonia as N - soluble (mg/L)	24	0.0646	0.102	0.0209	0.0433	0.399	0.4	0.001	**0.007**	0.002	0.15	1.899	3.699	0.317	<0.001	0.674	<0.001	1.551	0.342
Oxygen (Dissolved) (mg/L) field	17	0.0109	0.0133	0.00322	0.00683	0.045	0.046	0.001	**7.8**	0.003	0.0125	1.923	3.021	0.262	0.003	0.721	<0.001	0.186	0.00486
Total Phosphorus as P (mg/L)	21	7.852	1.541	0.336	0.701	5.6	10.9	5.3	**0.079**	6.8	8.55	0.388	-0.0907	0.123	0.511	0.963	0.57	164.9	1342.33
Total Reactive Phosphorus (Ortho P) – soluble (Field Filtered) (mg/L)	24	0.112	0.0763	0.0156	0.0322	0.228	0.27	0.042	**0.0395**	0.049	0.19	0.904	-0.741	0.229	0.002	0.815	<0.001	2.679	0.433
Potassium as K (mg/L)	24	0.0532	0.0456	0.00931	0.0193	0.151	0.16	0.009	**3.2**	0.017	0.0825	1.175	0.574	0.166	0.086	0.846	0.002	1.278	0.116
Sodium as Na (mg/L)	26	3.146	0.91	0.179	0.368	3.5	4.7	1.2	**31**	2.675	3.65	-0.0957	-0.238	0.121	0.397	0.969	0.586	81.8	278.08
Sulphate as SO_4 (mg/L)	26	37.846	14.807	2.904	5.981	49	65	16	**~9**	27	52.25	0.393	-1.297	0.202	0.008	0.909	0.025	984	42722
Copper - Dissolved (µg/L)	1								**16**										
Aluminium - Dissolved (µg/L)	51	26	64.038	56.956	11.17	23.005	185	210	**37.5**	37.5	25	100	1.413	0.746	0.328	<0.001	0.72	<0.001	1665
Iron – Dissolved (µg/L)	51	26	63.077	75.566	14.82	30.522	245	250	**10**	10	5	110	1.127	0.0795	0.297	<0.001	0.778	<0.001	1640
Zinc - Dissolved (µg/L)	51	26	9.423	6.376	1.25	2.575	25	30	**7.5**	7.5	5	10	1.862	3.43	0.31	<0.001	0.701	<0.001	245
Manganese - Dissolved (µg/L)	51	26	6.346	2.262	0.444	0.914	5	10	**5**	5	5	10	1.105	-0.85	0.455	<0.001	0.557	<0.001	165
Carbonate as CO_3 (mg/L)	41	21	0.795	0.571	0.124	0.26	1.8	1.9	**0.75**	0.7	0.3	1.1	0.752	-0.377	0.141	0.327	0.896	0.03	16.7

Table 2. Summary statistics for Dawson River at Beckers (7/9/10 to 11/5/18).

Note: data were provided with results that were less than the limit of reporting (LOR) already converted to half the LOR; hence calculations have included an unknown amount of censored data and should be interpreted with caution.

Column	n	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	25%	75%	Skewness	Kurtosis	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Electrical Conductivity @ 25C (µS/cm)	44	315.477	138.354	20.858	42.063	604	718	114	269.5	231.5	385.5	1.253	1.355	0.178	0.001	0.89	<0.001	13881	5202239
Electrical Conductivity @ 25C Field	35	342.457	163.996	27.72	56.335	694	851	157	303	211	459	1.251	1.43	0.163	0.02	0.877	0.001	11986	5019112
EC combined (µS/cm)	74	329.041	153.48	17.842	35.558	737	851	114	270.5	221.75	420.25	1.243	1.254	0.167	<0.001	0.887	<0.001	24349	9731405
Turbidity (NTU)	29	129.376	174.214	32.351	66.267	608	610	2	54	15.5	152.5	1.69	1.712	0.257	<0.001	0.716	<0.001	3751.9	1335216.61
Turbidity (NTU) field	41	193.064	242.446	37.864	76.525	984	990	6	73	22	336.55	1.643	2.336	0.222	<0.001	0.768	<0.001	7915.64	3879435.082
Turbidity (NTU) Combined	65	170.993	221.646	27.492	54.921	988	990	2	57	19.5	254.5	1.731	2.683	0.226	<0.001	0.751	<0.001	11114.54	5044638.692
Water Temperature (deg C) field	45	24.643	5.434	0.81	1.632	19.7	34.6	14.9	25	20.2	29.095	-0.0475	-0.997	0.139	0.03	0.959	0.112	1108.93	28626.349
pH (pH units)	44	7.667	0.323	0.0487	0.0982	1.31	8.34	7.03	7.725	7.4	7.855	-0.0538	-0.389	0.105	0.256	0.965	0.203	337.36	2591.121
pH (pH units) field	41	7.568	0.295	0.0461	0.0931	1.4	8.6	7.2	7.5	7.3	7.705	1.171	2.238	0.177	0.002	0.902	0.002	310.3	2351.922
pH Combined	80	7.62	0.32	0.0358	0.0712	1.57	8.6	7.03	7.595	7.308	7.83	0.465	0.0617	0.0913	0.096	0.969	0.051	609.6	4653.247
Total Alkalinity as $CaCO_3$ (mg/L)	55	71.8	18.786	2.533	5.078	87	123	36	66	60	85	0.789	0.254	0.196	<0.001	0.934	0.005	3949	302595
Bicarbonate as HCO_3 (mg/L)	36	85.889	26.699	4.45	9.034	105	148	43	78	65	108	0.582	-0.531	0.157	0.024	0.934	0.032	3092	290518
Total Suspended Solids (mg/L)	32	95.969	149.94	26.506	54.059	558	565	7	25	15	94.75	2.096	3.341	0.327	<0.001	0.615	<0.001	3071	991661
Calcium as Ca soluble (mg/L)	56	17.163	8.413	1.124	2.253	40.5	47	6.5	14	13	19	2.3	5.806	0.204	<0.001	0.736	<0.001	961.1	20387.59
Chloride as Cl (mg/L)	56	47.214	32.611	4.358	8.733	136.5	145	8.5	39.5	24.25	55.25	1.508	2.055	0.18	<0.001	0.847	<0.001	2644	183325.44
Magnesium as Mg soluble (mg/L)	56	7.495	4.019	0.537	1.076	18.7	21	2.3	6.55	5.4	8	1.904	4.04	0.218	<0.001	0.8	<0.001	419.7	4033.73
Total Nitrogen (mg/L)	27	0.694	0.342	0.0657	0.135	0.98	1.3	0.32	0.57	0.4	0.94	0.835	-0.767	0.226	0.001	0.84	<0.001	18.73	16.028
Nitrate+nitrite as N soluble (mg/L)	27	0.0781	0.102	0.0196	0.0403	0.389	0.39	0.001	0.025	0.009	0.16	1.592	2.04	0.279	<0.001	0.752	<0.001	2.108	0.434
Ammonia as N - soluble (mg/L)	16	0.0276	0.0255	0.00638	0.0136	0.077	0.079	0.002	0.0175	0.00825	0.0415	1.023	-0.204	0.23	0.023	0.842	0.01	0.442	0.022
Oxygen (Dissolved) (mg/L) field	46	7.397	1.607	0.237	0.477	8.1	11.8	3.7	7.205	6.36	8.525	0.197	0.59	0.0832	0.547	0.982	0.671	340.28	2633.346
Total Phosphorus as P (mg/L)	27	0.18	0.156	0.03	0.0618	0.507	0.55	0.043	0.11	0.067	0.21	1.202	0.0614	0.216	0.002	0.789	<0.001	4.847	1.504
Total Reactive Phosphorus (Ortho P) – soluble (Field Filtered) (mg/L)	27	0.0719	0.0755	0.0145	0.0299	0.273	0.28	0.007	0.035	0.023	0.089	1.566	1.545	0.264	<0.001	0.768	<0.001	1.94	0.287
Potassium as K (mg/L)	55	5.729	1.281	0.173	0.346	6.5	10	3.5	6	5	6.6	0.359	0.836	0.116	0.062	0.949	0.02	315.1	1893.91
Sodium as Na (mg/L)	56	29.875	15.401	2.058	4.125	63	75	12	26.5	18	37	1.263	0.995	0.177	<0.001	0.869	<0.001	1673	63027
Sulphate as SO_4 (mg/L)	56	8.177	7.647	1.022	2.048	36.5	37	0.5	6	4.375	8.65	2.571	6.344	0.27	<0.001	0.651	<0.001	457.9	6960.29
Aluminium - Dissolved (µg/L)	55	136.5	178.679	24.093	48.304	725	730	5	50	21	180	1.716	2.305	0.242	<0.001	0.742	<0.001	7507.5	2748790.25
Copper - Dissolved (µg/L)	35	3.644	3.879	0.656	1.333	14.5	15	0.5	2.5	1.2	4	2.284	4.6	0.28	<0.001	0.662	<0.001	127.54	976.464
Iron – Dissolved (µg/L)	55	168.467	230.889	31.133	62.418	1295	1300	5	90	25	200	2.781	10.062	0.24	<0.001	0.679	<0.001	9265.7	4439685.89
Zinc - Dissolved (µg/L)	55	11.415	16.556	2.232	4.476	89.75	90	0.25	5	2.5	10	2.976	10.143	0.298	<0.001	0.62	<0.001	627.81	21968.026
Manganese - Dissolved (µg/L)	55	44.875	66.882	9.018	18.081	246.7	248	1.3	11	5	53	1.948	2.75	0.268	<0.001	0.654	<0.001	2468.1	352310.81
Carbonate as CO_3 (mg/L)	30	0.437	0.28	0.0511	0.104	1.3	1.4	0.1	0.5	0.2	0.5	1.62	4.097	0.31	<0.001	0.805	<0.001	13.1	7.99
Oxygen per cent saturation (%)	18	79.544	14.876	3.506	7.398	50.9	97.9	47	82.7	70.525	91.35	-0.943	0.0513	0.169	0.188	0.908	0.079	1431.8	117653.68

Table 3. Summary statistics for Fitzroy River at Riverslea data (13/7/10-5/6/18).
Note: data were provided with results that were less than the limit of reporting (LOR) already converted to half the LOR; hence calculations have included an unknown amount of censored data and should be interpreted with caution.

Column	n	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	25%	75%	Skewness	Kurtosis	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Electrical Conductivity @ 25C (µS/cm)	51	379.588	189.327	26.511	53.249	585	666	81	325	246	542	0.147	-1.264	0.143	0.011	0.926	0.003	19359	9140681
Electrical Conductivity @ 25C Field	41	409.317	194.776	30.419	61.479	599	678	79	442	267	579.5	-0.186	-1.107	0.0996	0.369	0.93	0.014	16782	8386674
EC combined (µS/cm)	88	391.466	194.179	20.7	41.143	599	678	79	356	260.25	550.5	0.0121	-1.267	0.0998	0.03	0.927	<0.001	34449	16765977
Turbidity (NTU)	51	99.255	116.266	16.28	32.7	407	408	1	53	7	163	1.219	0.613	0.234	<0.001	0.803	<0.001	5062	1178314
Turbidity (NTU) field	49	98.755	109.71	15.673	31.512	424	428	4	21	10	190.5	1.026	0.189	0.271	<0.001	0.815	<0.001	4839	1055619
Turbidity (NTU) Combined	96	96.594	110.103	11.237	22.309	427	428	1	23	9	161.75	1.118	0.391	0.254	<0.001	0.813	<0.001	9273	2047367
Water Temperature (deg C) field	51	24.371	4.224	0.591	1.188	16.9	32.8	15.9	25.2	20.9	26.8	-0.221	-0.729	0.13	0.032	0.961	0.093	1242.9	31182.19
pH (pH units)	51	7.857	0.447	0.0626	0.126	2.06	8.98	6.92	8.02	7.49	8.2	-0.259	-0.515	0.152	0.005	0.937	0.009	400.7	3158.236
pH (pH units) field	51	7.79	0.576	0.0806	0.162	2.7	9.3	6.6	7.9	7.4	8.2	0.0729	-0.175	0.136	0.019	0.976	0.393	397.3	3111.63
pH Combined	98	7.817	0.51	0.0515	0.102	2.7	9.3	6.6	7.9	7.4	8.2	-0.166	-0.254	0.139	<0.001	0.961	0.005	766.03	6012.996
Total Alkalinity as $CaCO_3$ (mg/L)	51	90.725	35.551	4.978	9.999	122	146	24	89	68	127	-0.255	-0.883	0.101	0.21	0.946	0.022	4627	482981
Bicarbonate as HCO_3 (mg/L)	51	108.824	42.097	5.895	11.84	145	174	29	108	83	151	-0.266	-0.842	0.0967	0.266	0.947	0.023	5550	692578
Total Suspended Solids (mg/L)	20	82.25	95.191	21.285	44.551	339	343	4	50.5	10.5	109.75	1.666	2.373	0.206	0.027	0.789	<0.001	1645	307465
Calcium as Ca soluble (mg/L)	51	19.502	8.751	1.225	2.461	29.9	34	4.1	19	13	27	-0.0474	-0.965	0.0719	0.672	0.96	0.081	994.6	23225.22
Chloride as Cl (mg/L)	51	53.075	35.577	4.982	10.006	112.6	120	7.4	41	24	82	0.51	-0.972	0.154	0.004	0.915	0.001	2706.8	206947.5
Magnesium as Mg soluble (mg/L)	51	12.218	6.893	0.965	1.939	21.9	24	2.1	10	6.8	19	0.264	-1.198	0.156	0.003	0.932	0.006	623.1	9988.83
Total Nitrogen (mg/L)	51	0.523	0.286	0.04	0.0803	1.33	1.5	0.17	0.52	0.25	0.68	0.961	1.175	0.138	0.017	0.907	<0.001	26.69	18.044
Nitrate+nitrite as N soluble (mg/L)	51	0.0478	0.092	0.0129	0.0259	0.479	0.48	0.001	0.013	0.002	0.04	2.925	9.768	0.34	<0.001	0.56	<0.001	2.439	0.54
Ammonia as N - soluble (mg/L)	20	0.0255	0.0359	0.00803	0.0168	0.149	0.15	0.001	0.0105	0.005	0.035	2.569	7.449	0.25	0.002	0.673	<0.001	0.51	0.0375
Oxygen (Dissolved) (mg/L) field	51	7.994	2.289	0.321	0.644	10.2	14	3.8	7.55	6.5	9.2	0.479	0.42	0.109	0.129	0.968	0.183	407.7	3521.175
Total Phosphorus as P (mg/L)	51	0.17	0.103	0.0144	0.0288	0.304	0.35	0.046	0.13	0.076	0.28	0.345	-1.539	0.184	<0.001	0.863	<0.001	8.67	2
Total Reactive Phosphorus (Ortho P) – soluble (Field Filtered) (mg/L)	51	0.0816	0.0476	0.00666	0.0134	0.159	0.17	0.011	0.07	0.04	0.13	0.434	-1.248	0.163	0.002	0.901	<0.001	4.161	0.453
Potassium as K (mg/L)	51	3.82	0.927	0.13	0.261	4.1	5.9	1.8	3.6	3.2	4.6	0.364	-0.0589	0.125	0.045	0.966	0.145	194.8	787.02
Sodium as Na (mg/L)	51	35.529	19.025	2.664	5.351	59	67	8	30	22	51	0.247	-1.226	0.124	0.047	0.927	0.004	1812	82476
Sulphate as SO_4 (mg/L)	51	14.025	10.689	1.497	3.006	40	42	2	11.6	5.5	22	1.078	0.259	0.199	<0.001	0.869	<0.001	715.3	15744.71
Copper - Dissolved (µg/L)	6	7.05	6.231	2.544	6.539	13.2	15	1.8	4.1	2.175	15	0.868	-1.876	0.331	0.038	0.755	0.022	42.3	492.33
Aluminium - Dissolved (µg/L)	51	371.765	696.682	97.555	195.945	2875	2900	25	50	50	330	2.602	6.208	0.337	<0.001	0.547	<0.001	18960	31316950
Iron – Dissolved (µg/L)	51	207.941	349.168	48.893	98.205	1395	1400	5	60	10	190	2.301	4.838	0.316	<0.001	0.623	<0.001	10605	8301125
Zinc - Dissolved (µg/L)	51	22.255	61.044	8.548	17.169	425	430	5	10	5	10	6.257	41.785	0.442	<0.001	0.262	<0.001	1135	211575
Manganese - Dissolved (µg/L)	51	8.039	2.465	0.345	0.693	5	10	5	10	5	10	-0.455	-1.868	0.395	<0.001	0.62	<0.001	410	3600
Carbonate as CO_3 (mg/L)	41	1.015	1.076	0.168	0.339	6.2	6.2	0	0.8	0.2	1.5	2.843	12.792	0.173	0.003	0.733	<0.001	41.6	88.48

Table 4. Summary statistics for Fitzroy River at The Gap (Eden Bann Weir) data (**14/7/10-5/6/18**).

Note: data were provided with results that were less than the limit of reporting (LOR) already converted to half the LOR; hence calculations have included an unknown amount of censored data and should be interpreted with caution.

Column	n	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	25%	75%	Skewness	Kurtosis	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Electrical Conductivity @ 25C (µS/cm)	53	436.321	170.368	23.402	46.959	767	844	77	466	365.5	466	0.0333	0.427	0.267	<0.001	0.874	<0.001	23125	11599233
Electrical Conductivity @ 25C Field	59	440.29	221.788	28.874	57.798	766	862	96	383	258	630	0.501	-0.976	0.124	0.024	0.926	0.002	25977.11	14290467
EC combined (µS/cm)	107	440.235	198.544	19.194	38.054	785	862	77	466	287	515	0.398	-0.472	0.187	<0.001	0.95	<0.001	47105.11	24915793
Turbidity (NTU)	53	83.534	122.393	16.812	33.736	673	674	1	37	8.5	127	2.717	9.739	0.25	<0.001	0.679	<0.001	4427.3	1148798
Turbidity (NTU) field	51	116.872	184.278	25.804	51.829	914	918	4	36	9	141	2.718	8.25	0.27	<0.001	0.641	<0.001	5960.47	2394533
Turbidity (NTU) Combined	99	93.442	146.404	14.714	29.2	917	918	1	33	9	127	3.163	12.835	0.264	<0.001	0.632	<0.001	9250.77	2964946
Water Temperature (deg C) field	65	25.342	3.602	0.447	0.893	13.8	30.8	17	26.3	22.85	27.885	-0.798	-0.32	0.162	<0.001	0.914	<0.001	1647.26	42576
pH (pH units)	53	7.925	0.373	0.0513	0.103	1.57	8.57	7	8.04	7.675	8.22	-0.853	0.0833	0.165	<0.001	0.925	0.003	420	3335.554
pH (pH units) field	61	7.716	0.432	0.0553	0.111	2.09	8.89	6.8	7.7	7.4	8.05	0.325	0.199	0.0889	0.262	0.981	0.47	470.7	3643.288
pH Combined	109	7.826	0.413	0.0395	0.0783	2.09	8.89	6.8	7.8	7.55	8.17	-0.2	-0.235	0.0982	0.012	0.98	0.107	852.99	6693.539
Total Alkalinity as $CaCO_3$ (mg/L)	66	106.803	45.755	5.632	11.248	171	202	31	96	68	153.75	0.309	-1.141	0.15	<0.001	0.935	0.002	7049	888933
Bicarbonate as HCO_3 (mg/L)	54	130.981	55.514	7.554	15.152	200	238	38	116.5	88.5	186.25	0.206	-1.202	0.145	0.006	0.938	0.007	7073	1089765
Total Suspended Solids (mg/L)	15	92	148.248	38.278	82.097	565	568	3	27	7	137	2.707	8.096	0.292	0.001	0.634	<0.001	1380	434646
Calcium as Ca soluble (mg/L)	66	20.585	8.932	1.099	2.196	32.2	38	5.8	18.5	13.75	27	0.384	-0.845	0.118	0.024	0.952	0.013	1358.6	33152.42
Chloride as Cl (mg/L)	66	60.742	37.291	4.59	9.167	128	140	12	51.5	29	85.5	0.697	-0.704	0.127	0.01	0.907	<0.001	4009	333909
Magnesium as Mg soluble (mg/L)	66	16.761	10.214	1.257	2.511	36.7	40	3.3	14	8.5	25.25	0.662	-0.754	0.168	<0.001	0.906	<0.001	1106.2	25321.26
Total Nitrogen (mg/L)	77	0.511	0.246	0.028	0.0558	1.04	1.2	0.16	0.44	0.33	0.625	1.032	0.94	0.122	0.006	0.921	<0.001	39.32	24.679
Nitrate+nitrite as N soluble (mg/L)	43	0.0683	0.117	0.0178	0.036	0.418	0.42	0.002	0.012	0.002	0.028	1.775	1.961	0.402	<0.001	0.62	<0.001	2.938	0.775
Ammonia as N - soluble (mg/L)	15	0.01	0.00862	0.00223	0.00477	0.028	0.029	0.001	0.007	0.005	0.012	1.406	1.289	0.236	0.024	0.822	0.007	0.15	0.00254
Oxygen (Dissolved) (mg/L) field	63	6.402	1.875	0.236	0.472	9.6	9.9	0.3	6.5	5.1	8	-0.439	0.546	0.0676	0.622	0.974	0.205	403.32	2799.949
Total Phosphorus as P (mg/L)	77	0.141	0.102	0.0116	0.0231	0.424	0.441	0.017	0.095	0.0605	0.21	1.227	0.889	0.182	<0.001	0.864	<0.001	10.871	2.32
Total Reactive Phosphorus (Ortho P) – soluble (Field Filtered) (mg/L)	43	0.0839	0.0526	0.00803	0.0162	0.172	0.18	0.008	0.081	0.034	0.14	0.271	-1.268	0.135	0.047	0.927	0.009	3.607	0.419
Potassium as K (mg/L)	65	3.826	1.17	0.145	0.29	4.4	5.9	1.5	3.5	3.1	5	0.0607	-0.956	0.134	0.005	0.958	0.026	248.7	1039.17
Sodium as Na (mg/L)	66	38.13	19.575	2.41	4.812	68.4	78	9.6	32	21	53	0.725	-0.611	0.144	0.002	0.903	<0.001	2516.6	120865.2
Sulphate as SO_4 (mg/L)	66	15.373	9.598	1.181	2.359	39	40	1	14.2	7	23.5	0.322	-0.87	0.107	0.058	0.948	0.008	1014.6	21584.9
Aluminium - Dissolved (µg/L)	65	91.209	139.564	17.311	34.582	797.5	800	2.5	50	25	55	3.281	12.04	0.376	<0.001	0.54	<0.001	5928.6	1787343
Copper - Dissolved (µg/L)	22	3.873	4.915	1.048	2.179	23.9	25	1.1	2.7	1.975	3.325	4.125	18.194	0.335	<0.001	0.457	<0.001	85.2	837.34
Iron – Dissolved (µg/L)	65	94.822	135.775	16.841	33.643	607.5	610	2.5	54	10	100	2.38	5.478	0.271	<0.001	0.66	<0.001	6163.4	1764248
Zinc - Dissolved (µg/L)	64	15.395	20.214	2.527	5.049	93.75	94	0.25	10	5	19.25	2.656	7.042	0.324	<0.001	0.636	<0.001	985.3	40912.43
Manganese - Dissolved (µg/L)	65	12.973	32.205	3.995	7.98	229.75	230	0.25	10	5	10	5.912	36.405	0.455	<0.001	0.26	<0.001	843.23	77318.02
Carbonate as CO_3 (mg/L)	54	1.143	1.063	0.145	0.29	4.6	4.6	0	0.6	0.475	2.025	1.294	1.4	0.217	<0.001	0.843	<0.001	61.7	130.37
Oxygen per cent saturation (%)	20	70.472	14.593	3.263	6.83	52	94.7	42.7	72.2	57.925	77.625	-0.0412	-0.42	0.128	0.487	0.962	0.594	1409.45	103373.7

Table 5. Summary statistics for Fitzroy River at Wattlebank data (26/10/10-18/5/17).

Note: data were provided with results that were less than the limit of reporting (LOR) already converted to half the LOR; hence calculations have included an unknown amount of censored data and should be interpreted with caution.

Column	n	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	25%	75%	Skewness	Kurtosis	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
pH (pH units) field	67	7.627	0.481	0.0588	0.117	1.6	8.5	6.9	7.6	7.2	8.1	0.553	-1.074	0.229	<0.001	0.884	<0.001	511	3912.62
Electrical Conductivity @ 25C (µS/cm)	53	456.472	309.342	42.491	85.265	795	902	107	325	198	862	0.358	-1.557	0.188	<0.001	0.835	<0.001	24193	16019431
Water Temperature (deg C) field	84	25.545	2.206	0.241	0.479	10.7	32.5	21.8	24.6	24.5	27.425	0.788	0.952	0.234	<0.001	0.889	<0.001	2145.8	55219.02
Oxygen (Dissolved) (mg/L) field	84	7.701	5.053	0.551	1.097	30.3	32.2	1.9	6.8	6.7	7.3	4.027	17.264	0.381	<0.001	0.454	<0.001	646.9	7100.87
Total Nitrogen (mg/L)	31	0.535	0.218	0.0392	0.08	0.95	1.19	0.24	0.5	0.36	0.64	1.167	1.734	0.123	0.267	0.917	0.019	16.6	10.315
Total Phosphorus as P (mg/L)	31	0.148	0.113	0.0203	0.0414	0.402	0.422	0.02	0.114	0.066	0.22	1.196	0.477	0.218	<0.001	0.848	<0.001	4.595	1.064

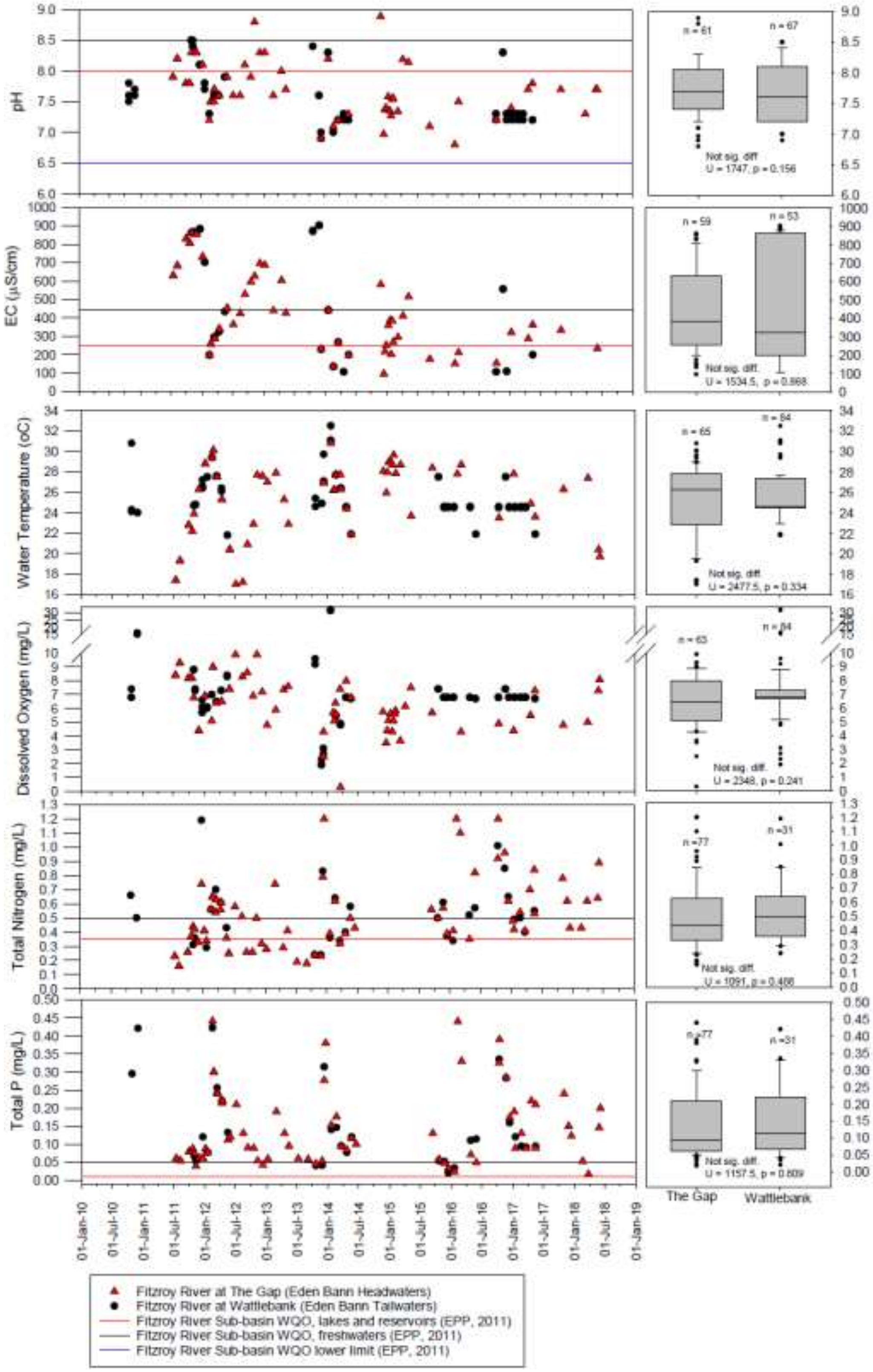


Figure 1. Time series and box plots of pH, EC, temperature, DO, TN and TP concentration data from "Fitzroy River at the Gap" (Eden Bann Weir Headwaters) – red triangles, and "Fitzroy River at Wattlebank" (Eden Bann Weir Tailwaters) – black circles. Note: Fitzroy River at the Gap data: 14/7/11 – 5/6/18, n = 59-77 and Fitzroy River at Wattle bank: 26/10/10 – 18/5/17, n = 31-84. Box plots and Mann

Whitney comparisons do not represent data points from identical time points, hence should be interpreted with caution.

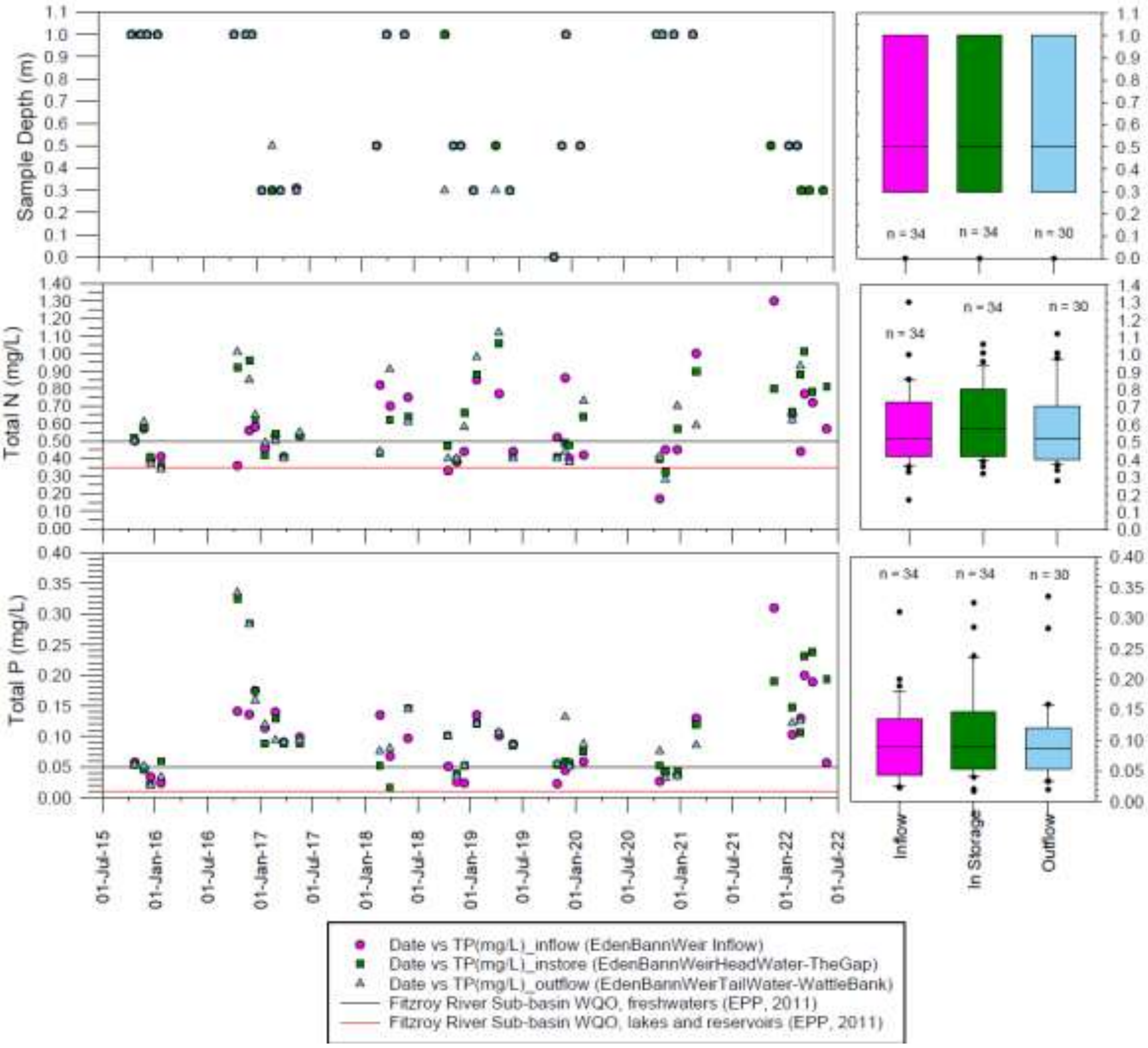


Figure 2. Comparison of nitrogen and phosphorous concentration at an existing Eden Bann Weir .

Flow, TSS and Turbidity, Fitzroy River at Riverslea 2010-2018 - time-series plots.

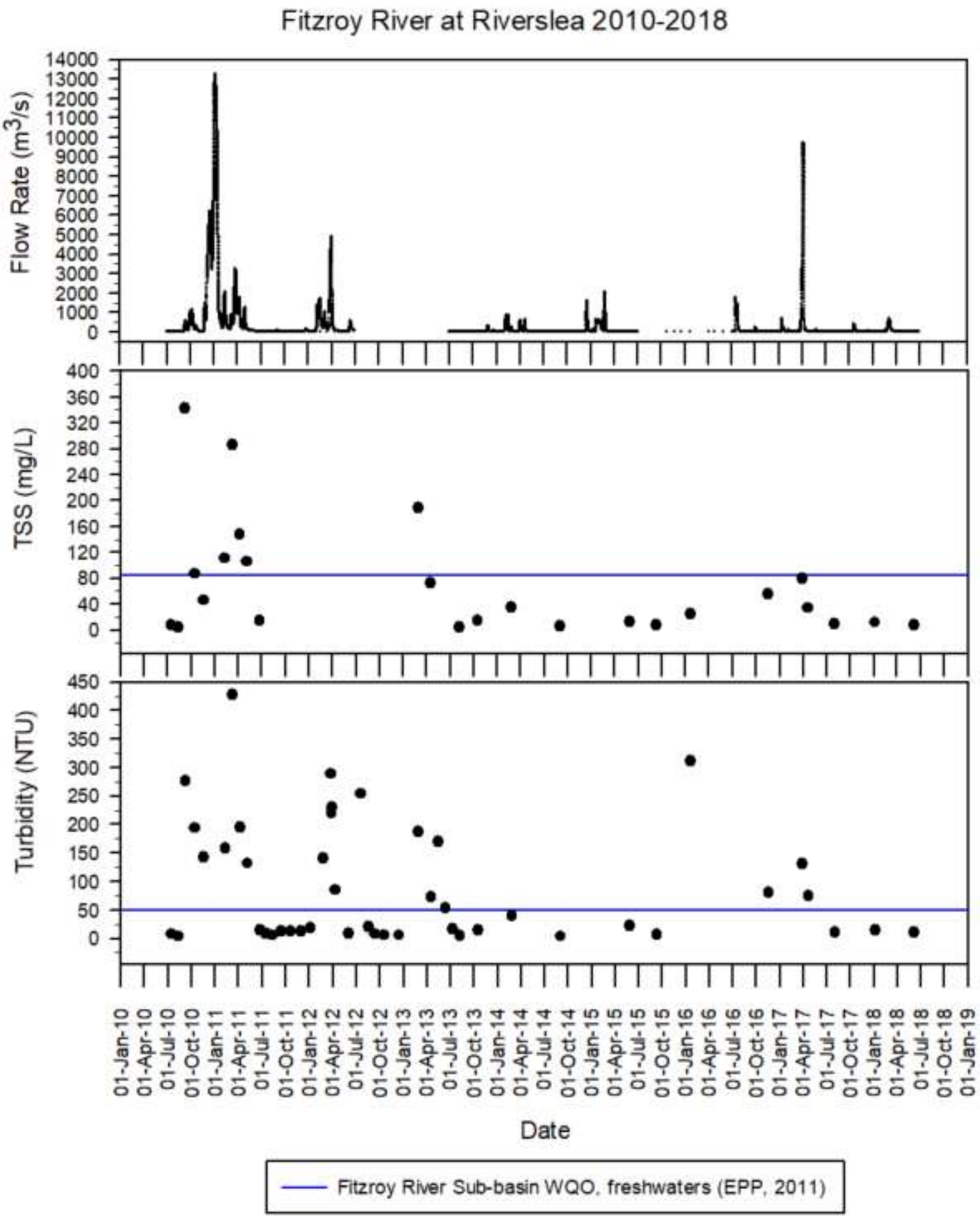


Figure 3: River flow rate (discharge, m^3/s), total suspended solids (TSS) concentration (mg/L) and turbidity values (NTU), measured at or sampled from "Fitzroy River at Riverslea". Water quality results relate to various time points between during 13/7/10 to 5/6/18. Date range and scale on x-axis is the same for all parameters. Note: data were provided with any results that were less than the limit of reporting (LOR) already converted to half the LOR. Data source: FPRH

Flow, TSS and Turbidity, Fitzroy River at the Gap, 2010-2018 - time-series plots.

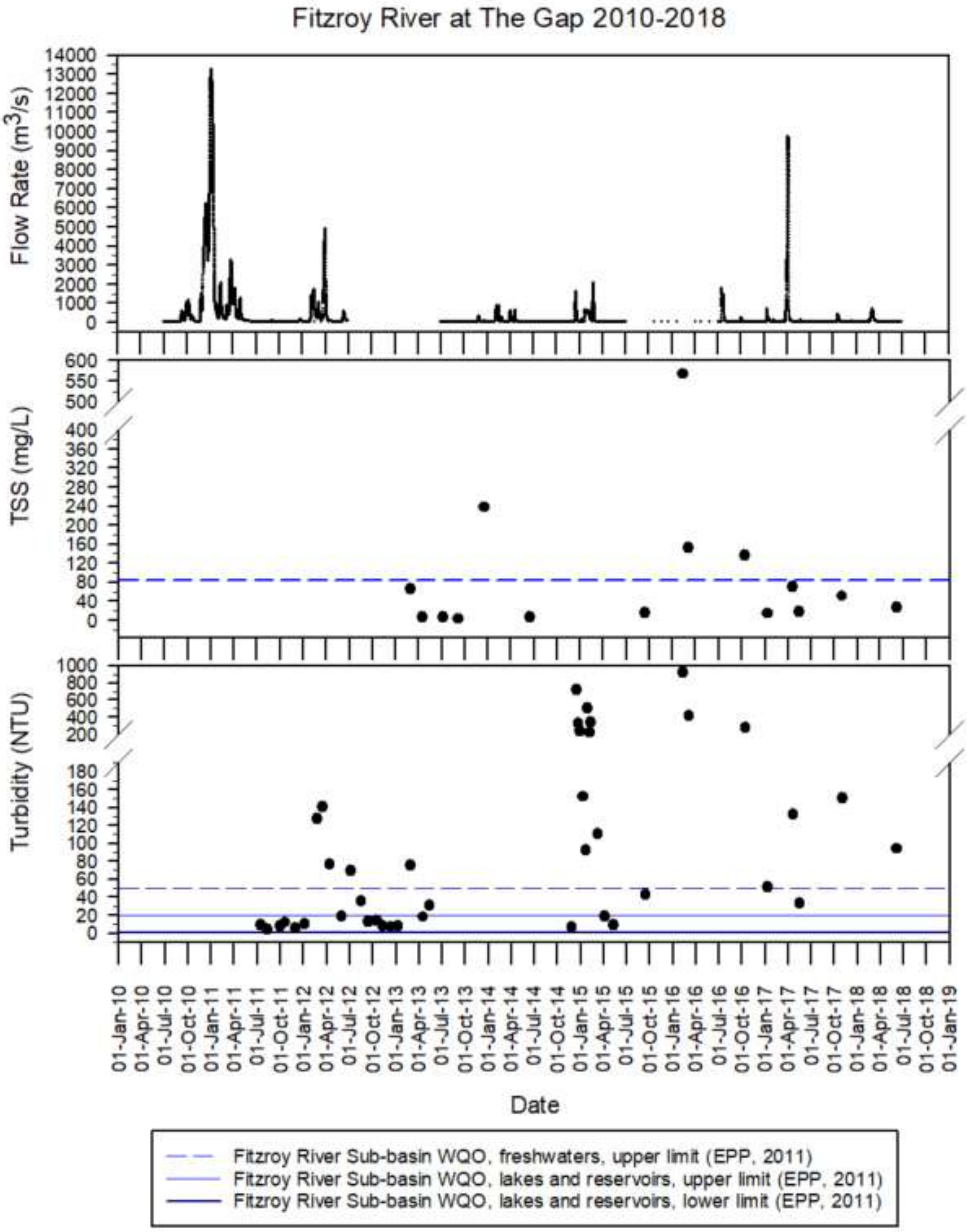
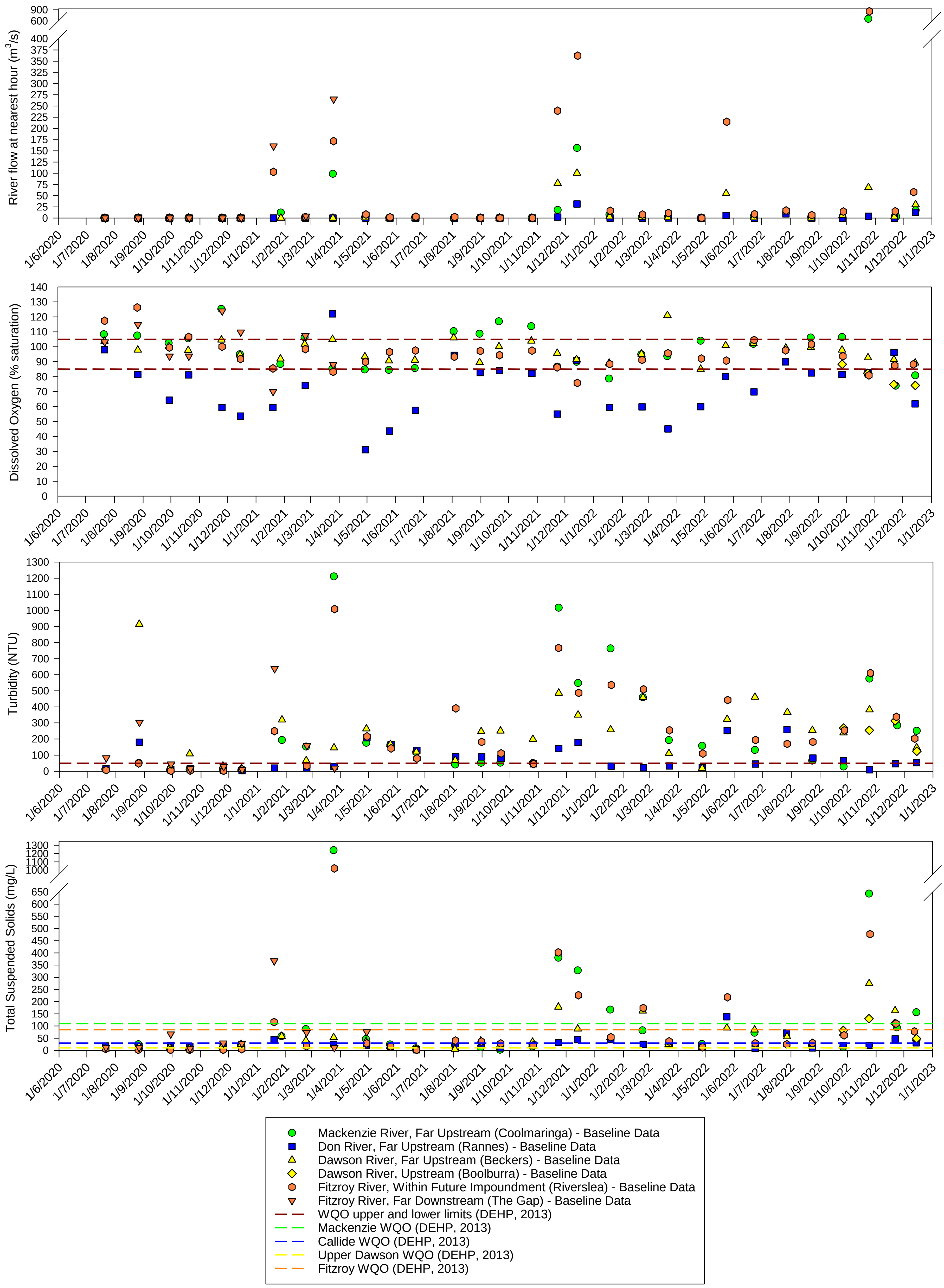
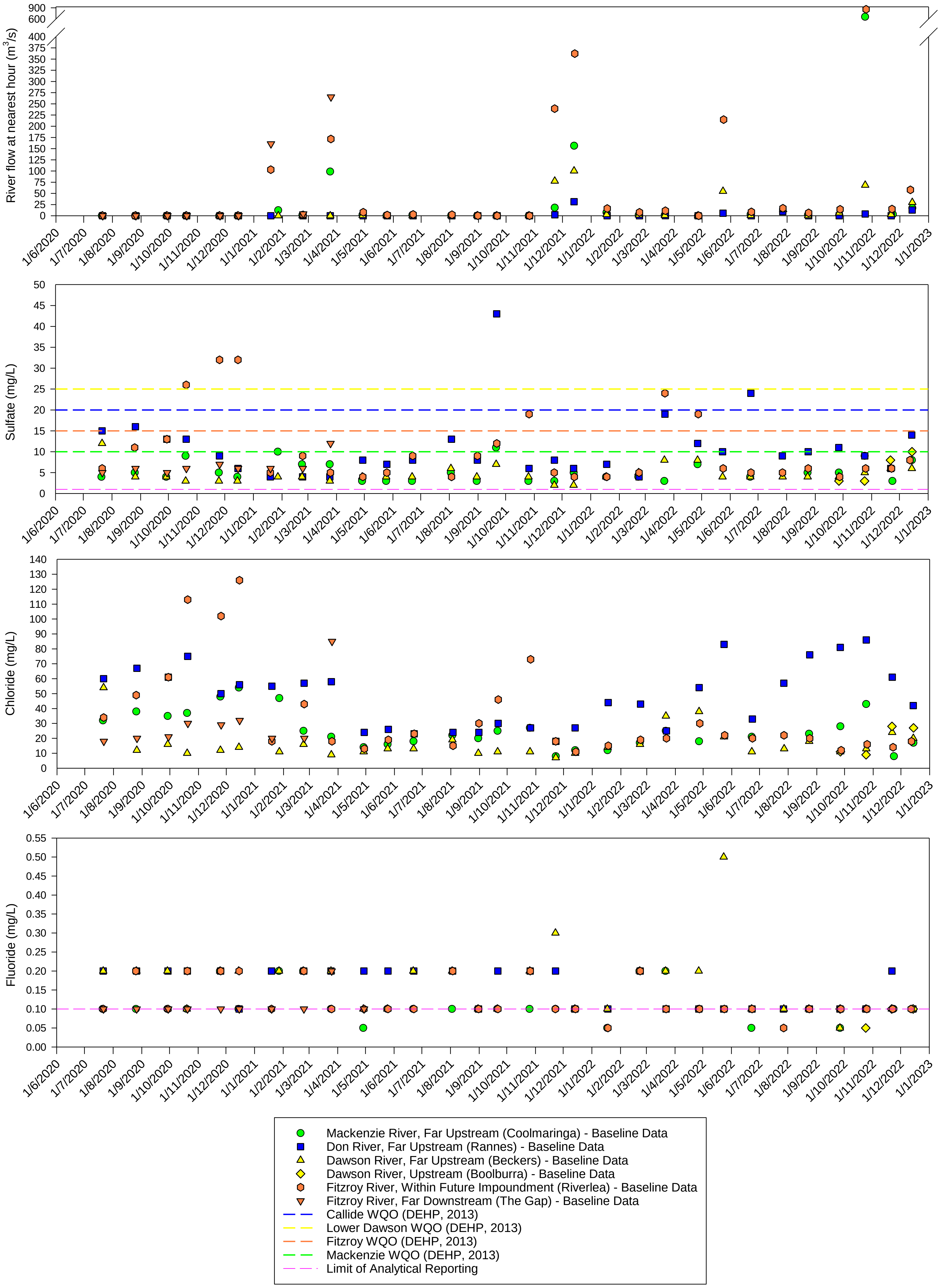


Figure 4: River flow rate (discharge, m^3/s), total suspended solids (TSS) concentration (mg/L) and turbidity values (NTU), measured at or sampled from "Fitzroy River at the Gap". Water quality results relate to various time points between 14/7/11 and 5/6/18. Date range and scale on x-axis is the same for all parameters. Note: data were provided with any results that were less than the limit of reporting (LOR) already converted to half the LOR. Data source: FPRH

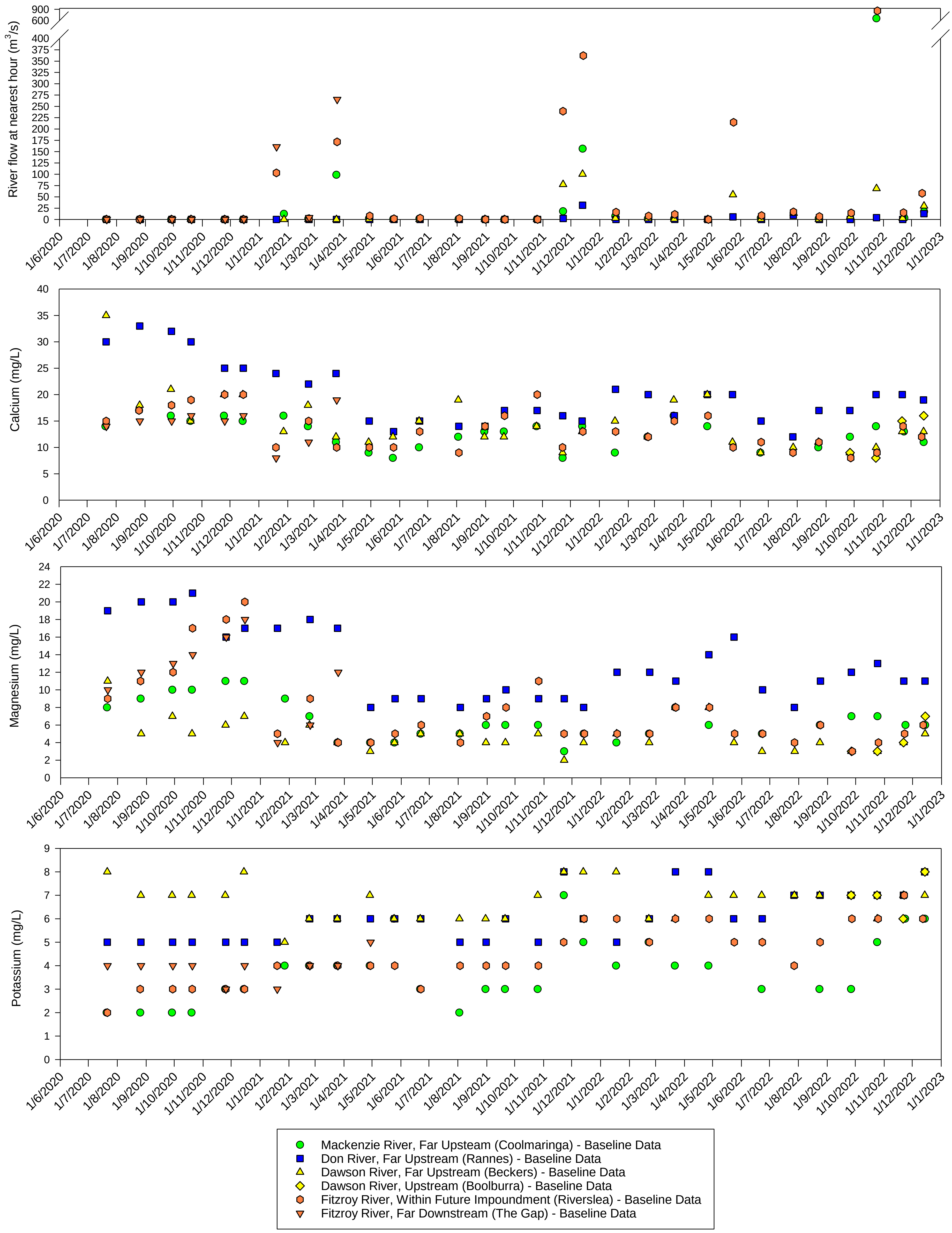
Appendix 2 – Time Series Graphs of Baseline Monitoring Data

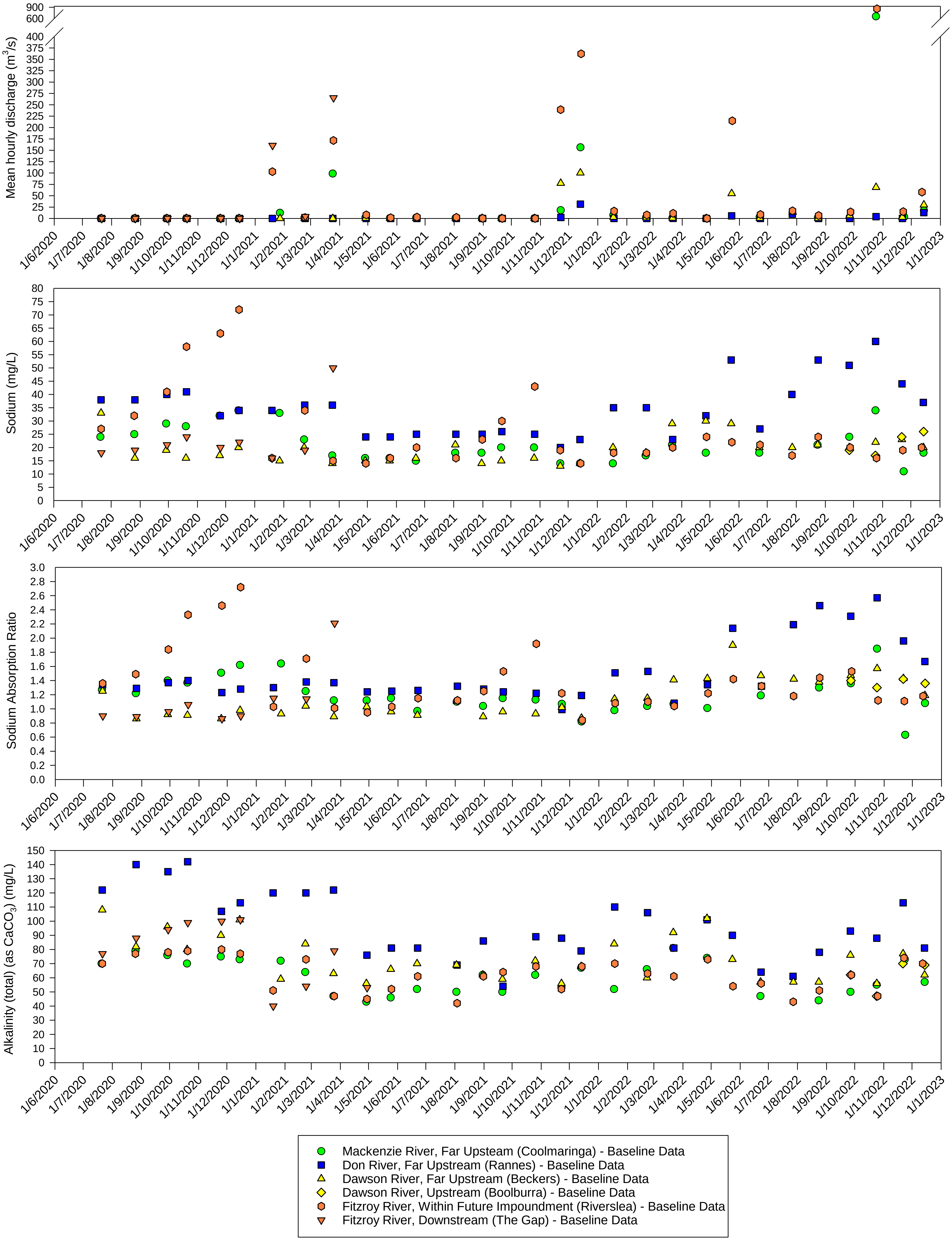
Appendix 2 - Time series graphs of baseline monitoring data by site

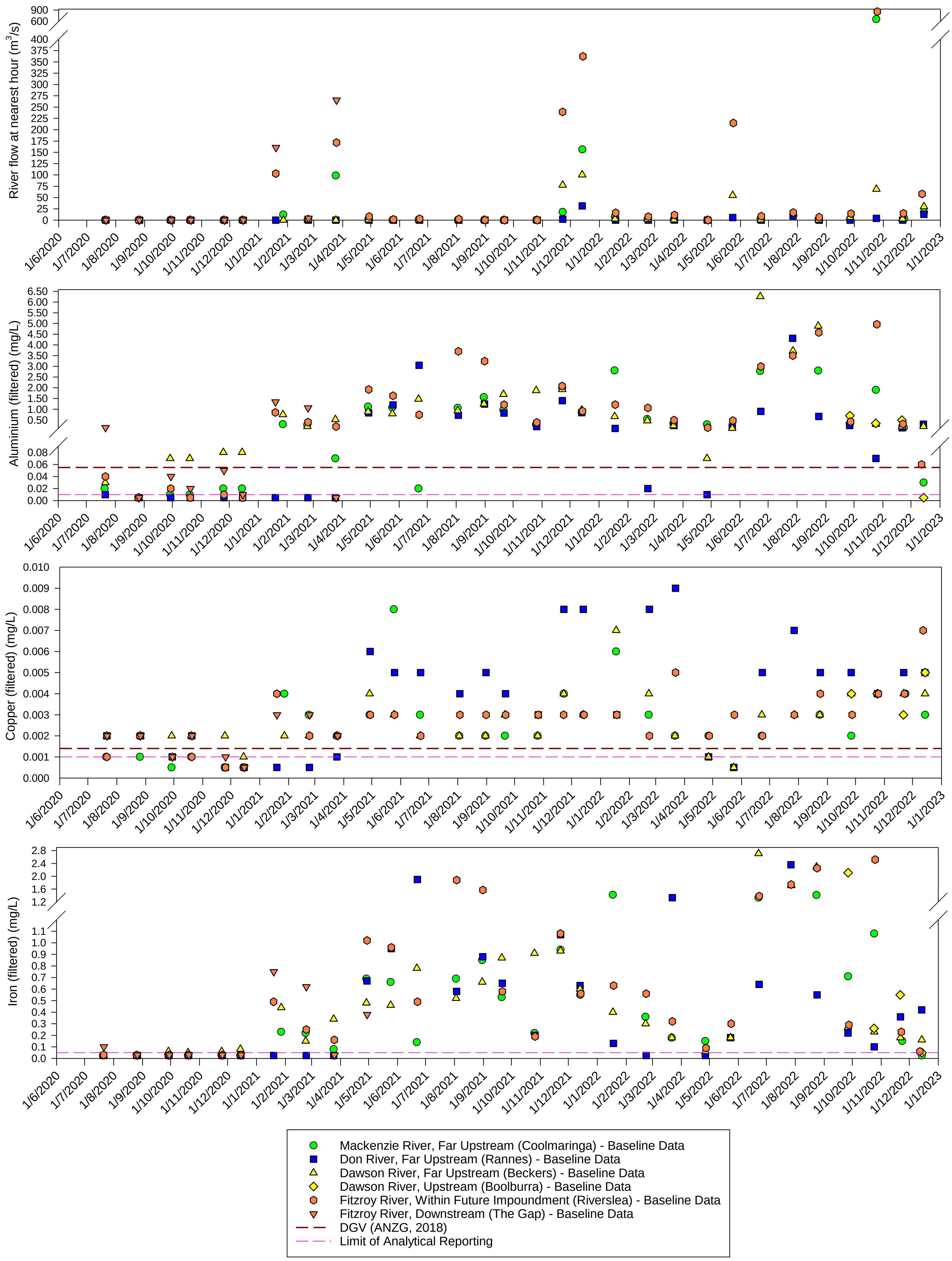


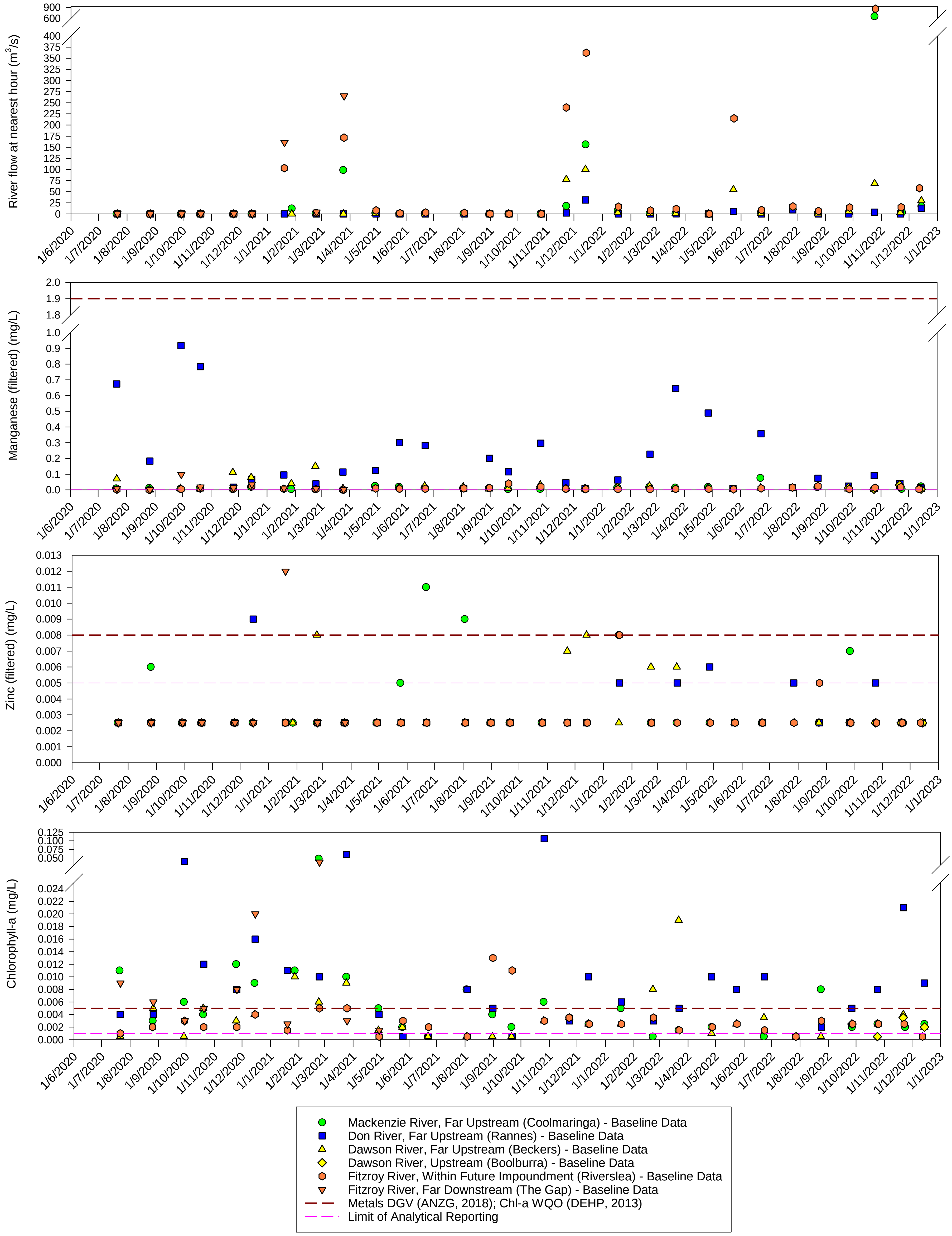


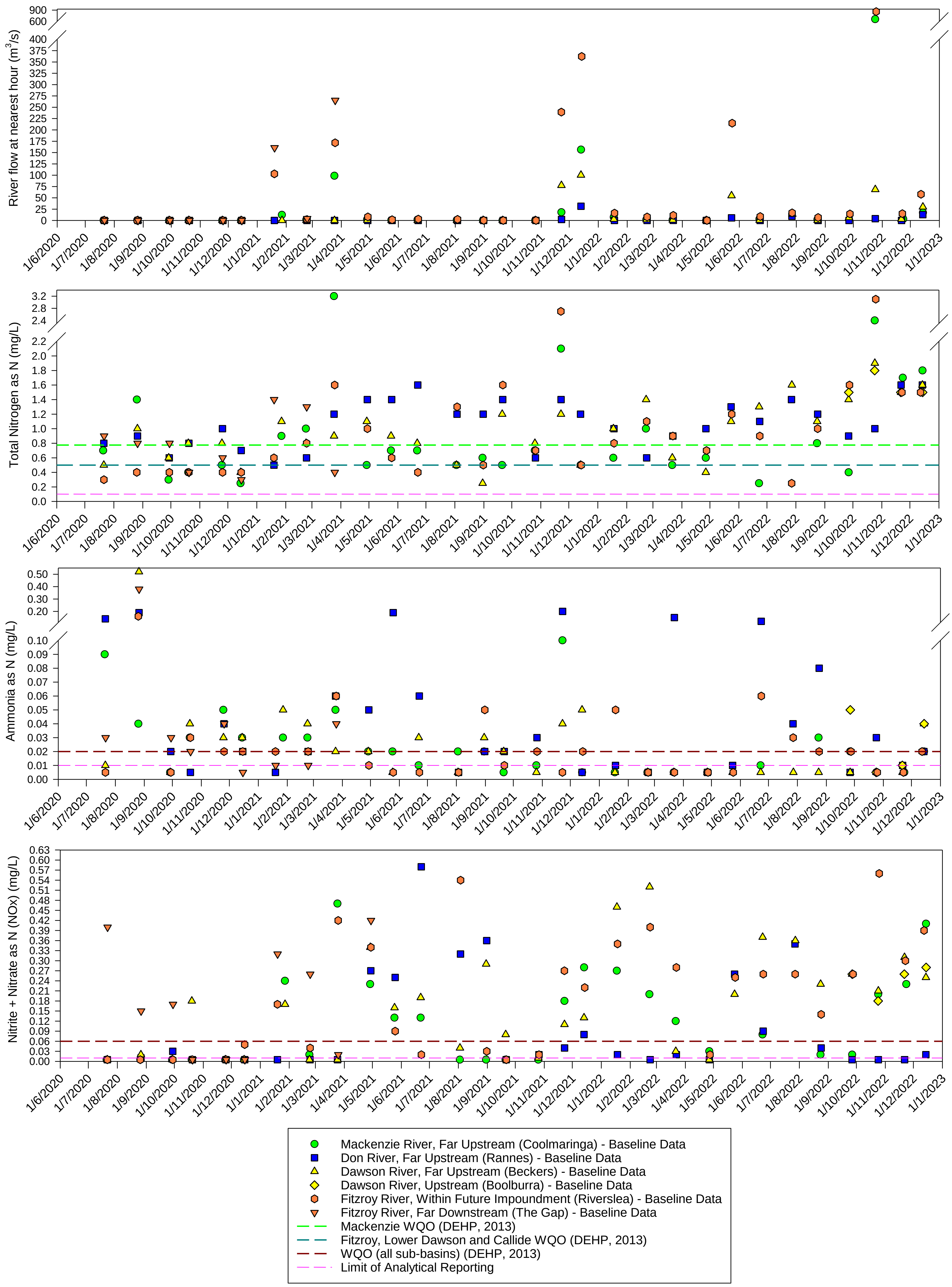
River flow at nearest hour (m³/s)
Sulfate (mg/L)
Chloride (mg/L)
Fluoride (mg/L)
1/6/2020
1/7/2020
1/8/2020
1/9/2020
1/10/2020
1/11/2020
1/12/2020
1/1/2021
1/2/2021
1/3/2021
1/4/2021
1/5/2021
1/6/2021
1/7/2021
1/8/2021
1/9/2021
1/10/2021
1/11/2021
1/12/2021
1/1/2022
1/2/2022
1/3/2022
1/4/2022
1/5/2022
1/6/2022
1/7/2022
1/8/2022
1/9/2022
1/10/2022
1/11/2022
1/12/2022
1/1/2023
Mackenzie River, Far Upstream (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverlea) - Baseline Data
Fitzroy River, Far Downstream (The Gap) - Baseline Data
Callide WQO (DEHP, 2013)
Lower Dawson WQO (DEHP, 2013)
Fitzroy WQO (DEHP, 2013)
Mackenzie WQO (DEHP, 2013)
Limit of Analytical Reporting

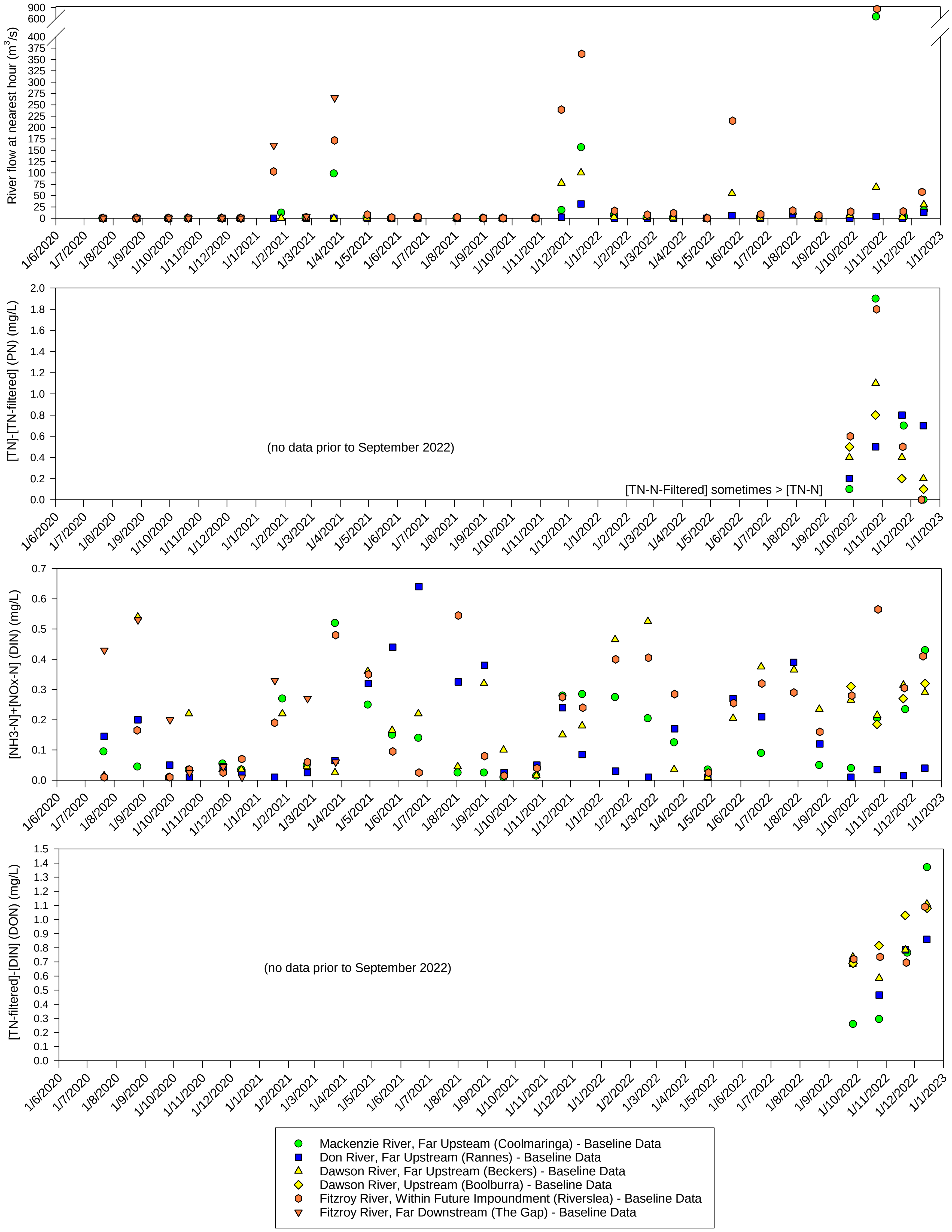

River flow at nearest hour (m^3/s)
Calcium (mg/L)
Magnesium (mg/L)
Potassium (mg/L)
Mackenzie River, Far Upsteam (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Far Downstream (The Gap) - Baseline Data

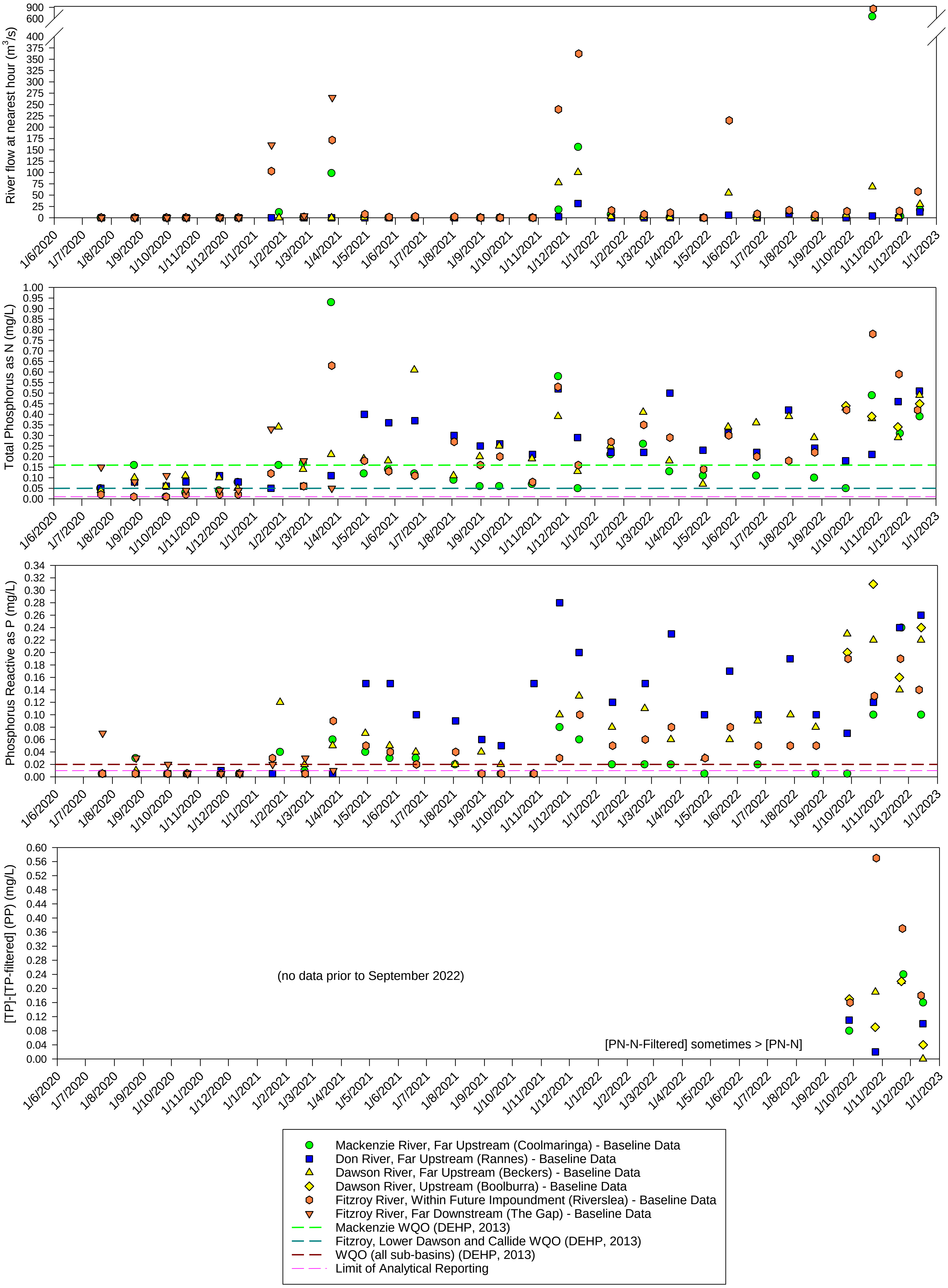

Mean hourly discharge (m³/s)
Sodium (mg/L)
Sodium Absorption Ratio
Alkalinity (total) (as CaCO₃) (mg/L)
1/6/2020
1/7/2020
1/8/2020
1/9/2020
1/10/2020
1/11/2020
1/12/2020
1/1/2021
1/2/2021
1/3/2021
1/4/2021
1/5/2021
1/6/2021
1/7/2021
1/8/2021
1/9/2021
1/10/2021
1/11/2021
1/12/2021
1/1/2022
1/2/2022
1/3/2022
1/4/2022
1/5/2022
1/6/2022
1/7/2022
1/8/2022
1/9/2022
1/10/2022
1/11/2022
1/12/2022
1/1/2023
Mackenzie River, Far Upsteam (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Downstream (The Gap) - Baseline Data


River flow at nearest hour (m^3/s)
Aluminium (filtered) (mg/L)
Copper (filtered) (mg/L)
Iron (filtered) (mg/L)
Mackenzie River, Far Upstream (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Downstream (The Gap) - Baseline Data
DGV (ANZG, 2018)
Limit of Analytical Reporting

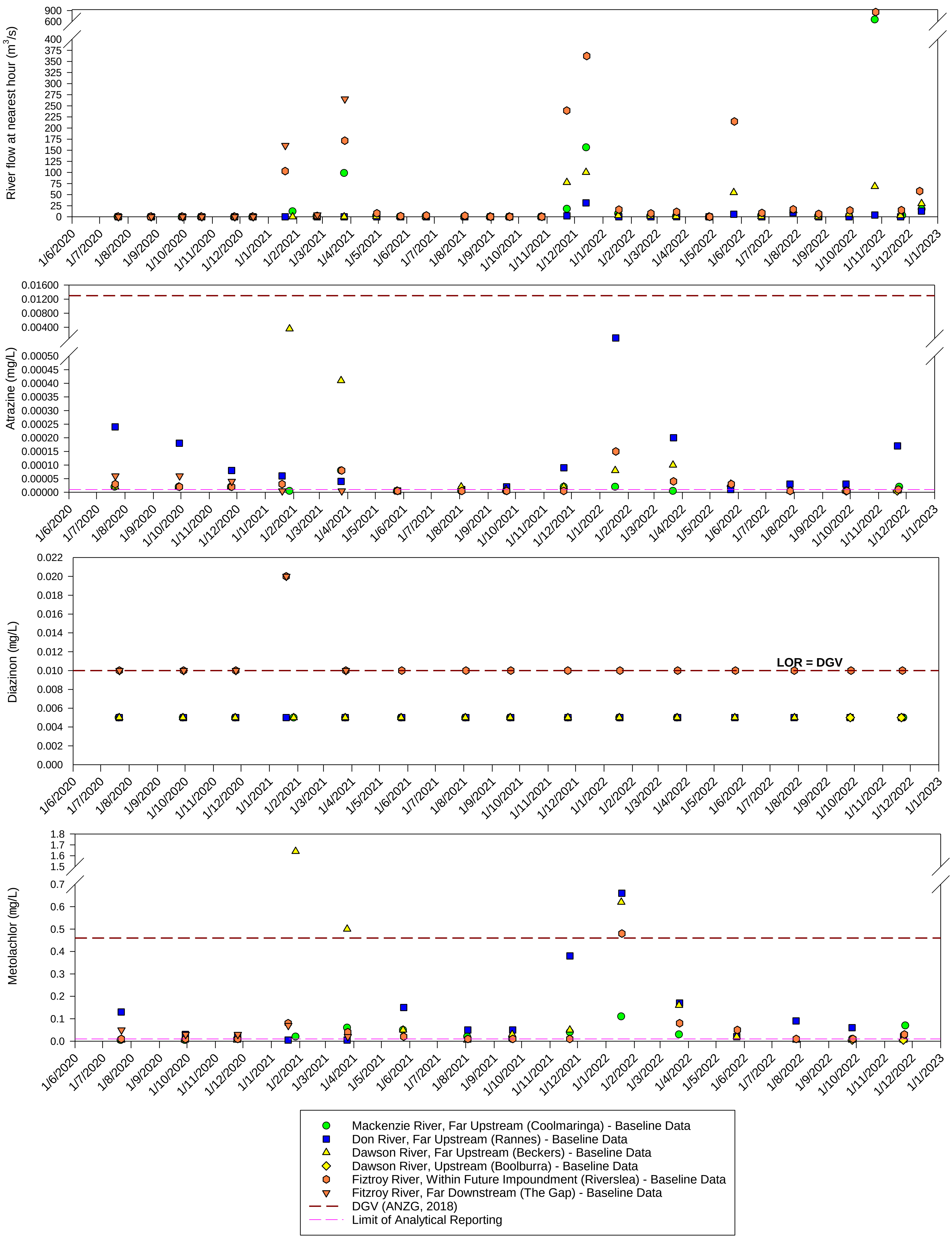

River flow at nearest hour (m3/s)
Manganese (filtered) (mg/L)
Zinc (filtered) (mg/L)
Chlorophyll-a (mg/L)
Mackenzie River, Far Upstream (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Far Downstream (The Gap) - Baseline Data
Metals DGV (ANZG, 2018); Chl-a WQO (DEHP, 2013)
Limit of Analytical Reporting

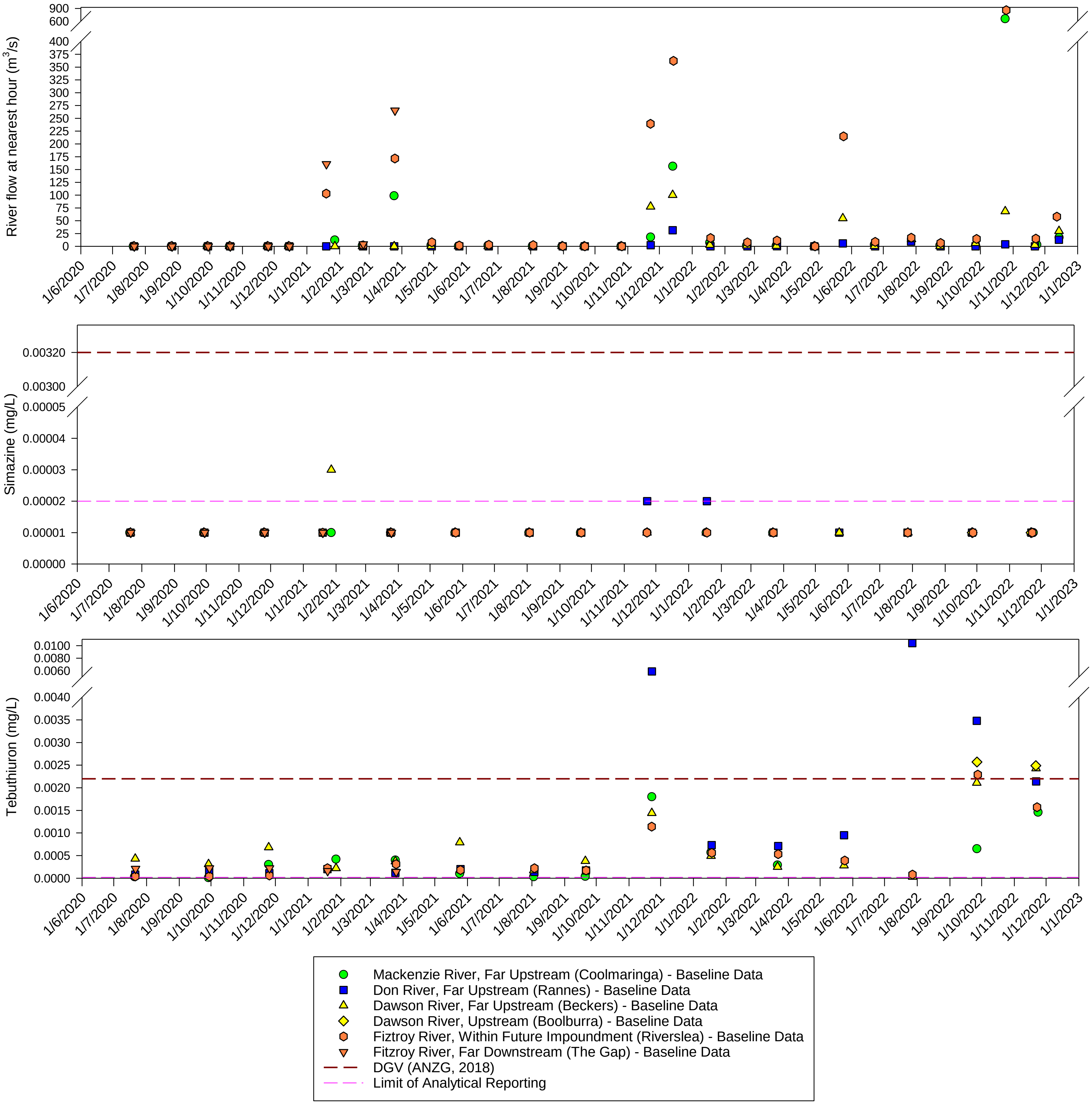

River flow at nearest hour (m^3/s)
Total Nitrogen as N (mg/L)
Ammonia as N (mg/L)
Nitrite + Nitrate as N (NOx) (mg/L)
Mackenzie River, Far Upstream (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Far Downstream (The Gap) - Baseline Data
Mackenzie WQO (DEHP, 2013)
Fitzroy, Lower Dawson and Callide WQO (DEHP, 2013)
WQO (all sub-basins) (DEHP, 2013)
Limit of Analytical Reporting


River flow at nearest hour (m3/s)
[TN]-[TN-filtered] (PN) (mg/L)
(no data prior to September 2022)
[TN-N-Filtered] sometimes > [TN-N]
[NH3-N]+[NOx-N] (DIN) (mg/L)
[TN-filtered]-[DIN] (DON) (mg/L)
(no data prior to September 2022)
Mackenzie River, Far Upsteam (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Far Downstream (The Gap) - Baseline Data



River flow at nearest hour (m³/s)
Total Phosphorus as N (mg/L)
Phosphorus Reactive as P (mg/L)
[TP]-[TP-filtered] (PP) (mg/L)
(no data prior to September 2022)
[PN-N-Filtered] sometimes > [PN-N]
Mackenzie River, Far Upstream (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Far Downstream (The Gap) - Baseline Data
Mackenzie WQO (DEHP, 2013)
Fitzroy, Lower Dawson and Callide WQO (DEHP, 2013)
WQO (all sub-basins) (DEHP, 2013)
Limit of Analytical Reporting


River flow at nearest hour (m³/s)
Atrazine (mg/L)
Diazinon (mg/L)
LOR = DGV
Metolachlor (mg/L)
Mackenzie River, Far Upstream (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fitzroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Far Downstream (The Gap) - Baseline Data
DGV (ANZG, 2018)
Limit of Analytical Reporting



River flow at nearest hour (m^3/s)
Simazine (mg/L)
Tebuthiuron (mg/L)
Mackenzie River, Far Upstream (Coolmaringa) - Baseline Data
Don River, Far Upstream (Rannes) - Baseline Data
Dawson River, Far Upstream (Beckers) - Baseline Data
Dawson River, Upstream (Boolburra) - Baseline Data
Fiztroy River, Within Future Impoundment (Riverslea) - Baseline Data
Fitzroy River, Far Downstream (The Gap) - Baseline Data
DGV (ANZG, 2018)
Limit of Analytical Reporting

Appendix 3 – Baseline Monitoring Data

Appendix 3 Descriptive statistics of baseline monitoring data summarised by catchment and by catchment-season.

This data represents the water quality monitoring undertaken by Sunwater between July 2020 and December 2022 and is the source of the pre-action baselines described in Table 13 of the program (with the exception of TSS and turbidity for the Fitzroy Sub-basin). For reference the columns in each table for Q1 and Q3 represent the 25^{th}%ile and 75^{th}%ile respectively. ‘Wet’ season data includes the months November to April and ‘Dry’ season data includes the months May to October.

Mackenzie Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Mackenzie River, Far Upstream of future inundation area (Coolmaringa) and Upstream of future inundation area (ApisCkRd), sampled during Jul 2020 to Dec 2022. **Baseline Condition - all time points**	n	Mean	Max	Min	Range	Std Deviation	Variance	RMS	Skewness	Kurtosis	Median	Q1 (25th%ile)	Q3 (75th%ile)
River flow at nearest hour to time sampled (m^3/s)	30	35	657	0.0	657	126	16001	129	4.8	24	1.4	0.2	4.3
Oxidation-Reduction Potential (in-situ) (mV)	29	122	278	55	223	45	2001	130	1.5	4.6	120	90	149
Water Temperature (in-situ) (°C)	30	26.4	32.2	19.7	12.5	3.6	13.1	26.6	-0.4	-1.0	26.8	23.1	29.3
Dissolved Oxygen (in-situ) (% Saturation) (85-110 %sat)	30	97	125	74	51	13	173	98	0.1	-0.9	98	86	107
Electrical Conductivity (in-situ) (µS/cm) (<310 or <210 µS/cm)	30	249	442	145	297	80	6356	261	1.0	0.5	226^	191	285
pH (in-situ) (6.5-8.5)	30	7.8	10.3	5.8	4.6	1.0	1.0	7.9	0.6	0.3	7.4	7.1	8.5
Turbidity (in-situ) (NTU) (50 NTU)	30	242	1211	3	1207	314	98496	392	1.9	3.1	142	48	259
Ammonia as N (mg/L) (<20 µg/L)	30	0.02	0.10	0.005	0.09	0.02	0.00	0.03	1.9	3.9	0.02	0.005	0.03
Chloride (mg/L)	30	25	54	8	46	12	150	28	0.8	-0.1	23	17	33
Chlorophyll a (mg/L) (<5.0 µg/L)	30	0.006	0.048	0.0005	0.047	0.009	0.000	0.011	4.1	19	0.004	0.002	0.008
Aluminium (filtered) (mg/L) (55 µg/L)	30	0.77	2.81	0.005	2.80	0.92	0.85	1.19	1.2	0.4	0.30	0.03	1.09
Copper (filtered) (mg/L) (1.4 µg/L)	30	0.003	0.008	0.0005	0.008	0.002	0.000	0.003	1.4	3.2	0.002	0.002	0.003
Iron (filtered) (mg/L)	30	0.46	1.42	0.025	1.39	0.45	0.21	0.64	0.9	-0.3	0.22	0.07	0.69
Manganese (filtered) (mg/L) (1900 µg/L)	30	0.013	0.076	0.0005	0.075	0.014	0.000	0.019	3.6	16	0.009	0.006	0.017
Zinc (filtered) (mg/L) (8 µg/L)	30	0.004	0.011	0.0025	0.009	0.002	0.000	0.004	2.1	3.3	0.0025	0.0025	0.0025
Hardness as $CaCO_3$ (mg/L)	30	59	85	32	53	15	231	60	0.2	-0.9	57	49	69
Calcium (filtered) (mg/L)	30	13	17	8	9	3	7	13	-0.3	-1.0	13	11	14
Magnesium (filtered) (mg/L)	30	7	11	3	8	2	5	7	0.6	-0.5	6	5	8
Potassium (filtered) (mg/L)	30	4	7	2	5	1	2	4	0.7	-0.2	4	3	4
Sodium (filtered) (mg/L)	30	21	34	11	23	7	43	22	0.7	-0.5	19	17	24
Sodium Absorption Ratio	30	1.2	1.9	0.6	1.2	0.3	0.1	1.2	0.5	1.1	1.1	1.1	1.3
Nitrate (as N) (mg/L)	30	0.12	0.47	0.005	0.47	0.13	0.02	0.18	1.1	0.4	0.05	0.005	0.21
Nitrite + Nitrate as N (NOx) (mg/L) (<60 µg/L)	30	0.12	0.47	0.005	0.47	0.13	0.02	0.18	1.1	0.5	0.05	0.005	0.21
Phosphorous Reactive as P (FRP) (mg/L) (<20 µg/L)	30	0.03	0.24	0.005	0.23	0.05	0.00	0.06	3.0	11.0	0.02	0.005	0.04
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (<10 mg/L)	30	5.2	11	3.0	8.0	2.4	5.6	5.7	1.1	0.1	4.5	3.0	7.0
Total Suspended Solids (Lab) (mg/L) (<110 mg/L)	29	132	1240	2.5	1238	265	70032	291	3.3	12	25	14	91
Kjeldahl Nitrogen Total (TKN) (mg/L)	30	0.81	2.70	0.25	2.45	0.62	0.39	1.02	1.7	2.5	0.60	0.40	0.85
Total Nitrogen as N (TN) (mg/L) (<775 µg/L)	30	0.91	3.20	0.25	2.95	0.71	0.51	1.15	1.8	3.1	0.65	0.50	1.00
Total Phosphorus as P (mg/L) (<160 µg/L)	30	0.18	0.93	0.01	0.92	0.20	0.04	0.27	2.4	6.6	0.11	0.06	0.18
Alkalinity (total) as $CaCO_3$ (mg/L)	30	61	81	43	38	12	142	62	0.0	-1.4	62	50	72
Fluoride (mg/L)	30	0.1	0.2	0.05	0.2	0.0	0.0	0.1	1.1	0.5	0.1	0.1	0.1
Total Nitrogen as N (filtered) (TDN) (mg/L)	6	0.90	1.80	0.30	1.50	0.67	0.45	1.07	1.0	0.1	0.75	0.45	1.20
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	30	0.14	0.52	0.01	0.51	0.13	0.02	0.19	1.2	1.0	0.09	0.04	0.24
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (<420 µg/L)	30	0.79	2.65	0.22	2.43	0.61	0.38	0.99	1.7	2.5	0.58	0.39	0.84
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	6	0.67	1.37	0.26	1.11	0.52	0.27	0.81	1.0	-0.3	0.53	0.29	0.92
[TKN] – [TKN-filtered] (mg/L)*	6	0.68	1.90	0.00	1.90	0.87	0.76	1.01	1.3	1.2	0.40	0.08	1.00
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	6	0.68	1.90	0.00	1.90	0.87	0.76	1.01	1.3	1.2	0.40	0.08	1.00
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	6	0.10	0.24	-0.06	0.30	0.13	0.02	0.15	-0.6	0.0	0.12	0.04	0.18

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. ^Value > WQO for EC during high flow (although not all samples collected during high flow). Values in orange font are outside usual range for this system (note, corresponding lab pH values were 7.4 and 7.9, respectively). Red font indicates [TP-filtered] > [Total P]. *LOR for calculated values is unknown.

Mackenzie Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Mackenzie River, Far Upstream of future inundation area (Coolmaringa) and Upstream of future inundation area (ApisCkRd), sampled during Jul 2020 to Dec 2022. **Baseline Condition – Wet Season time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25th%ile)**	**Q3 (75th%ile)**
River flow at nearest hour to time sampled (m^3/s)	14	23	156	0.0	156	46	2132	50	2.5	6	2.8	1.3	16.1
Oxidation-Reduction Potential (in-situ) (mV)	13	120	162	83	79	27	705	122	0.1	-1.3	120	105	140
Water Temperature (in-situ) (°C)	14	28.3	32.2	22.0	10.2	2.7	7.2	28.4	-1.0	1.1	29.3	26.8	29.7
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	14	92	125	74	51	13	173	93	1.2	2.1	89	85	95
Electrical Conductivity (in-situ) (µS/cm) (<310 or <210 µS/cm)	14	244	442	145	297	91	8209	259	1.1	0.0	204	186	318
pH (in-situ) (WQO, 6.5-8.5)	14	7.5	8.8	6.5	2.3	0.7	0.5	7.5	0.6	-0.3	7.3	7.1	7.9
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	14	387	1211	5	1206	372	138022	527	1.2	0.6	222	162	526
Ammonia as N (mg/L) (WQO, <20 µg/L)	14	0.03	0.10	0.005	0.09	0.03	0.00	0.04	1.8	3.7	0.02	0.005	0.03
Chloride (mg/L)	14	23	54	8	46	15	234	28	1.2	0.0	18	13	25
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	14	0.008	0.048	0.0005	0.047	0.012	0.000	0.014	3.1	11	0.004	0.002	0.010
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	14	0.63	2.81	0.02	2.79	0.83	0.69	1.02	1.9	3.0	0.30	0.09	0.77
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	14	0.003	0.006	0.0005	0.005	0.001	0.000	0.003	0.2	0.8	0.003	0.002	0.004
Iron (filtered) (mg/L) (proposed DGV under consideration)	14	0.36	1.42	0.025	1.39	0.41	0.17	0.53	1.7	2.4	0.20	0.10	0.50
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	14	0.011	0.025	0.0005	0.025	0.008	0.000	0.014	0.3	-2	0.010	0.004	0.018
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	14	0.003	0.008	0.0025	0.006	0.001	0.000	0.003	3.7	14.0	0.0025	0.0025	0.0025
Hardness as $CaCO_3$ (mg/L)	14	58	85	32	53	17	283	60	0.2	-1.0	57	46	71
Calcium (filtered) (mg/L)	14	13	16	8	8	3	8	13	-0.4	-1.1	14	11	15
Magnesium (filtered) (mg/L)	14	6	11	3	8	3	7	7	0.8	-0.4	6	4	8
Potassium (filtered) (mg/L)	14	5	7	3	4	1	1	5	0.9	0.2	4	4	5
Sodium (filtered) (mg/L)	14	20	34	11	23	8	58	21	1.0	-0.3	18	15	23
Sodium Absorption Ratio	14	1.1	1.6	0.6	1.0	0.3	0.1	1.2	0.4	0.1	1.1	1.0	1.2
Nitrate (as N) (mg/L)	14	0.19	0.47	0.005	0.47	0.14	0.02	0.24	0.3	-0.5	0.22	0.05	0.26
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	14	0.19	0.47	0.005	0.47	0.15	0.02	0.24	0.3	-0.5	0.22	0.05	0.26
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	14	0.05	0.24	0.005	0.23	0.06	0.00	0.08	2.4	6.9	0.03	0.01	0.06
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <10 mg/L)	14	5.2	10	3.0	7.0	2.2	5.0	5.6	0.8	-0.3	4.5	3.3	7.0
Total Suspended Solids (Lab) (mg/L) (WQO, <110 mg/L)	14	194	1240	9.0	1231	322	103451	366	3.0	10	85	31	164
Kjeldahl Nitrogen Total (TKN) (mg/L)	14	0.92	2.70	0.25	2.45	0.72	0.52	1.15	1.4	1.6	0.65	0.43	1.30
Total Nitrogen as N (TN) (mg/L) (WQO, <775 µg/L)	14	1.08	3.20	0.25	2.95	0.83	0.69	1.35	1.5	2.0	0.75	0.50	1.53
Total Phosphorus as P (mg/L) (WQO, <160 µg/L)	14	0.25	0.93	0.04	0.89	0.24	0.06	0.35	2.0	4.0	0.16	0.11	0.30
Alkalinity (total) as $CaCO_3$ (mg/L)	14	64	81	43	38	12	138	65	-0.5	-1.0	67	54	73
Fluoride (mg/L)	14	0.1	0.2	0.05	0.2	0.1	0.0	0.1	0.3	-1.5	0.1	0.1	0.2
Total Nitrogen as N (filtered) (TDN) (mg/L)	2	1.40	1.80	1.00	0.80	*0.57*	*0.32*	*1.46*	*0.0*	*0.0*	*1.40*	*1.20*	*1.60*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	14	0.22	0.52	0.04	0.48	0.15	0.02	0.26	0.4	-0.2	0.24	0.07	0.28
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	14	0.89	2.65	0.22	2.43	0.70	0.50	1.12	1.4	1.6	0.63	0.41	1.28
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	2	1.07	1.37	0.76	0.61	*0.43*	*0.18*	*1.11*	*0.0*	*0.0*	*1.07*	*0.92*	*1.22*
[TKN] – [TKN-filtered] (mg/L)*	2	0.35	0.70	0.00	0.70	*0.49*	*0.24*	*0.49*	*0.0*	*0.0*	*0.35*	*0.17*	*0.52*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	2	0.35	0.70	0.00	0.70	*0.49*	*0.24*	*0.49*	*0.0*	*0.0*	*0.35*	*0.17*	*0.52*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	2	0.20	0.24	0.16	0.08	*0.06*	*0.00*	*0.20*	*0.0*	*0.0*	*0.20*	*0.18*	*0.22*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Italic font indicates there were only 2 data points and results of statistical tests are not valid. * LOR for calculated values is unknown.

Mackenzie Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Mackenzie River, Far Upstream of future inundation area (Coolmaringa) and Upstream of future inundation area (ApisCkRd), sampled during Jul 2020 to Dec 2022. **Baseline Condition – Dry Season time points**	n	Mean	Max	Min	Range	Std Deviation	Variance	RMS	Skewness	Kurtosis	Median	Q1 (25th%ile)	Q3 (75th%ile)
River flow at nearest hour to time sampled (m^3/s)	16	48	657	0.0	657	175	30769	176	3.7	14	0.5	0.1	1.7
Oxidation-Reduction Potential (in-situ) (mV)	16	124	278	55	223	58	3342	136	1.4	3.0	116	89	149
Water Temperature (in-situ) (°C)	16	24.5	31.1	19.7	11.4	3.5	12.1	24.7	0.3	-0.9	24.3	21.6	27.1
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	16	103	117	81	36	11	122	103	-1.1	0.0	106	102	109
Electrical Conductivity (in-situ) (µS/cm) (<310 or <210 µS/cm)	16	255	440	158	282	70	4931	264	1.2	3.0	250	223	282
pH (in-situ) (WQO, 6.5-8.5)	16	8.1	10.3	5.8	4.6	1.2	1.5	8.2	0.1	-0.2	8.1	7.2	8.9
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	16	97	575	3	572	146	21176	170	3.1	10.5	51	32	105
Ammonia as N (mg/L) (WQO, <20 µg/L)	16	0.02	0.09	0.005	0.09	0.02	0.00	0.03	2.4	6.9	0.02	0.010	0.03
Chloride (mg/L)	16	28	43	16	27	8	69	29	0.5	-0.9	26	21	34
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	16	0.004	0.011	0.0005	0.010	0.003	0.000	0.005	0.8	-0.1	0.004	0.002	0.006
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	16	0.91	2.80	0.005	2.79	1.01	1.03	1.34	0.9	-0.4	0.62	0.02	1.44
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	16	0.002	0.008	0.0005	0.008	0.002	0.000	0.003	2.3	6.5	0.002	0.001	0.003
Iron (filtered) (mg/L) (proposed DGV under consideration)	16	0.55	1.41	0.025	1.38	0.49	0.24	0.73	0.4	-1.0	0.60	0.05	0.81
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	16	0.015	0.076	0.005	0.071	0.018	0.000	0.023	3.4	12	0.009	0.007	0.012
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	16	0.004	0.011	0.0025	0.009	0.003	0.000	0.005	1.4	0.9	0.0025	0.0025	0.006
Hardness as $CaCO_3$ (mg/L)	16	59	81	36	45	14	197	61	0.2	-0.8	58	50	67
Calcium (filtered) (mg/L)	16	13	17	8	9	3	7	13	-0.2	-0.7	13	11	14
Magnesium (filtered) (mg/L)	16	7	10	4	6	2	4	7	0.6	-0.6	6	5	8
Potassium (filtered) (mg/L)	16	3	6	2	4	1	1	3	1.7	2.7	3	2	3
Sodium (filtered) (mg/L)	16	22	34	15	19	5	30	23	0.8	0.0	21	18	25
Sodium Absorption Ratio	16	1.3	1.9	1.0	0.9	0.2	0.0	1.3	1.7	4.3	1.2	1.1	1.3
Nitrate (as N) (mg/L)	16	0.04	0.20	0.005	0.20	0.06	0.00	0.08	1.5	1.3	0.005	0.005	0.06
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	16	0.04	0.20	0.005	0.20	0.06	0.00	0.08	1.5	1.3	0.005	0.005	0.06
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	16	0.02	0.10	0.005	0.09	0.03	0.00	0.03	2.7	8.4	0.005	0.005	0.03
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <10 mg/L)	16	5.2	11	3.0	8.0	2.6	6.6	5.8	1.3	0.7	4.5	3.3	5.0
Total Suspended Solids (Lab) (mg/L) (WQO, <110 mg/L)	15	66	643	2.5	641	174	30407	180	3.5	13	15	8	24
Kjeldahl Nitrogen Total (TKN) (mg/L)	16	0.71	2.20	0.25	1.95	0.51	0.26	0.86	2.3	5.5	0.60	0.43	0.70
Total Nitrogen as N (TN) (mg/L) (WQO, <775 µg/L)	16	0.74	2.40	0.25	2.15	0.55	0.31	0.91	2.4	6.4	0.65	0.43	0.70
Total Phosphorus as P (mg/L) (WQO, <160 µg/L)	16	0.11	0.49	0.01	0.48	0.12	0.01	0.16	2.9	9.8	0.08	0.05	0.12
Alkalinity (total) as $CaCO_3$ (mg/L)	16	58	79	44	35	12	137	59	0.6	-1.1	54	50	68
Fluoride (mg/L)	16	0.1	0.1	0.05	0.1	0.0	0.0	0.1	-2.3	3.8	0.1	0.1	0.1
Total Nitrogen as N (filtered) (TDN) (mg/L)	4	0.40	0.50	0.30	0.20	*0.14*	*0.02*	*0.41*	*0.0*	*0.0*	*0.40*	*0.35*	*0.45*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	16	0.07	0.20	0.01	0.19	0.06	0.00	0.09	1.2	0.5	0.04	0.03	0.09
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	16	0.69	2.19	0.24	1.95	0.51	0.26	0.85	2.3	5.9	0.58	0.41	0.67
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	4	0.28	0.29	0.26	0.03	*0.02*	*0.00*	*0.28*	*0.0*	*0.0*	*0.28*	*0.27*	*0.29*
[TKN] – [TKN-filtered] (mg/L)*	4	1.00	1.90	0.10	1.80	*1.27*	*1.62*	*1.35*	*0.0*	*0.0*	*1.00*	*0.55*	*1.45*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	4	1.00	1.90	0.10	1.80	*1.27*	*1.62*	*1.35*	*0.0*	*0.0*	*1.00*	*0.55*	*1.45*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	4	0.01	0.08	-0.06	0.14	*0.10*	*0.01*	*0.07*	*0.0*	*0.0*	*0.01*	*-0.02*	*0.04*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. ^Value > WQO for EC during high flow (although not all samples collected during high flow). Red font indicates [TP-filtered] > [Total P]. Italic font indicates there were only 4 data points and results of statistical tests may not be valid. * LOR for calculated values is unknown.

Callide Catchment: Phys-Chem WQ, Summary Statistics Sites = Don River, Far Upstream of future inundation area (Rannes), sampled during Jul 2020 to Dec 2022. **Baseline Condition - all time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25th%ile)**	**Q3 (75th%ile)**
River flow at nearest hour to time sampled (m^3/s)	30	2	31	0.0	31	6	40	7	3.9	17	0.0	0.0	0.1
Oxidation-Reduction Potential (in-situ) (mV)	30	126	211	61	150	37	1367	131	0.1	-0.3	127	109	147
Water Temperature (in-situ) (°C)	30	22.5	31.7	13.8	17.9	5.7	32.6	23.2	-0.2	-1.3	23.3	17.1	27.4
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	30	73	122	31	91	19	373	75	0.1	0.3	77	59	83
Electrical Conductivity (in-situ) (µS/cm) (<1150 or <600 µS/cm)	30	339	501	125	376	101	10135	353	-0.3	-1.0	356	257	420
pH (in-situ) (WQO, 6.5-8.5)	30	7.6	9.2	6.6	2.6	0.7	0.4	7.6	1.0	0.5	7.5	7.1	8.0
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	30	78	258	4	254	76	5722	108	1.1	0.2	46	20	120
Ammonia as N (mg/L) (WQO, <20 µg/L)	30	0.05	0.20	0.005	0.20	0.06	0.00	0.08	1.4	0.8	0.02	0.01	0.06
Chloride (mg/L)	30	48	86	18	68	21	424	52	0.2	-1.1	52	27	61
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	30	0.013	0.106	0.0005	0.105	0.021	0.000	0.025	3.5	13	0.008	0.004	0.010
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	30	0.58	4.31	0.005	4.30	0.96	0.92	1.11	2.7	8.2	0.18	0.01	0.83
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	30	0.004	0.009	0.0005	0.008	0.003	0.000	0.005	0.3	-0.9	0.004	0.001	0.005
Iron (filtered) (mg/L) (proposed DGV under consideration)	30	0.47	2.36	0.025	2.33	0.59	0.34	0.74	1.8	3.2	0.21	0.025	0.65
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	30	0.211	0.917	0.008	0.909	0.251	0.063	0.324	1.6	2	0.104	0.038	0.294
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	30	0.003	0.009	0.0025	0.006	0.002	0.000	0.003	2.6	7.0	0.0025	0.0025	0.0025
Hardness as $CaCO_3$ (mg/L)	30	103	165	63	102	31	961	107	0.7	-0.6	94	78	129
Calcium (filtered) (mg/L)	30	20	33	12	21	6	33	21	0.9	0.0	20	15	24
Magnesium (filtered) (mg/L)	30	13	21	8	13	4	17	13	0.6	-1.0	12	9	17
Potassium (filtered) (mg/L)	30	6	8	5	3	1	1	6	0.6	-0.7	6	5	7
Sodium (filtered) (mg/L)	30	35	60	20	40	10	105	36	0.8	0.1	35	25	40
Sodium Absorption Ratio	30	1.5	2.6	1.0	1.6	0.4	0.2	1.6	1.4	0.9	1.3	1.3	1.5
Nitrate (as N) (mg/L)	30	0.09	0.58	0.005	0.57	0.15	0.02	0.17	1.8	2.7	0.02	0.005	0.07
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	30	0.09	0.58	0.005	0.57	0.15	0.02	0.17	1.8	2.7	0.02	0.005	0.09
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	30	0.10	0.28	0.005	0.28	0.09	0.01	0.13	0.4	-0.8	0.10	0.006	0.15
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <20 mg/L)	30	10.9	43	4.0	39.0	7.7	58.5	13.2	2.8	10.4	9	6.3	13.0
Total Suspended Solids (Lab) (mg/L) (WQO, <30 mg/L)	30	28	138	2.5	136	25	640	37	3.2	12	22	16	31
Kjeldahl Nitrogen Total (TKN) (mg/L)	30	0.98	1.60	0.50	1.10	0.28	0.08	1.02	0.4	0.0	1.00	0.80	1.10
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	30	1.07	1.60	0.50	1.10	0.33	0.11	1.12	-0.1	-1.0	1.05	0.82	1.38
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	30	0.25	0.52	0.05	0.47	0.15	0.02	0.28	0.4	-0.8	0.22	0.11	0.35
Alkalinity (total) as $CaCO_3$ (mg/L)	30	96	142	54	88	24	554	99	0.3	-0.7	90	81	113
Fluoride (mg/L)	30	0.2	0.2	0.1	0.1	0.1	0.0	0.2	-0.3	-2.1	0.2	0.1	0.2
Total Nitrogen as N (filtered) (TDN) (mg/L)	4	0.73	0.90	0.50	*0.40*	*0.17*	*0.03*	*0.74*	*-0.8*	*0.3*	*0.75*	*0.65*	*0.82*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	30	0.15	0.64	0.01	0.63	0.16	0.03	0.22	1.4	1.4	0.06	0.03	0.23
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	30	0.93	1.59	0.50	1.10	0.28	0.08	0.97	0.7	0.4	0.95	0.72	1.06
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	4	0.70	0.86	0.47	*0.40*	*0.17*	*0.03*	*0.72*	*-1.1*	*1.0*	*0.74*	*0.63*	*0.80*
[TKN] – [TKN-filtered] (mg/L)*	4	0.55	0.80	0.20	*0.60*	*0.26*	*0.07*	*0.60*	*-0.9*	*-0.3*	*0.60*	*0.43*	*0.73*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	4	0.55	0.80	0.20	*0.60*	*0.26*	*0.07*	*0.60*	*-0.9*	*-0.3*	*0.60*	*0.43*	*0.73*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	4	0.04	0.11	-0.06	*0.17*	*0.08*	*0.01*	*0.08*	*-0.8*	*-1.5*	*0.06*	*0.00*	*0.10*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Red font indicates [TP-filtered] > [Total P]. Italic font indicates there were only 4 data points and results of statistical tests may not be valid. *LOR for calculated values is unknown.

Callide Catchment: Phys-Chem WQ, Summary Statistics Sites = Don River, Far Upstream of future inundation area (Rannes), sampled during Jul 2020 to Dec 2022. **Baseline Condition – Wet Season time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25^{th}%ile)**	**Q3 (75^{th}%ile)**
River flow at nearest hour to time sampled (m^3/s)	14	3	31	0.0	31	9	77	9	3.0	9	0.0	0.0	0.3
Oxidation-Reduction Potential (in-situ) (mV)	14	121	168	68	100	25	638	124	-0.4	0.9	121	112	134
Water Temperature (in-situ) (°C)	14	27.0	31.7	21.0	10.7	2.9	8.7	27.2	-0.5	0.1	27.3	25.5	28.7
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	14	66	122	31	91	23	530	70	1.2	1.7	60	56	71
Electrical Conductivity (in-situ) (µS/cm) (<1150 or <600 µS/cm)	14	366	453	223	230	78	6118	374	-0.7	-1.1	400	296	420
pH (in-situ) (WQO, 6.5-8.5)	14	7.4	8.2	6.6	1.6	0.4	0.2	7.4	0.1	-0.2	7.5	7.1	7.7
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	14	58	208	4	204	66	4407	86	1.6	1.1	31	20	52
Ammonia as N (mg/L) (WQO, <20 µg/L)	14	0.04	0.20	0.005	0.20	0.06	0.00	0.07	2.0	3.5	0.02	0.01	0.05
Chloride (mg/L)	14	44	61	18	43	15	214	46	-0.6	-1.1	47	31	56
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	14	0.013	0.060	0.003	0.057	0.015	0.000	0.019	3.0	10	0.009	0.005	0.011
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	14	0.28	1.40	0.005	1.39	0.43	0.19	0.50	1.8	2.4	0.06	0.005	0.28
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	14	0.004	0.009	0.0005	0.008	0.003	0.000	0.005	0.2	-1.8	0.004	0.001	0.008
Iron (filtered) (mg/L) (proposed DGV under consideration)	14	0.34	1.33	0.025	1.31	0.43	0.19	0.54	1.3	0.7	0.08	0.025	0.58
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	14	0.142	0.644	0.010	0.634	0.191	0.037	0.233	2.0	3	0.066	0.038	0.122
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	14	0.004	0.009	0.0025	0.006	0.002	0.000	0.004	1.9	3.5	0.0025	0.0025	0.004
Hardness as $CaCO_3$ (mg/L)	14	103	132	70	62	23	537	106	-0.1	-1.5	101	87	129
Calcium (filtered) (mg/L)	14	20	25	15	10	4	13	20	-0.1	-1.3	20	17	24
Magnesium (filtered) (mg/L)	14	13	18	8	10	4	13	13	0.1	-1.5	12	11	17
Potassium (filtered) (mg/L)	14	6	8	5	3	1	1	6	0.4	-1.4	6	5	8
Sodium (filtered) (mg/L)	14	32	44	20	24	7	46	32	-0.4	-0.4	34	26	36
Sodium Absorption Ratio	14	1.4	2.0	1.0	1.0	0.2	0.1	1.4	1.0	1.6	1.3	1.2	1.5
Nitrate (as N) (mg/L)	14	0.03	0.27	0.005	0.27	0.07	0.01	0.08	3.3	11.3	0.005	0.005	0.02
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	14	0.04	0.27	0.005	0.27	0.07	0.01	0.08	3.2	11.1	0.005	0.005	0.02
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	14	0.13	0.28	0.005	0.28	0.11	0.01	0.16	0.0	-1.6	0.14	0.006	0.22
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <20 mg/L)	14	7.9	19	4.0	15.0	4.4	19.3	9.0	1.5	2.0	6.5	4.5	8.8
Total Suspended Solids (Lab) (mg/L) (WQO, <30 mg/L)	14	29	47	8.0	39	12	153	31	0.0	-1	27	23	41
Kjeldahl Nitrogen Total (TKN) (mg/L)	14	1.02	1.60	0.50	1.10	0.35	0.12	1.08	0.3	-0.7	1.00	0.75	1.18
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	14	1.05	1.60	0.50	1.10	0.37	0.14	1.11	0.1	-1.1	1.00	0.75	1.35
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	14	0.27	0.52	0.05	0.47	0.18	0.03	0.32	0.3	-1.6	0.22	0.11	0.44
Alkalinity (total) as $CaCO_3$ (mg/L)	14	101	122	76	46	17	282	103	-0.4	-1.5	107	83	113
Fluoride (mg/L)	14	0.2	0.2	0.1	0.1	0.1	0.0	0.2	-0.3	-2.2	0.2	0.1	0.2
Total Nitrogen as N (filtered) (TDN) (mg/L)	2	0.85	0.90	0.80	0.10	*0.07*	*0.00*	*0.85*	*0.0*	*0.0*	*0.85*	*0.82*	*0.88*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	14	0.08	0.32	0.01	0.31	0.10	0.01	0.12	1.7	2.2	0.04	0.02	0.08
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	14	0.98	1.59	0.50	1.10	0.34	0.12	1.03	0.4	-0.3	0.99	0.70	1.13
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	2	0.82	0.86	0.79	0.07	*0.05*	*0.00*	*0.82*	*0.0*	*0.0*	*0.82*	*0.80*	*0.84*
[TKN] – [TKN-filtered] (mg/L)*	2	0.75	0.80	0.70	0.10	*0.07*	*0.01*	*0.75*	*0.0*	*0.0*	*0.75*	*0.73*	*0.77*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	2	0.75	0.80	0.70	0.10	*0.07*	*0.01*	*0.75*	*0.0*	*0.0*	*0.75*	*0.73*	*0.77*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	2	0.02	0.10	-0.06	0.16	*0.11*	*0.01*	*0.08*	*0.0*	*0.0*	*0.02*	*-0.02*	*0.06*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Red font indicates [TP-filtered] > [Total P]. Italic font indicates there were only 2 data points and results of statistical tests are not valid. * LOR for calculated values is unknown.

Callide Catchment: Phys-Chem WQ, Summary Statistics Sites = Don River, Far Upstream of future inundation area (Rannes), sampled during Jul 2020 to Dec 2022. **Baseline Condition – Dry Season time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25th%ile)**	**Q3 (75th%ile)**
River flow at nearest hour to time sampled (m^3/s)	16	1	9	0.0	9	3	8	3	2.3	5	0.0	0.0	0.0
Oxidation-Reduction Potential (in-situ) (mV)	16	129	211	61	150	45	2057	137	0.0	-1.1	135	84	167
Water Temperature (in-situ) (°C)	16	18.6	28.6	13.8	14.8	4.5	20.3	19.1	0.7	-0.3	17.7	14.6	21.3
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	16	78	98	44	54	14	188	80	-1.2	1.8	82	77	83
Electrical Conductivity (in-situ) (µS/cm) (<1150 or <600 µS/cm)	16	314	501	125	376	114	12935	333	0.1	-1.1	314	213	399
pH (in-situ) (WQO, 6.5-8.5)	16	7.7	9.2	6.8	2.5	0.8	0.6	7.8	0.7	-0.7	7.4	7.1	8.3
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	16	96	258	8	249	81	6536	124	0.9	0.0	81	38	139
Ammonia as N (mg/L) (WQO, <20 µg/L)	16	0.06	0.19	0.005	0.19	0.06	0.00	0.09	1.2	0.1	0.03	0.02	0.09
Chloride (mg/L)	16	52	86	23	63	25	601	57	0.0	-1.8	59	27	75
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	16	0.013	0.106	0.0005	0.105	0.026	0.001	0.029	3.3	11	0.005	0.002	0.009
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	16	0.85	4.31	0.005	4.30	1.21	1.46	1.45	2.1	4.2	0.45	0.05	0.98
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	16	0.004	0.007	0.0005	0.007	0.002	0.000	0.004	-0.3	-0.6	0.004	0.002	0.005
Iron (filtered) (mg/L) (proposed DGV under consideration)	16	0.58	2.36	0.025	2.33	0.69	0.47	0.88	1.7	2.4	0.38	0.08	0.71
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	16	0.271	0.917	0.008	0.909	0.286	0.082	0.387	1.3	1	0.192	0.062	0.314
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	16	0.003	0.005	0.0025	0.002	0.001	0.000	0.003	2.5	4.9	0.0025	0.0025	0.0025
Hardness as $CaCO_3$ (mg/L)	16	102	165	63	102	37	1391	108	0.9	-0.9	86	74	125
Calcium (filtered) (mg/L)	16	20	33	12	21	7	52	21	1.0	-0.6	17	15	23
Magnesium (filtered) (mg/L)	16	13	21	8	13	5	23	14	0.8	-1.1	11	9	17
Potassium (filtered) (mg/L)	16	6	7	5	2	1	1	6	0.4	-1.4	6	5	6
Sodium (filtered) (mg/L)	16	37	60	24	36	12	149	39	0.5	-1.1	38	25	44
Sodium Absorption Ratio	16	1.6	2.6	1.2	1.3	0.5	0.3	1.7	1.0	-0.9	1.3	1.3	2.2
Nitrate (as N) (mg/L)	16	0.14	0.58	0.005	0.57	0.18	0.03	0.23	1.1	0.3	0.03	0.005	0.27
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	16	0.15	0.58	0.005	0.57	0.18	0.03	0.23	1.1	0.3	0.04	0.005	0.27
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	16	0.09	0.19	0.005	0.19	0.06	0.00	0.10	0.1	-1.0	0.09	0.039	0.13
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <20 mg/L)	16	13.4	43	6.0	37.0	9.0	81.3	16.0	2.7	8.1	11	8.8	13.5
Total Suspended Solids (Lab) (mg/L) (WQO, <30 mg/L)	16	27	138	2.5	136	33	1104	42	3.0	9	18	13	21
Kjeldahl Nitrogen Total (TKN) (mg/L)	16	0.95	1.40	0.60	0.80	0.21	0.05	0.97	0.2	0.2	0.95	0.80	1.02
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	16	1.09	1.60	0.60	1.00	0.30	0.09	1.13	-0.1	-0.9	1.15	0.88	1.32
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	16	0.22	0.42	0.05	0.37	0.11	0.01	0.25	-0.1	-0.8	0.23	0.16	0.30
Alkalinity (total) as $CaCO_3$ (mg/L)	16	92	142	54	88	28	785	96	0.7	-0.5	87	76	100
Fluoride (mg/L)	16	0.2	0.2	0.1	0.1	0.1	0.0	0.2	-0.3	-2.2	0.2	0.1	0.2
Total Nitrogen as N (filtered) (TDN) (mg/L)	2	0.60	0.70	0.50	0.20	*0.14*	*0.02*	*0.61*	*0.0*	*0.0*	*0.60*	*0.55*	*0.65*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	16	0.21	0.64	0.01	0.63	0.19	0.03	0.27	0.9	0.1	0.17	0.05	0.34
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	16	0.89	1.38	0.57	0.81	0.21	0.04	0.91	0.5	0.7	0.89	0.76	1.00
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	2	0.58	0.69	0.47	0.22	*0.16*	*0.03*	*0.59*	*0.0*	*0.0*	*0.58*	*0.52*	*0.63*
[TKN] – [TKN-filtered] (mg/L)*	2	0.35	0.50	0.20	0.30	*0.21*	*0.04*	*0.38*	*0.0*	*0.0*	*0.35*	*0.28*	*0.43*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	2	0.35	0.50	0.20	0.30	*0.21*	*0.04*	*0.38*	*0.0*	*0.0*	*0.35*	*0.28*	*0.43*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	2	0.06	0.11	0.02	0.09	*0.06*	*0.00*	*0.08*	*0.0*	*0.0*	*0.06*	*0.04*	*0.09*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Italic font indicates there were only 2 data points and results of statistical tests are not valid. * LOR for calculated values is unknown.

Lower Dawson Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Dawson River, Far Upstream of future inundation area (Beckers), sampled during Jul 2020 to Dec 2022 & Dawson River, Upstream of future inundation area (Boolburra and Baralaba), sampled during Sep 2022 to Dec 2022. **Baseline Condition - all time points**	n	Mean	Max	Min	Range	Std Deviation	Variance	RMS	Skewness	Kurtosis	Median	Q1 (25th%ile)	Q3 (75th%ile)
River flow at nearest hour to time sampled (m^3/s)	30	12	100	0.0	100	27	708	29	2.3	5	0.3	0.0	2.9
Oxidation-Reduction Potential (in-situ) (mV)	34	123	225	71	154	35	1253	127	0.6	0.6	124	94	141
Water Temperature (in-situ) (°C)	33	24.9	32.4	12.3	20.1	5.0	24.6	25.3	-0.7	0.3	25.2	22.2	29.2
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	34	95	121	74	47	9	82	96	0.0	1.6	95	91	101
Electrical Conductivity (in-situ) (µS/cm) (<340 or <210 µS/cm)	34	197	339	56	283	58	3399	206	0.4	0.5	182	158	238
pH (in-situ) (WQO, 6.5-8.5)	34	7.6	9.2	6.8	2.4	0.6	0.3	7.7	1.1	0.6	7.4	7.2	8.1
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	34	238	914	9	904	180	32556	297	1.6	4.7	248	113	321
Ammonia as N (mg/L) (WQO, <20 µg/L)	34	0.03	0.52	0.005	0.51	0.09	0.01	0.09	5.5	31	0.01	0.005	0.04
Chloride (mg/L)	34	17	54	7	47	10	97	19	2.2	5.7	13	11	19
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	34	0.003	0.019	0.0005	0.019	0.004	0.000	0.005	2.7	9	0.002	0.001	0.004
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	34	0.96	6.26	0.005	6.26	1.41	1.98	1.69	2.6	6.9	0.48	0.13	0.95
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	34	0.003	0.007	0.0005	0.007	0.001	0.000	0.003	0.9	1.7	0.003	0.002	0.004
Iron (filtered) (mg/L) (proposed DGV under consideration)	34	0.56	2.71	0.025	2.68	0.68	0.46	0.87	2.0	3.4	0.32	0.15	0.65
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	34	0.024	0.150	0.0005	0.150	0.032	0.001	0.040	2.7	7	0.013	0.006	0.025
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	34	0.003	0.008	0.0025	0.006	0.002	0.000	0.004	2.3	3.7	0.0025	0.0025	0.0025
Hardness as $CaCO_3$ (mg/L)	34	56	133	31	102	20	419	59	1.8	4.9	49	44	68
Calcium (filtered) (mg/L)	34	14	35	8	27	5	27	15	1.9	6.1	13	11	18
Magnesium (filtered) (mg/L)	34	5	11	2	9	2	3	5	1.4	2.6	4	4	5
Potassium (filtered) (mg/L)	34	7	8	5	3	1	1	7	0.0	-0.5	7	6	7
Sodium (filtered) (mg/L)	34	20	33	13	20	5	25	20	1.0	0.6	20	16	21
Sodium Absorption Ratio	34	1.2	1.9	0.9	1.0	0.3	0.1	1.2	0.7	-0.1	1.1	0.9	1.4
Nitrate (as N) (mg/L)	34	0.17	0.52	0.005	0.51	0.14	0.02	0.22	0.5	-0.5	0.18	0.02	0.26
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	34	0.17	0.52	0.005	0.51	0.14	0.02	0.22	0.5	-0.5	0.18	0.02	0.26
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	34	0.09	0.31	0.005	0.31	0.08	0.01	0.12	1.0	0.2	0.06	0.02	0.13
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <25 mg/L)	34	4.8	12	2.0	10.0	2.2	5.0	5.3	1.6	2.6	4	4.0	5.8
Total Suspended Solids (Lab) (mg/L) (WQO, <10 mg/L)	34	62	274	5.0	269	60	3645	86	1.8	4	44	19	84
Kjeldahl Nitrogen Total (TKN) (mg/L)	34	0.87	1.70	0.25	1.45	0.34	0.12	0.93	0.4	-0.1	0.90	0.60	1.10
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	34	1.04	1.90	0.25	1.65	0.43	0.19	1.12	0.1	-0.9	1.05	0.80	1.40
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	34	0.26	0.61	0.04	0.57	0.15	0.02	0.30	0.3	-0.8	0.25	0.13	0.39
Alkalinity (total) as $CaCO_3$ (mg/L)	34	72	108	47	61	15	238	73	0.8	-0.2	69	59	82
Fluoride (mg/L)	34	0.2	0.5	0.05	0.4	0.1	0.0	0.2	2.1	7.1	0.1	0.1	0.2
Total Nitrogen as N (filtered) (TDN) (mg/L)	8	1.13	1.40	0.80	0.60	0.22	0.05	1.14	0.1	-1.3	1.05	1.00	1.32
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	34	0.21	0.54	0.01	0.53	0.15	0.02	0.26	0.4	-0.5	0.22	0.05	0.31
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	34	0.84	1.70	0.22	1.48	0.35	0.12	0.91	0.5	0.0	0.82	0.56	1.09
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	8	0.85	1.11	0.58	0.53	0.20	0.04	0.87	0.2	-1.6	0.80	0.72	1.04
[TKN] – [TKN-filtered] (mg/L)*	8	0.46	1.10	0.10	1.00	0.34	0.11	0.56	1.1	0.5	0.40	0.20	0.57
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	8	0.46	1.10	0.10	1.00	0.34	0.11	0.56	1.1	0.5	0.40	0.20	0.57
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	8	0.11	0.22	-0.04	0.26	0.10	0.01	0.15	-0.3	-1.7	0.13	0.03	0.20

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Red font indicates [TP-filtered] > [Total P]. *LOR for calculated values is unknown.

Lower Dawson Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Dawson River, Far Upstream of future inundation area (Beckers), sampled during Jul 2020 to Dec 2022 & Dawson River, Upstream of future inundation area (Boolburra and Baralaba), sampled during Sep 2022 to Dec 2022. **Baseline Condition – Wet Season time points**	n	Mean	Max	Min	Range	Std Deviation	Variance	RMS	Skewness	Kurtosis	Median	Q1 (25th%ile)	Q3 (75th%ile)
River flow at nearest hour to time sampled (m^3/s)	14	16	100	0.0	100	32	1048	35	2.2	3.6	0.8	0.1	2.9
Oxidation-Reduction Potential (in-situ) (mV)	16	118	184	79	105	25	613	121	0.9	2.3	122	98	129
Water Temperature (in-situ) (°C)	15	28.3	32.4	22.1	10.3	2.9	8.5	28.4	-1.0	0.6	29.2	27.0	30.3
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	16	94	121	74	47	11	129	94	0.5	1.5	93	89	97
Electrical Conductivity (in-situ) (µS/cm) (<340 or <210 µS/cm)	16	223	339	138	201	58	3333	230	0.1	-0.8	235^	170	264
pH (in-situ) (WQO, 6.5-8.5)	16	7.5	8.2	7.0	1.1	0.4	0.2	7.5	0.6	-1.2	7.4	7.2	7.9
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	16	214	486	18	469	153	23274	260	0.3	-1.0	202	99	320
Ammonia as N (mg/L) (WQO, <20 µg/L)	16	0.02	0.05	0.005	0.05	0.02	0.00	0.03	0.1	-1.6	0.02	0.005	0.04
Chloride (mg/L)	16	18	38	7	31	9	90	20	0.9	-0.2	15	11	25
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	16	0.005	0.019	0.001	0.018	0.005	0.000	0.007	2.1	5.0	0.004	0.002	0.007
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	16	0.48	1.92	0.005	1.91	0.49	0.24	0.67	1.8	4.2	0.34	0.16	0.68
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	16	0.003	0.007	0.001	0.006	0.002	0.000	0.003	0.8	0.8	0.003	0.002	0.004
Iron (filtered) (mg/L) (proposed DGV under consideration)	16	0.31	0.93	0.05	0.88	0.25	0.06	0.39	1.1	1.1	0.24	0.13	0.45
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	16	0.034	0.150	0.003	0.147	0.043	0.002	0.053	1.9	3.0	0.016	0.008	0.033
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	16	0.004	0.008	0.0025	0.006	0.002	0.000	0.004	1.1	-0.7	0.0025	0.0025	0.0060
Hardness as $CaCO_3$ (mg/L)	16	58	83	31	52	16	249	60	0.2	-1.1	54	48	71
Calcium (filtered) (mg/L)	16	15	20	9	11	4	12	15	0.2	-1.1	14	13	18
Magnesium (filtered) (mg/L)	16	5	8	2	6	2	3	5	0.3	-0.7	5	4	6
Potassium (filtered) (mg/L)	16	7	8	5	3	1	1	7	-0.2	-0.9	7	6	8
Sodium (filtered) (mg/L)	16	20	30	13	17	5	28	21	0.6	-0.6	20	15	23
Sodium Absorption Ratio	16	1.1	1.4	0.9	0.6	0.2	0.0	1.2	0.3	-1.5	1.1	1.0	1.4
Nitrate (as N) (mg/L)	16	0.18	0.52	0.005	0.51	0.17	0.03	0.24	0.6	-0.7	0.14	0.005	0.29
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	16	0.18	0.52	0.005	0.51	0.17	0.03	0.25	0.6	-0.7	0.15	0.005	0.29
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	16	0.10	0.24	0.005	0.23	0.07	0.01	0.12	0.6	-0.2	0.09	0.05	0.13
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <25 mg/L)	16	5.0	10	2.0	8.0	2.4	5.9	5.5	0.7	-0.6	4.0	3.0	6.5
Total Suspended Solids (Lab) (mg/L) (WQO, <10 mg/L)	16	70	178	8.0	170	55	3005	88	1.1	-0.2	51	33	94
Kjeldahl Nitrogen Total (TKN) (mg/L)	16	0.84	1.30	0.40	0.90	0.30	0.09	0.89	-0.1	-1.2	0.85	0.58	1.13
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	16	1.02	1.60	0.40	1.20	0.41	0.17	1.09	-0.1	-1.3	1.05	0.75	1.42
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	16	0.25	0.49	0.05	0.44	0.14	0.02	0.29	0.2	-1.2	0.23	0.14	0.35
Alkalinity (total) as $CaCO_3$ (mg/L)	16	75	102	56	46	16	247	76	0.5	-1.1	70	62	86
Fluoride (mg/L)	16	0.2	0.3	0.1	0.2	0.1	0.0	0.2	0.4	-0.5	0.2	0.1	0.2
Total Nitrogen as N (filtered) (TDN) (mg/L)	4	1.30	1.40	1.10	0.30	*0.14*	*0.02*	*1.31*	*-1.4*	*1.5*	*1.35*	*1.25*	*1.40*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	16	0.20	0.52	0.01	0.51	0.17	0.03	0.26	0.4	-0.9	0.20	0.04	0.32
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	16	0.82	1.26	0.37	0.89	0.30	0.09	0.87	-0.1	-1.2	0.81	0.57	1.08
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	4	1.00	1.11	0.79	0.32	*0.15*	*0.02*	*1.01*	*-1.7*	*3.0*	*1.06*	*0.97*	*1.09*
[TKN] – [TKN-filtered] (mg/L)*	4	0.23	0.40	0.10	0.30	*0.13*	*0.02*	*0.25*	*1.1*	*2.2*	*0.20*	*0.17*	*0.25*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	4	0.23	0.40	0.10	0.30	*0.13*	*0.02*	*0.25*	*1.1*	*2.2*	*0.20*	*0.17*	*0.25*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	4	0.12	0.22	0.00	0.22	*0.12*	*0.01*	*0.16*	*-0.1*	*-5.4*	*0.13*	*0.03*	*0.22*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. ^Value > WQO for EC during high flow (although not all samples collected during high flow). Italic font indicates there were only 4 data points and results of statistical tests may not be valid. * LOR for calculated values is unknown.

Lower Dawson Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Dawson River, Far Upstream of future inundation area (Beckers), sampled during Jul 2020 to Dec 2022 & Dawson River, Upstream of future inundation area (Boolburra and Baralaba), sampled during Sep 2022 to Dec 2022. **Baseline Condition – Dry Season time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25th%ile)**	**Q3 (75th%ile)**
River flow at nearest hour to time sampled (m^3/s)	16	9	68	0.0	68	21	441	22	2.4	5.0	0.1	0.0	2.1
Oxidation-Reduction Potential (in-situ) (mV)	18	126	225	71	154	43	1860	133	0.4	-0.2	136	83	154
Water Temperature (in-situ) (°C)	18	22.0	31.0	12.3	18.7	4.6	20.7	22.5	-0.5	0.8	22.5	20.2	25.0
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	18	97	106	82	24	6	41	97	-0.7	-0.1	99	92	101
Electrical Conductivity (in-situ) (µS/cm) (<340 or <210 µS/cm)	18	175	317	56	261	50	2478	181	0.7	4.8	168	156	196
pH (in-situ) (WQO, 6.5-8.5)	18	7.8	9.2	6.8	2.4	0.7	0.5	7.8	0.8	-0.4	7.4	7.3	8.3
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	18	259	914	9	904	204	41689	326	2.0	5.8	248	132	310
Ammonia as N (mg/L) (WQO, <20 µg/L)	18	0.04	0.52	0.005	0.51	0.12	0.01	0.12	4.1	17	0.005	0.005	0.03
Chloride (mg/L)	18	15	54	9	45	10	104	18	3.5	14	13	11	15
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	18	0.002	0.005	0.0005	0.004	0.002	0.000	0.002	0.8	-0.3	0.001	0.0005	0.002
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	18	1.38	6.26	0.005	6.26	1.80	3.22	2.23	1.8	2.5	0.75	0.16	1.63
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	18	0.003	0.004	0.0005	0.004	0.001	0.000	0.003	-0.1	-0.2	0.002	0.002	0.003
Iron (filtered) (mg/L) (proposed DGV under consideration)	18	0.78	2.71	0.025	2.68	0.85	0.72	1.14	1.2	0.3	0.49	0.19	0.90
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	18	0.015	0.070	0.001	0.069	0.016	0.000	0.021	2.7	8.6	0.011	0.006	0.017
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	18	0.002	0.002	0.0025	0.000		0.000	0.002	0.0	0.0	0.0025	0.0025	0.0025
Hardness as $CaCO_3$ (mg/L)	18	53	133	32	101	24	581	58	2.4	6.8	46	37	58
Calcium (filtered) (mg/L)	18	14	35	8	27	6	42	15	2.3	6.4	12	10	15
Magnesium (filtered) (mg/L)	18	5	11	3	8	2	4	5	2.4	7.2	4	3	5
Potassium (filtered) (mg/L)	18	7	8	6	2	1	0	7	0.0	-0.3	7	6	7
Sodium (filtered) (mg/L)	18	19	33	14	19	5	24	20	1.6	2.9	19	16	21
Sodium Absorption Ratio	18	1.2	1.9	0.9	1.0	0.3	0.1	1.2	0.6	-0.3	1.2	0.9	1.4
Nitrate (as N) (mg/L)	18	0.17	0.37	0.005	0.37	0.12	0.01	0.21	0.0	-1.0	0.19	0.05	0.25
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	18	0.17	0.37	0.005	0.37	0.12	0.01	0.21	0.0	-1.0	0.19	0.05	0.25
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	18	0.08	0.31	0.005	0.31	0.09	0.01	0.12	1.3	0.6	0.05	0.01	0.10
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <25 mg/L)	18	4.6	12	3.0	9.0	2.1	4.4	5.0	2.9	9.7	4.0	4.0	4.0
Total Suspended Solids (Lab) (mg/L) (WQO, <10 mg/L)	18	55	274	5.0	269	66	4313	84	2.4	7.1	32	14	79
Kjeldahl Nitrogen Total (TKN) (mg/L)	18	0.90	1.70	0.25	1.45	0.38	0.14	0.97	0.5	0.1	0.90	0.60	1.10
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	18	1.06	1.90	0.25	1.65	0.46	0.22	1.15	0.2	-0.7	1.05	0.80	1.38
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	18	0.27	0.61	0.04	0.57	0.16	0.02	0.31	0.3	-0.5	0.27	0.13	0.39
Alkalinity (total) as $CaCO_3$ (mg/L)	18	69	108	47	61	15	230	71	1.1	1.4	68	58	75
Fluoride (mg/L)	18	0.2	0.5	0.05	0.4	0.1	0.0	0.2	2.5	7.8	0.1	0.1	0.2
Total Nitrogen as N (filtered) (TDN) (mg/L)	4	0.95	1.00	0.80	0.20	*0.10*	*0.01*	*0.95*	*-2.0*	*4.0*	*1.00*	*0.95*	*1.00*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	18	0.21	0.54	0.01	0.53	0.14	0.02	0.25	0.4	0.2	0.22	0.12	0.30
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	18	0.86	1.70	0.22	1.48	0.39	0.16	0.94	0.7	0.1	0.85	0.56	1.09
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	4	0.71	0.81	0.58	0.23	*0.10*	*0.01*	*0.71*	*-0.4*	*0.5*	*0.71*	*0.66*	*0.75*
[TKN] – [TKN-filtered] (mg/L)*	4	0.70	1.10	0.40	0.70	*0.32*	*0.10*	*0.75*	*0.6*	*-1.7*	*0.65*	*0.47*	*0.88*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	4	0.70	1.10	0.40	0.70	*0.32*	*0.10*	*0.75*	*0.6*	*-1.7*	*0.65*	*0.47*	*0.88*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	4	0.10	0.19	-0.04	0.23	*0.10*	*0.01*	*0.14*	*-1.1*	*0.3*	*0.13*	*0.06*	*0.17*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Red font indicates [TP-filtered] > [Total P]. Italic font indicates there were only 4 data points and results of statistical tests may not be valid. *LOR for calculated values is unknown.

Fitzroy Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Fitzroy River, within future inundation area (Riverslea), sampled during Jul 2020 to Dec 2022 & Fitzroy River, Far Downstream of future inundation area (The Gap), sampled during Jul 2020 to Apr 2021 (prior to RWP construction). **Baseline Condition – All time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25th%ile)**	**Q3 (75th%ile)**
River flow at nearest hour to time sampled (m^3/s)	39	65	860	0.0	860	158	24929	169	3.8	17	3.1	0.0	16.5
Oxidation-Reduction Potential (in-situ) (mV)	39	129	181	72	109	28	781	132	0.5	-0.5	122	110	141
Water Temperature (in-situ) (°C)	39	24.2	31.3	15.3	16.0	4.7	21.9	24.7	-0.3	-0.9	24.9	21.2	28.1
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	39	96	126	70	56	12	137	97	0.6	0.9	94	89	101
Electrical Conductivity (in-situ) (µS/cm) (<445 or <250 µS/cm)	39	249	607	117	490	120	14317	276	1.6	2.2	210	168	269
pH (in-situ) (WQO, 6.5-8.5)	39	7.9	9.3	6.7	2.5	0.7	0.5	7.9	0.3	-1.1	7.8	7.3	8.4
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	39	228	1008	2	1006	241	57890	329	1.4	1.8	170	39	321
Ammonia as N (mg/L) (WQO, <20 µg/L)	39	0.03	0.38	0.005	0.38	0.06	0.00	0.07	4.8	25	0.02	0.005	0.03
Chloride (mg/L)	39	34	126	11	115	29	818	44	2.0	3.5	20	18	33
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	39	0.005	0.038	0.0005	0.037	0.007	0.000	0.008	3.8	17	0.002	0.002	0.004
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	39	1.03	4.96	0.005	4.95	1.36	1.85	1.69	1.6	1.6	0.42	0.04	1.28
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	39	0.003	0.007	0.0005	0.007	0.001	0.000	0.003	0.9	2.4	0.003	0.002	0.003
Iron (filtered) (mg/L) (proposed DGV under consideration)	39	0.55	2.52	0.025	2.49	0.67	0.45	0.86	1.5	1.6	0.29	0.025	0.69
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	39	0.013	0.098	0.001	0.097	0.017	0.000	0.021	4.0	19	0.007	0.005	0.013
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	39	0.003	0.012	0.0025	0.010	0.002	0.000	0.003	4.4	20	0.0025	0.0025	0.0025
Hardness as $CaCO_3$ (mg/L)	39	68	132	32	100	27	736	74	0.7	-0.5	57	46	90
Calcium (filtered) (mg/L)	39	14	20	8	12	4	13	14	0.2	-0.9	14	10	16
Magnesium (filtered) (mg/L)	39	8	20	3	17	5	22	10	1.0	-0.1	6	5	12
Potassium (filtered) (mg/L)	39	4	7	2	5	1	1	4	0.4	-0.4	4	4	5
Sodium (filtered) (mg/L)	39	26	72	14	58	14	194	29	2.0	3.5	20	18	26
Sodium Absorption Ratio	39	1.3	2.7	0.8	1.9	0.5	0.2	1.4	1.6	1.9	1.1	1.0	1.5
Nitrate (as N) (mg/L)	39	0.18	0.56	0.005	0.56	0.17	0.03	0.24	0.5	-0.8	0.17	0.02	0.29
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	39	0.18	0.56	0.005	0.56	0.17	0.03	0.24	0.5	-0.8	0.17	0.02	0.29
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	39	0.04	0.19	0.005	0.19	0.05	0.00	0.07	1.6	2.4	0.03	0.005	0.05
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <15 mg/L)	39	9	32	4	28	8	57	12	2.0	3.1	6	5	10
Total Suspended Solids (Lab) (mg/L) (WQO, <85 mg/L)	39	100	1020	2.5	1018	190	35922	212	3.5	15	29	12	76
Kjeldahl Nitrogen Total (TKN) (mg/L)	39	0.76	2.50	0.25	2.25	0.51	0.26	0.91	2.1	4.8	0.60	0.40	0.95
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	39	0.92	3.10	0.25	2.85	0.62	0.39	1.11	1.7	3.7	0.80	0.40	1.25
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	39	0.20	0.78	0.01	0.77	0.19	0.04	0.27	1.4	1.6	0.16	0.05	0.28
Alkalinity (total) as $CaCO_3$ (mg/L)	39	67	101	40	61	16	270	69	0.4	-0.5	68	53	77
Fluoride (mg/L)	39	0.1	0.2	0.05	0.2	0.0	0.0	0.1	1.1	-0.3	0.1	0.1	0.1
Total Nitrogen as N (filtered) (TDN) (mg/L)	4	1.20	1.50	1.00	0.50	*0.24*	*0.06*	*1.22*	*0.5*	*-2.9*	*1.15*	*1.00*	*1.35*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	39	0.21	0.56	0.01	0.56	0.17	0.03	0.27	0.4	-1.0	0.20	0.04	0.32
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	39	0.73	2.49	0.22	2.27	0.52	0.27	0.89	2.0	4.6	0.56	0.38	0.94
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	4	0.81	1.09	0.69	0.40	*0.19*	*0.04*	*0.83*	*2.0*	*3.9*	*0.73*	*0.71*	*0.82*
[TKN] – [TKN-filtered] (mg/L)*	4	0.73	1.80	0.00	1.80	*0.76*	*0.58*	*0.98*	*1.3*	*2.4*	*0.55*	*0.38*	*0.90*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	4	0.73	1.80	0.00	1.80	*0.76*	*0.58*	*0.98*	*1.3*	*2.4*	*0.55*	*0.38*	*0.90*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	4	0.32	0.57	0.16	0.41	*0.19*	*0.04*	*0.36*	*0.8*	*-1.3*	*0.28*	*0.18*	*0.42*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Italic font indicates there were only 4 data points and results of statistical tests may not be valid. * LOR for calculated values is unknown.

Fitzroy Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Fitzroy River, within future inundation area (Riverslea), sampled during Jul 2020 to Dec 2022 & Fitzroy River, Far Downstream of future inundation area (The Gap), sampled during Jul 2020 to Apr 2021 (prior to RWP construction). **Baseline Condition – Wet Season time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25^{th}%ile)**	**Q3 (75^{th}%ile)**
River flow at nearest hour to time sampled (m^3/s)	19	75	362	0.0	362	111	12333	132	1.5	1	11.3	1.1	131.9
Oxidation-Reduction Potential (in-situ) (mV)	19	120	176	92	84	23	539	123	1.0	0.8	119	105	131
Water Temperature (in-situ) (°C)	19	27.6	31.3	22.0	9.3	2.6	6.9	27.7	-0.6	0.1	27.9	25.9	29.1
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	19	92	124	70	54	12	148	93	0.8	1.7	90	87	97
Electrical Conductivity (in-situ) (µS/cm) (<445 or <250 µS/cm)	19	276	607	135	472	138	19020	307	1.4	1.2	226	184	335
pH (in-situ) (WQO, 6.5-8.5)	19	7.7	9.0	6.9	2.1	0.6	0.3	7.7	0.6	-0.3	7.6	7.3	8.1
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	19	294	1008	2	1006	291	84699	408	1.0	0.4	216	31	498
Ammonia as N (mg/L) (WQO, <20 µg/L)	19	0.02	0.06	0.005	0.05	0.02	0.00	0.03	1.2	0.8	0.02	0.005	0.02
Chloride (mg/L)	19	34	126	11	115	33	1077	47	2.0	3.1	20	18	31
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	19	0.006	0.038	0.0005	0.037	0.009	0.000	0.010	3.2	10	0.002	0.002	0.004
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	19	0.64	2.08	0.005	2.07	0.66	0.44	0.91	0.9	-0.2	0.40	0.05	1.06
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	19	0.003	0.007	0.0005	0.007	0.002	0.000	0.003	0.9	1.6	0.003	0.002	0.003
Iron (filtered) (mg/L) (proposed DGV under consideration)	19	0.37	1.08	0.025	1.06	0.34	0.12	0.50	0.7	-0.5	0.25	0.04	0.59
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	19	0.009	0.036	0.001	0.035	0.008	0.000	0.013	2.2	5	0.007	0.005	0.010
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	19	0.003	0.012	0.0025	0.010	0.002	0.000	0.004	3.2	9.8	0.0025	0.0025	0.002
Hardness as $CaCO_3$ (mg/L)	19	69	132	36	96	30	902	75	1.0	-0.3	55	48	86
Calcium (filtered) (mg/L)	19	14	20	8	12	4	12	14	0.4	-0.6	13	11	16
Magnesium (filtered) (mg/L)	19	9	20	4	16	5	29	10	1.2	-0.1	6	5	11
Potassium (filtered) (mg/L)	19	5	7	3	4	1	2	5	0.4	-1.1	4	4	6
Sodium (filtered) (mg/L)	19	26	72	14	58	17	285	31	2.0	2.9	19	17	23
Sodium Absorption Ratio	19	1.3	2.7	0.8	1.9	0.6	0.3	1.4	1.7	1.9	1.1	1.0	1.2
Nitrate (as N) (mg/L)	19	0.20	0.42	0.005	0.41	0.16	0.02	0.25	-0.2	-1.7	0.26	0.03	0.33
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	19	0.20	0.42	0.005	0.41	0.16	0.02	0.25	-0.2	-1.7	0.26	0.03	0.33
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	19	0.05	0.19	0.005	0.19	0.05	0.00	0.07	1.5	2.0	0.03	0.01	0.07
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <15 mg/L)	19	10	32	4.0	28	9	85	14	1.7	1.6	6	5	11
Total Suspended Solids (Lab) (mg/L) (WQO, <85 mg/L)	19	147	1020	2.5	1018	242	58424	277	3.0	10	54	23	145
Kjeldahl Nitrogen Total (TKN) (mg/L)	19	0.79	2.40	0.30	2.10	0.49	0.24	0.92	2.1	6.0	0.70	0.45	1.05
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	19	0.97	2.70	0.30	2.40	0.59	0.35	1.13	1.4	2.6	0.80	0.55	1.35
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	19	0.23	0.63	0.02	0.61	0.20	0.04	0.30	0.8	-0.5	0.18	0.05	0.34
Alkalinity (total) as $CaCO_3$ (mg/L)	19	67	101	40	61	17	284	69	0.4	-0.1	70	53	76
Fluoride (mg/L)	19	0.1	0.2	0.05	0.2	0.0	0.0	0.1	0.9	-0.7	0.1	0.1	0.2
Total Nitrogen as N (filtered) (TDN) (mg/L)	2	1.25	1.50	1.00	0.50	*0.35*	*0.13*	*1.27*	*0.0*	*0.0*	*1.25*	*1.13*	*1.38*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	19	0.22	0.48	0.01	0.47	0.16	0.02	0.27	-0.1	-1.5	0.27	0.06	0.34
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	19	0.77	2.39	0.29	2.10	0.49	0.24	0.91	2.1	6.1	0.69	0.41	1.04
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	2	0.89	1.09	0.69	0.40	*0.28*	*0.08*	*0.91*	*0.0*	*0.0*	*0.89*	*0.79*	*0.99*
[TKN] – [TKN-filtered] (mg/L)*	2	0.25	0.50	0.00	0.50	*0.35*	*0.13*	*0.35*	*0.0*	*0.0*	*0.25*	*0.13*	*0.38*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	2	0.25	0.50	0.00	0.50	*0.35*	*0.13*	*0.35*	*0.0*	*0.0*	*0.25*	*0.13*	*0.38*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	2	0.28	0.37	0.18	0.19	*0.13*	*0.02*	*0.29*	*0.0*	*0.0*	*0.28*	*0.23*	*0.32*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Italic font indicates there were only 2 data points and results of statistical tests are not valid. * LOR for calculated values is unknown.

Fitzroy Sub-basin: Phys-Chem WQ, Summary Statistics Sites = Fitzroy River, within future inundation area (Riverslea), sampled during Jul 2020 to Dec 2022 & Fitzroy River, Far Downstream of future inundation area (The Gap), sampled during Jul 2020 to Apr 2021 (prior to RWP construction). **Baseline Condition – Dry Season time points**	n	Mean	Max	Min	Range	Std Deviation	Variance	RMS	Skewness	Kurtosis	Median	Q1 (25th%ile)	Q3 (75th%ile)
River flow at nearest hour to time sampled (m^3/s)	20	56	860	0.0	860	195	37998	198	4.1	17	0.2	0.0	7.1
Oxidation-Reduction Potential (in-situ) (mV)	20	137	181	72	109	30	920	140	0.0	-0.6	129	120	165
Water Temperature (in-situ) (°C)	20	21.1	31.1	15.3	15.8	4.0	15.7	21.4	0.6	0.6	21.2	18.4	23.8
Dissolved Oxygen (in-situ) (% Saturation) (WQO, 85-110 %sat)	20	100	126	81	45	10	104	101	1.0	1.6	97	94	104
Electrical Conductivity (in-situ) (µS/cm) (<445 or <250 µS/cm)	20	223	506	117	389	96	9195	242	1.7	2.9	190	160	268
pH (in-situ) (WQO, 6.5-8.5)	20	8.1	9.3	6.7	2.5	0.8	0.7	8.1	-0.2	-1.3	8.2	7.3	8.7
Turbidity (in-situ) (NTU) (WQO, <50 NTU)	20	165	610	3	607	165	27111	230	1.3	1.5	126	45	209
Ammonia as N (mg/L) (WQO, <20 µg/L)	20	0.04	0.38	0.005	0.38	0.09	0.01	0.10	3.5	13	0.02	0.005	0.03
Chloride (mg/L)	20	33	113	12	101	25	616	41	2.1	4.9	22	20	37
Chlorophyll a (mg/L) (WQO, <5.0 µg/L)	20	0.004	0.013	0.0005	0.013	0.003	0.000	0.005	1.7	2	0.003	0.002	0.004
Aluminium (filtered) (mg/L) (DGV = 55 µg/L)	20	1.40	4.96	0.005	4.95	1.73	2.99	2.19	1.0	-0.6	0.44	0.04	3.05
Copper (filtered) (mg/L) (DGV = 1.4 µg/L)	20	0.002	0.004	0.001	0.003	0.001	0.000	0.003	-0.1	-0.8	0.002	0.002	0.003
Iron (filtered) (mg/L) (proposed DGV under consideration)	20	0.72	2.52	0.025	2.49	0.85	0.72	1.10	1.0	-0.5	0.30	0.025	1.43
Manganese (filtered) (mg/L) (DGV = 1900 µg/L)	20	0.016	0.098	0.001	0.097	0.021	0.000	0.026	3.3	12	0.010	0.005	0.016
Zinc (filtered) (mg/L) (DGV = 8 µg/L)	20	0.003	0.005	0.0025	0.002	0.001	0.000	0.003	4.5	20	0.0025	0.0025	0.0025
Hardness as $CaCO_3$ (mg/L)	20	68	117	32	85	25	616	72	0.2	-1.1	69	46	89
Calcium (filtered) (mg/L)	20	13	20	8	12	4	13	14	0.1	-1.1	14	10	16
Magnesium (filtered) (mg/L)	20	8	17	3	14	4	16	9	0.5	-0.7	8	5	11
Potassium (filtered) (mg/L)	20	4	6	2	4	1	1	4	0.2	0.4	4	4	4
Sodium (filtered) (mg/L)	20	25	58	16	42	11	118	28	1.8	3.4	22	19	28
Sodium Absorption Ratio	20	1.3	2.3	0.9	1.4	0.4	0.1	1.4	1.2	1.4	1.3	1.1	1.5
Nitrate (as N) (mg/L)	20	0.16	0.56	0.005	0.56	0.18	0.03	0.24	1.1	0.4	0.12	0.005	0.26
Nitrite + Nitrate as N (NOx) (mg/L) (WQO, <60 µg/L)	20	0.16	0.56	0.005	0.56	0.18	0.03	0.24	1.1	0.4	0.12	0.005	0.26
Phosphorous Reactive as P (FRP) (mg/L) (WQO, <20 µg/L)	20	0.04	0.19	0.005	0.19	0.05	0.00	0.06	2.0	4.2	0.02	0.005	0.05
Sulfate as SO_4 - Turbidimetric (filtered) (mg/L) (WQO, <15 mg/L)	20	8.4	26	4.0	22	5.6	31	10	2.1	4.6	6.0	5.0	9.5
Total Suspended Solids (Lab) (mg/L) (WQO, <85 mg/L)	20	55	477	2.5	475	110	12128	121	3.4	12	23	8	37
Kjeldahl Nitrogen Total (TKN) (mg/L)	20	0.73	2.50	0.25	2.25	0.54	0.29	0.90	2.2	5.6	0.55	0.40	0.82
Total Nitrogen as N (TN) (mg/L) (WQO, <500 µg/L)	20	0.88	3.10	0.25	2.85	0.67	0.44	1.09	2.1	5.9	0.75	0.40	1.05
Total Phosphorus as P (mg/L) (WQO, <50 µg/L)	20	0.17	0.78	0.01	0.77	0.18	0.03	0.25	2.3	6.6	0.14	0.07	0.20
Alkalinity (total) as $CaCO_3$ (mg/L)	20	66	99	42	57	16	270	68	0.4	-0.6	63	54	77
Fluoride (mg/L)	20	0.1	0.2	0.05	0.2	0.0	0.0	0.1	1.3	0.5	0.1	0.1	0.1
Total Nitrogen as N (filtered) (TDN) (mg/L)	2	1.15	1.30	1.00	0.30	*0.21*	*0.04*	*1.16*	*0.0*	*0.0*	*1.15*	*1.08*	*1.22*
Dissolved Inorganic N (DIN) (DIN = [NH3] + [NOx]) (mg/L)*	20	0.20	0.56	0.01	0.56	0.19	0.04	0.28	0.8	-0.7	0.16	0.03	0.30
Organic N (Org N = [TKN] – [NH3]) (mg/L)* (WQO, <420 µg/L)	20	0.69	2.49	0.22	2.27	0.56	0.31	0.88	2.2	5.2	0.48	0.38	0.82
Dissolved Organic N (DON) (DON = TDN - DIN) (mg/L)*	2	0.73	0.74	0.72	0.01	*0.01*	*0.00*	*0.73*	*0.0*	*0.0*	*0.73*	*0.72*	*0.73*
[TKN] – [TKN-filtered] (mg/L)*	2	1.20	1.80	0.60	1.20	*0.85*	*0.72*	*1.34*	*0.0*	*0.0*	*1.20*	*0.90*	*1.50*
Particulate Nitrogen (PN) (PN = [TN]- [TDN]) (mg/L)*	2	1.20	1.80	0.60	1.20	*0.85*	*0.72*	*1.34*	*0.0*	*0.0*	*1.20*	*0.90*	*1.50*
Particulate Phosphorus (PP) (PP = [TP] – [TP-filtered]) (mg/L)*	2	0.37	0.57	0.16	0.41	*0.29*	*0.08*	*0.42*	*0.0*	*0.0*	*0.37*	*0.26*	*0.47*

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Value in brackets is ANZG DGV or sub-basin WQO. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. Light-red-filled cells indicate median value ≥ DGV or WQO. Light grey-filled cells indicate at least one value ≥ DGV. Italic font indicates there were only 2 data points and results of statistical tests are not valid. * LOR for calculated values is unknown.

Mackenzie Sub-basin: Pesticides [only those that were detected during LFWQMP] **Summary Statistics** Sites = Mackenzie River, Far Upstream of future inundation area (Coolmaringa) and Upstream of future inundation area (ApisCkRd). Sampled during Jul 2020 to Dec 2022. **Baseline Condition – All time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25^{th}%ile)**	**Q3 (75^{th}%ile)**
Diketonitrile (DKN) (µg/L)	13	0.02	0.10	0.005	0.10	0.03	0.00	0.03	2.4	5.5	0.005	0.005	0.005
Imazapic (µg/L)	13	0.01	0.03	0.005	0.03	0.01	0.00	0.01	3.6	13	0.005	0.005	0.005
Isoxaflutole (µg/L)	13	0.01	0.13	0.005	0.13	0.03	0.00	0.04	3.6	13	0.005	0.005	0.005
Flupropanate (mg/L)	13	0.0001	0.0003	0.00005	0.0003	0.0001	0.0000	0.0001	1.2	-0.2	0.00005	0.00005	0.0002
Thiamethoxam (mg/L)	13	0.00001	0.00001	0.00001	0.00000	-	0.00000	0.00001	0.0	0.0	0.00001	0.00001	0.00001
Atrazine (**mg/L**) (DGV = 13 µg/L, moderate reliability)	13	0.00002	0.00008	0.000005	0.00008	0.00002	0.00000	0.00003	2.8	8.8	0.00002	0.000005	0.00002
Diazinon (µg/L) (DGV = 0.01 µg/L, moderate reliability)	13	0.005	0.005	0.005	0.00	-	0.00	0.01	0.0	0.0	0.005	0.005	0.005
Diuron (µg/L) (DGV = 0.2 µg/L, unknown reliability)	13	0.01	0.05	0.01	0.04	0.01	0.00	0.02	3.6	13	0.01	0.01	0.01
Hexazinone (µg/L)	13	0.01	0.03	0.01	0.02	0.01	0.00	0.01	3.6	13	0.01	0.01	0.01
Metolachlor (µg/L) (DGV = 0.46 µg/L, very high reliability)	13	0.03	0.11	0.005	0.11	0.03	0.00	0.05	1.3	1.5	0.02	0.01	0.05
Imidacloprid (mg/L)	13	0.000005	0.000005	0.000005	0.00000	-	0.00000	0.00001	0.0	0.0	0.000005	0.000005	0.000005
Propazine (mg/L)	13	0.000005	0.000005	0.000005	0.00000	-	0.00000	0.00001	0.0	0.0	0.000005	0.000005	0.000005
Propiconazole (µg/L)	13	0.025	0.025	0.025	0.00	-	0.00	0.03	0.0	0.0	0.025	0.025	0.025
Simazine (**mg/L**) (DGV = 3.2 µg/L, moderate reliability)	13	0.00001	0.00001	0.00001	0.00000	-	0.00000	0.00001	0.0	0.0	0.00001	0.00001	0.00001
Tebuthiuron (**mg/L**) (DGV = 2.2 µg/L, low reliability)	13	0.00047	0.00180	0.00001	0.00179	0.00056	0.00000	0.00071	1.6	2.0	0.00030	0.00004	0.00057
Terbutylazine (mg/L)	13	0.00002	0.00011	0.000005	0.00011	0.00003	0.00000	0.00004	2.3	5.0	0.000005	0.000005	0.00002
Tebuconazole (mg/L)	13	0.00001	0.00012	0.000005	0.00012	0.00003	0.00000	0.00003	3.6	13	0.000005	0.000005	0.000005
Atrazine-desethyl (µg/L)	13	0.05	0.05	0.05	0.0	-	0.0	0.1	0.0	0.0	0.05	0.05	0.05
Chlorantraniliprole (mg/L)	13	0.00005	0.0001	0.00005	0.0001	0.0000	0.0000	0.0001	3.6	13	0.00005	0.00005	0.00005

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Values in brackets are ANZG DGV. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR.

Callide Sub-basin: Pesticides [only those that were detected during LFWQMP] **Summary Statistics** Sites = Don River, Far Upstream of future inundation area (Rannes) Sampled during Jul 2020 to Dec 2022. **Baseline Condition – All time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25th%ile)**	**Q3 (75th%ile)**
Diketonitrile (DKN) (µg/L)	15	0.005	0.01	0.005	0.01	0.00	0.00	0.01	3.9	15	0.005	0.005	0.005
Imazapic (µg/L)	15	0.01	0.06	0.005	0.06	0.02	0.00	0.02	2.3	4.0	0.005	0.005	0.005
Isoxaflutole (µg/L)	15	0.005	0.005	0.005	0.00	-	0.00	0.01	0.0	0.0	0.005	0.005	0.005
Fluproponate (mg/L)	15	0.00005	0.00005	0.00005	0.0000	-	0.0000	0.0001	0.0	0.0	0.00005	0.00005	0.0001
Thiamethoxam (mg/L)	15	0.00001	0.00004	0.00001	0.00003	0.00001	0.00000	0.00001	3.9	15	0.00001	0.00001	0.00001
Atrazine (**mg/L**) (DGV = 13 µg/L, moderate reliability)	15	0.00014	0.00097	0.000005	0.00097	0.00024	0.00000	0.00027	3.2	11	0.00006	0.00003	0.00018
Diazinon (µg/L) (DGV = 0.01 µg/L, moderate reliability)*	15	0.005	0.005	0.005	0.00	-	0.00	0.01	0.0	0.0	0.005	0.005	0.005
Diuron (µg/L) (DGV = 0.2 µg/L, unknown reliability)	15	0.01	0.01	0.01	0.00	-	0.00	0.01	0.0	0.0	0.01	0.01	0.01
Hexazinone (µg/L)	15	0.03	0.18	0.01	0.17	0.04	0.00	0.05	3.0	10	0.01	0.01	0.04
Metolachlor (µg/L) (DGV = 0.46 µg/L, very high reliability)	15	0.12	0.66	0.005	0.66	0.18	0.03	0.21	2.4	6.0	0.05	0.02	0.14
Imidacloprid (mg/L)	15	0.000005	0.00001	0.000005	0.00001	0.00000	0.00000	0.00001	3.9	15	0.000005	0.000005	0.000005
Propazine (mg/L)	15	0.000005	0.000005	0.000005	0.00000	-	0.00000	0.00001	0.0	0.0	0.000005	0.000005	0.000005
Propiconazole (µg/L)	15	0.03	0.07	0.025	0.05	0.01	0.00	0.03	3.9	15	0.025	0.025	0.025
Simazine (**mg/L**) (DGV = 3.2 µg/L, moderate reliability)	15	0.00001	0.00002	0.00001	0.00001	0.00000	0.00000	0.00001	2.4	4.3	0.00001	0.00001	0.00001
Tebuthiuron (**mg/L**) (DGV = 2.2 µg/L, low reliability)	15	0.00170	0.01040	0.00008	0.01032	0.00291	0.00001	0.00328	2.4	5.6	0.00020	0.00015	0.00155
Terbutylazine (mg/L)	15	0.000005	0.000005	0.000005	0.00000	-	0.00000	0.00001	0.0	0.0	0.000005	0.000005	0.000005
Tebuconazole (mg/L)	15	0.00001	0.00002	0.000005	0.00002	0.00001	0.00000	0.00001	2.4	4.3	0.000005	0.000005	0.000005
Atrazine-desethyl (µg/L)	15	0.1	0.2	0.05	0.2	0.0	0.0	0.1	3.9	15	0.05	0.05	0.05
Chlorantraniliprole (mg/L)	15	0.0001	0.0005	0.00005	0.0005	0.0001	0.0000	0.0001	3.9	15	0.00005	0.00005	0.00005

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Values in brackets are ANZG DGV. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. *DGV=LOR. Grey-filled cells indicate at least one value ≥ guideline values.

Lower Dawson Sub-basin: Pesticides [only those that were detected during LFWQMP] **Summary Statistics** Sites = Dawson River, Far Upstream of future inundation area (Beckers), sampled during Jul 2020 to Dec 2022 & Dawson River, Upstream of future inundation area (Boolburra and Baralaba), sampled during Sep 2022 to Dec 2022. **Baseline Condition – All time points**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25^{th}%ile)**	**Q3 (75^{th}%ile)**
Diketonitrile (DKN) (µg/L)	17	0.01	0.03	0.005	0.03	0.01	0.00	0.01	2.9	8.1	0.005	0.005	0.005
Imazapic (µg/L)	17	0.005	0.005	0.005	0.00	-	0.00	0.01	0.0	0.0	0.005	0.005	0.005
Isoxaflutole (µg/L)	17	0.005	0.005	0.005	0.00	-	0.00	0.01	0.0	0.0	0.005	0.005	0.005
Fluproponate (mg/L)	17	0.00005	0.00005	0.00005	0.0000	-	0.0000	0.0001	0.0	0.0	0.00005	0.00005	0.00005
Thiamethoxam (mg/L)	17	0.00001	0.00001	0.00001	0.00000	-	0.00000	0.00001	0.0	0.0	0.00001	0.00001	0.00001
Atrazine (**mg/L**) (DGV = 13 µg/L, moderate reliability)	17	0.00025	0.00356	0.000005	0.00356	0.00086	0.00000	0.00087	4.0	16	0.00002	0.000005	0.00003
Diazinon (µg/L) (DGV = 0.01 µg/L, moderate reliability)*	17	0.005	0.005	0.005	0.00	-	0.00	0.01	0.0	0.0	0.005	0.005	0.005
Diuron (µg/L) (DGV = 0.2 µg/L, unknown reliability)	17	0.01	0.01	0.01	0.00	-	0.00	0.01	0.0	0.0	0.01	0.01	0.01
Hexazinone (µg/L)	17	0.02	0.09	0.01	0.08	0.02	0.00	0.03	2.6	8.1	0.01	0.01	0.03
Metolachlor (µg/L) (DGV = 0.46 µg/L, very high reliability)	17	0.18	1.64	0.005	1.64	0.42	0.17	0.44	3.1	10	0.01	0.01	0.05
Imidacloprid (mg/L)	17	0.000005	0.00001	0.000005	0.00001	0.0000	0.0000	0.0000	4.1	17	0.000005	0.000005	0.000005
Propazine (mg/L)	17	0.00001	0.00002	0.000005	0.00002	0.0000	0.0000	0.0000	4.1	17	0.000005	0.000005	0.000005
Propiconazole (µg/L)	17	0.025	0.025	0.025	0.00	-	0.00	0.025	0.0	0.0	0.025	0.025	0.025
Simazine (**mg/L**) (DGV = 3.2 µg/L, moderate reliability)	17	0.00001	0.00003	0.00001	0.00002	0.00000	0.00000	0.00001	4.1	17	0.00001	0.00001	0.00001
Tebuthiuron (**mg/L**) (DGV = 2.2 µg/L, low reliability)	17	0.00091	0.00257	0.00003	0.00254	0.00091	0.00000	0.00127	1.1	-0.6	0.00043	0.00028	0.00144
Terbutylazine (mg/L)	17	0.00001	0.00001	0.000005	0.00000	-	0.00000	0.00001	0.0	0.0	0.000005	0.000005	0.000005
Tebuconazole (mg/L)	17	0.00001	0.00001	0.000005	0.00001	0.00000	0.00000	0.00001	4.1	17	0.000005	0.000005	0.000005
Atrazine-desethyl (µg/L)	17	0.05	0.1	0.05	0.1	0.0	0.0	0.1	4.1	17	0.05	0.05	0.05
Chlorantraniliprole (mg/L)	17	0.00005	0.00005	0.00005	0.0000	-	0.0000	0.0001	0.0	0.0	0.00005	0.00005	0.00005

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Values in brackets are ANZG DGV. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR.
*DGV=LOR. Grey-filled cells indicate at least one value ≥ guideline values.

Fitzroy Sub-basin: Pesticides [only those that were detected during LFWQMP] **Summary Statistics** Sites = Fitzroy River, within future inundation area (Riverslea), sampled during Jul 2020 to Dec 2022 & Fitzroy River, Far Downstream of future inundation area (The Gap), sampled during Jul 2020 to Apr 2021 (prior to RWP construction). **Baseline Condition time points (n=20)**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25th%ile)**	**Q3 (75th%ile)**
Diketonitrile (DKN) (µg/L)	20	0.01	0.04	0.005	0.04	0.01	0.00	0.01	3.5	13	0.005	0.005	0.005
Imazapic (µg/L)	20	0.005	0.01	0.005	0.01	0.00	0.00	0.01	4.5	20	0.005	0.005	0.005
Isoxaflutole (µg/L)	20	0.005	0.01	0.005	0.00	-	0.00	0.01	0.0	0.0	0.005	0.005	0.005
Fluproponate (mg/L)	20	0.0001	0.0006	0.00005	0.0006	0.0002	0.0000	0.0002	2.7	6.1	0.00005	0.00005	0.0001
Thiamethoxam (mg/L)	20	0.00001	0.00001	0.00001	0.00000	-	0.00000	0.00001	0.0	0.0	0.00001	0.00001	0.00001
Atrazine (**mg/L**) (DGV = 13 µg/L, moderate reliability)	20	0.00003	0.00015	0.000005	0.00015	0.00004	0.00000	0.00005	2.2	5.8	0.000020	0.000005	0.00004
Diazinon (µg/L) (DGV = 0.01 µg/L, moderate reliability)*	20	0.007	0.020	0.005	0.02	0.00	0.00	0.01	2.9	7.0	0.005	0.005	0.005
Diuron (µg/L) (DGV = 0.2 µg/L, unknown reliability)	20	0.01	0.04	0.01	0.03	0.01	0.00	0.01	4.5	20	0.01	0.01	0.01
Hexazinone (µg/L)	20	0.02	0.07	0.01	0.06	0.01	0.00	0.02	3.3	12	0.01	0.01	0.01
Metolachlor (µg/L) (DGV = 0.46 µg/L, very high reliability)	20	0.05	0.48	0.005	0.48	0.10	0.01	0.11	4.0	17	0.03	0.01	0.05
Imidacloprid (mg/L)	20	0.00001	0.00002	0.000005	0.0000	0.0000	0.0000	0.0000	3.9	16	0.000005	0.000005	0.000005
Propazine (mg/L)	20	0.000005	0.000005	0.000005	0.0000	-	0.0000	0.0000	0.0	0.0	0.000005	0.000005	0.000005
Propiconazole (µg/L)	20	0.025	0.025	0.025	0.00	-	0.00	0.025	0.0	0.0	0.025	0.025	0.025
Simazine (**mg/L**) (DGV = 3.2 µg/L, moderate reliability)	20	0.00001	0.0001	0.00001	0.0001	0.0000	0.0000	0.0000	4.5	20	0.00001	0.00001	0.00001
Tebuthiuron (**mg/L**) (DGV = 2.2 µg/L, low reliability)	20	0.00044	0.00229	0.00004	0.00225	0.00058	0.00000	0.00071	2.3	5.3	0.00022	0.00016	0.00043
Terbutylazine (mg/L)	20	0.00001	0.00003	0.000005	0.00003	0.00001	0.00000	0.00001	1.7	1.9	0.000005	0.000005	0.00001
Tebuconazole (mg/L)	20	0.00001	0.00002	0.000005	0.00002	0.00000	0.00000	0.00001	4.5	20	0.000005	0.000005	0.000005
Atrazine-desethyl (µg/L)	20	0.05	0.05	0.05	0.0	-	0.0	0.1	0.0	0.0	0.05	0.05	0.05
Chlorantraniliprole (mg/L)	20	0.00005	0.00005	0.00005	0.0000	-	0.0000	0.0001	0.0	0.0	0.00005	0.00005	0.00005

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Values in brackets are ANZG DGV. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR. *DGV=LOR. Grey-filled cells indicate at least one value ≥ guideline values.

Fitzroy Sub-basin: Pesticides [only those that were detected during LFWQMP] **Summary Statistics** Sites = Nine sites along the Fitzroy River, either within, downstream or far downstream of the future inundation area, sampled during Jul 2020 to Dec 2022 (including all time points, prior to and during RWP construction). **All time points (n=42)**	**n**	**Mean**	**Max**	**Min**	**Range**	**Std Deviation**	**Variance**	**RMS**	**Skewness**	**Kurtosis**	**Median**	**Q1 (25th%ile)**	**Q3 (75th%ile)**
Diketonitrile (DKN) (µg/L)	42	0.02	0.08	0.005	0.08	0.02	0.00	0.02	1.8	3.3	0.005	0.005	0.02
Imazapic (µg/L)	42	0.01	0.02	0.005	0.02	0.01	0.00	0.01	1.9	2.0	0.005	0.005	0.005
Isoxaflutole (µg/L)	42	0.01	0.10	0.005	0.10	0.01	0.00	0.02	6.5	42	0.005	0.005	0.005
Fluproponate (mg/L)	42	0.0001	0.0006	0.00005	0.0006	0.0001	0.0000	0.0001	3.9	15	0.00005	0.00005	0.00005
Thiamethoxam (mg/L)	42	0.00001	0.00001	0.00001	0.0000	-	0.0000	0.0000	0.0	0.0	0.00001	0.00001	0.00001
Atrazine (**mg/L**) (DGV = 13 µg/L, moderate reliability)	42	0.00003	0.00018	0.000005	0.00018	0.00004	0.00000	0.00005	2.5	6.1	0.00002	0.000005	0.00004
Diazinon (µg/L) (DGV = 0.01 µg/L, moderate reliability)*	42	0.01	0.02	0.005	0.02	0.00	0.00	0.01	4.4	18	0.005	0.005	0.005
Diuron (µg/L) (DGV = 0.2 µg/L, unknown reliability)	42	0.02	0.08	0.01	0.07	0.02	0.00	0.02	2.2	4.2	0.01	0.01	0.01
Hexazinone (µg/L)	42	0.02	0.07	0.01	0.06	0.01	0.00	0.02	2.8	9.5	0.01	0.01	0.01
Metolachlor (µg/L) (DGV = 0.46 µg/L, very high reliability)	42	0.06	0.48	0.005	0.48	0.10	0.01	0.11	3.3	11	0.035	0.01	0.05
Imidacloprid (mg/L)	42	0.000005	0.00002	0.000005	0.0000	0.0000	0.0000	0.0000	5.7	34	0.000005	0.000005	0.000005
Propazine (mg/L)	42	0.000005	0.000005	0.000005	0.0000	-	0.0000	0.0000	0.0	0.0	0.000005	0.000005	0.000005
Propiconazole (µg/L)	42	0.025	0.025	0.025	0.00	-	0.00	0.03	0.0	0.0	0.025	0.025	0.025
Simazine (**mg/L**) (DGV = 3.2 µg/L, moderate reliability)	42	0.00002	0.00032	0.00001	0.00031	0.00005	0.00000	0.00005	5.5	33	0.00001	0.00001	0.00001
Tebuthiuron (**mg/L**) (DGV = 2.2 µg/L, low reliability)	42	0.00094	0.00299	0.00004	0.00295	0.00091	0.00000	0.00130	0.7	-1.0	0.00047	0.00019	0.00167
Terbutylazine (mg/L)	42	0.00002	0.00024	0.000005	0.00024	0.00004	0.00000	0.00005	3.9	17	0.00001	0.000005	0.00002
Tebuconazole (mg/L)	42	0.00001	0.00002	0.000005	0.00002	0.00001	0.00000	0.00001	2.0	2.2	0.000005	0.000005	0.000005
Atrazine-desethyl (µg/L)	42	0.05	0.10	0.05	0.1	0.0	0.0	0.1	6.5	42	0.05	0.05	0.05
Chlorantraniliprole (mg/L)	42	0.0001	0.0005	0.00005	0.0005	0.0001	0.0000	0.0001	6.3	40	0.00005	0.00005	0.00005

Refer to earlier tables for details of guideline values and limits of reporting (LOR). Values in brackets are ANZG DGV. Data shown here were converted to 0.5*LOR prior to calculation of statistics. Values in grey font are ≤LOR.
*DGV=LOR. Grey-filled cells indicate at least one value ≥ guideline value

Appendix 4 – List of Measured Pesticides

Appendix 4 Pesticides monitoring

Table A1: Pesticides measured every second month from July 2020, limits of analytical reporting provided by the commercial laboratory, and Toxicant Default Guideline Values (DGV) where available. n/a = DGV not available in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018).

Pesticide (measurement unit) Names in bold detected in monitoring samples and have been graphed	**Limit of Analytical Reporting (LOR)**	**Toxicant Default Guideline Value (DGV) (ANZG, 2018)**
Metsulfuron Methyl (µg/L)	5	n/a
Brodifacoum (mg/L)	0.00005	n/a
Fipronil (mg/L)	0.00001	n/a
Oryzalin (µg/L)	0.05	n/a
Asulam (µg/L)	2	n/a
Bromoxynil (µg/L)	0.05	n/a
Chlorothalonil (µg/L)	2	n/a
Diflufenican (µg/L)	0.02	n/a
Iprodione (µg/L)	0.05	n/a
Diketonitrile (DKN) (µg/L)	0.01	n/a
Imazapic (µg/L)	0.01	n/a
Isoxaflutole (µg/L)	0.01	n/a
Dichlorprop-P (µg/L)	0.1	n/a
Fluproponate (mg/L)	0.0001	n/a
Nicarbazin (mg/L)	0.0001	n/a
Pyrasulfotole (mg/L)	0.0001	n/a
Dicofol (µg/L)	0.1	n/a
Endothall (µg/L)	1	n/a
Hexaflurate (µg/L)	0.1	n/a
Propanil (µg/L)	0.1	n/a
Terbacil (µg/L)	0.1	n/a
Cyproconazole (µg/L)	0.02	n/a
Cyprodinil (mg/L)	0.00001	n/a
Demeton-O & Demeton-S (µg/L)	0.02	n/a
Hexaconazole* (µg/L)	0.02	n/a
Irgarol (µg/L)	0.002	n/a
Penconazole* (µg/L)	0.01	n/a
Pyrimethanil (µg/L)	0.02	n/a
Thiamethoxam (mg/L)	0.00002	n/a
Metribuzin (µg/L)	0.02	n/a
3-Hydroxy Carbofuran (µg/L)	0.02	n/a
Aldicarb (µg/L)	0.05	n/a
Ametryn (mg/L)	0.00001	n/a
Atrazine (mg/L)	0.00001	0.013
Azinophos methyl (µg/L)	0.02	0.02
Bendiocarb (µg/L)	0.1	n/a
Benomyl (µg/L)	0.01	n/a
Bolstar (Sulprofos) (µg/L)	0.05	n/a
Bromacil (µg/L)	0.02	n/a
Bromophos-ethyl (µg/L)	0.1	n/a
Carbaryl (µg/L)	0.01	n/a
Carbofuran (mg/L)	0.00001	0.0012
Carbophenothion (µg/L)	0.02	n/a

Azinphos Ethyl (mg/L)	0.00002	n/a
Chlorfenvinphos (µg/L)	0.02	n/a
Chlorpyrifos (µg/L)	0.02	0.01
Chlorpyrifos-methyl (mg/L)	0.0002	n/a
Chlorsulfuron (µg/L)	0.2	n/a
Coumaphos (µg/L)	0.01	n/a
Cyanazine (µg/L)	0.02	n/a
Cyromazine (µg/L)	0.05	n/a
Demeton-O (µg/L)	0.02	n/a
Demeton-S (µg/L)	0.02	n/a
Demeton-S-methyl (µg/L)	0.02	n/a
Diazinon (µg/L)	0.01	0.01
Dichlorvos (µg/L)	0.2	n/a
Diclofop-methyl (µg/L)	0.05	n/a
Difenoconazole (µg/L)	0.02	n/a
Dimethoate (µg/L)	0.02	0.15
Disulfoton (µg/L)	0.05	n/a
Diuron (µg/L)	0.02	n/a
Ethion (µg/L)	0.02	n/a
Ethoprop (µg/L)	0.01	n/a
Fenamiphos (µg/L)	0.01	n/a
Fenarimol (µg/L)	0.02	n/a
Fenitrothion (µg/L)	2	0.2
Fensulfothion (µg/L)	0.01	n/a
Fenthion (µg/L)	0.05	n/a
Fluometuron (µg/L)	0.01	n/a
EPN (µg/L)	0.05	n/a
Hexazinone (µg/L)	0.02	n/a
Malathion (µg/L)	0.02	0.05
Methiocarb (µg/L)	0.01	n/a
Methomyl (mg/L)	0.00001	0.0035
Methyl parathion (µg/L)	2	n/a
Metolachlor (µg/L)	0.01	0.46
Mevinphos (Phosdrin) (µg/L)	0.02	n/a
Molinate (mg/L)	0.0001	0.0034
Monocrotophos (µg/L)	0.02	n/a
Flusilazole (NuStar) (µg/L)	0.02	n/a
Omethoate (µg/L)	0.01	n/a
Oxamyl (µg/L)	0.01	n/a
Oxyfluorfen (µg/L)	1	n/a
Paclobutrazol (µg/L)	0.05	n/a
Parathion (µg/L)	0.2	0.004
Pendimethalin (µg/L)	0.05	n/a
Imidacloprid (mg/L)	0.00001	n/a
Phorate (µg/L)	0.1	n/a
Pirimiphos-methyl (mg/L)	0.00001	n/a
Pirimphos-ethyl (µg/L)	0.01	n/a
Profenofos (µg/L)	0.01	n/a
Prometryn (mg/L)	0.00001	n/a
Propazine (mg/L)	0.00001	n/a
Propiconazole (µg/L)	0.05	n/a
Prothiofos (µg/L)	0.1	n/a
Ronnel (µg/L)	10	n/a
Simazine (mg/L)	0.00002	0.0032

Sulfotepp (µg/L)	0.005	n/a
Tebuthiuron (mg/L)	0.00002	0.0022
Temephos (µg/L)	0.02	n/a
Terbufos (µg/L)	0.01	n/a
Terbutryn (mg/L)	0.00001	n/a
Terbutylazine (mg/L)	0.00001	n/a
Thiobencarb (mg/L)	0.00001	0.0028
Trichlorfon (µg/L)	0.02	n/a
Trichloronate (µg/L)	0.5	n/a
Trifluralin (mg/L)	0.01	0.0044
Tebuconazole (mg/L)	0.00001	n/a
Tetrachlorvinphos (mg/L)	0.00001	n/a
Thiodicarb (mg/L)	0.00001	n/a
Triazophos (mg/L)	0.000005	n/a
Aminopyralid (µg/L)	0.1	n/a
Atrazine Desispropyl (mg/L)	0.0001	n/a
Atrazine-desethyl (µg/L)	0.1	n/a
Azoxystrobin (mg/L)	0.0001	n/a
Bensulide (µg/L)	0.1	n/a
Boscalid (µg/L)	0.1	n/a
Carfentrazone-ethyl (mg/L)	0.0001	n/a
Haloxyfop (µg/L)	0.1	n/a
Imazapyr (mg/L)	0.01	n/a
Indoxacarb (mg/L)	0.0001	n/a
Metalaxyl-M (mg/L)	0.0001	n/a
Metaldehyde (mg/L)	0.01	n/a
Pyraclostrobin (µg/L)	0.1	n/a
Pyroxsulam (mg/L)	0.0001	n/a
Quinclorac (µg/L)	0.1	n/a
Spirotetramat (mg/L)	0.0001	n/a
Tetraconazole (µg/L)	0.1	n/a
Toltrazuril (mg/L)	0.0001	n/a
Trifloxystrobin (µg/L)	0.1	n/a
Trinexapac Ethyl (µg/L)	1	n/a
Naphthalophos (mg/L)	0.001	n/a
Novaluron (µg/L)	0.1	n/a
Rimsulfuron (µg/L)	0.1	n/a
Siduron (µg/L)	0.1	n/a
Chloroxuron (µg/L)	0.1	n/a
Propachlor (µg/L)	0.1	n/a
Vernolate (µg/L)	0.1	n/a
Acephate (µg/L)	0.5	n/a
Amitraz (mg/L)	0.1	n/a
Carbendazim (µg/L)	0.1	n/a
Carboxin (µg/L)	0.1	n/a
Avermectin (µg/L)	0.1	n/a
Chlorantraniliprole (mg/L)	0.0001	n/a
Butachlor (mg/L)	0.0001	n/a
Dichlobenil (µg/L)	0.1	n/a
Diflubenzuron (µg/L)	0.1	n/a
Diphenamid (µg/L)	0.1	n/a
s-Ethyl dipropylthiocarbamate (µg/L)	0.1	n/a
Etridiazole (µg/L)	0.5	n/a
Fenoxycarb (µg/L)	0.1	n/a

Flamprop-methyl (µg/L)	0.1	n/a
Formothion (µg/L)	20	n/a
Fosetyl-al (µg/L)	10	n/a
Iodosulfuron methyl (µg/L)	0.1	n/a
Isoproturon (µg/L)	0.1	n/a
Londax (µg/L)	0.1	n/a
Metachlor (µg/L)	0.1	n/a
Metalaxyl (µg/L)	0.1	n/a
Methidathion (µg/L)	0.1	n/a
Napropamide (µg/L)	0.1	n/a
Nitralin (µg/L)	0.1	n/a
Norflurazon (µg/L)	0.1	n/a
Pebulate (µg/L)	0.1	n/a
Pirimicarb (µg/L)	0.1	n/a
Prochloraz (µg/L)	0.1	n/a
Promecarb (µg/L)	0.1	n/a
Pronamide (µg/L)	0.1	n/a
Propamocarb (µg/L)	0.1	n/a
Propargite (mg/L)	0.0001	n/a
Pyrazophos (µg/L)	0.1	n/a
Pyriproxyfen (µg/L)	0.1	n/a
Systhane (µg/L)	0.1	n/a
Thiometon (µg/L)	0.5	n/a
Triadimefon (µg/L)	0.1	n/a
Triadimenol (mg/L)	0.0001	n/a
Trifloxysulfuron-sodium (µg/L)	0.1	n/a
2,4,5-Trichlorophenoxy Acetic Acid (mg/L)	0.01	0.036
2,4,5-TP (Silvex) (mg/L)	0.01	n/a
Hedonal (mg/L)	0.01	0.28
2,4-Dichlorprop (mg/L)	0.01	n/a
2,4,6-Trichlorophenoxy-acetic acid (mg/L)	0.01	n/a
4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB) (µg/L)	10	n/a
4-Chlorophenoxy acetic acid (mg/L)	0.01	n/a
Clopyralid (µg/L)	10	n/a
2,6-D (mg/L)	0.01	n/a
Dicamba (µg/L)	10	n/a
Picloram (µg/L)	10	n/a
Fluroxypyr (µg/L)	10	n/a
2-Methyl-4-chlorophenoxyacetic acid (µg/L)	10	n/a
2-Methyl-4-Chlorophenoxy Butanoic Acid (µg/L)	10	n/a
Mecoprop (µg/L)	10	n/a
Triclopyr (mg/L)	0.01	n/a

Appendix 5 – Hydrographs and Sampling Data

Appendix 5 – Discharge during Lower Fitzroy sampling events

Discharge data from gauging stations at Riverslea (Figure 1) and The Gap (Figure 2) were sourced from the Queensland Government's Water Monitoring Information Portal: https://water-monitoring.information.qld.gov.au/

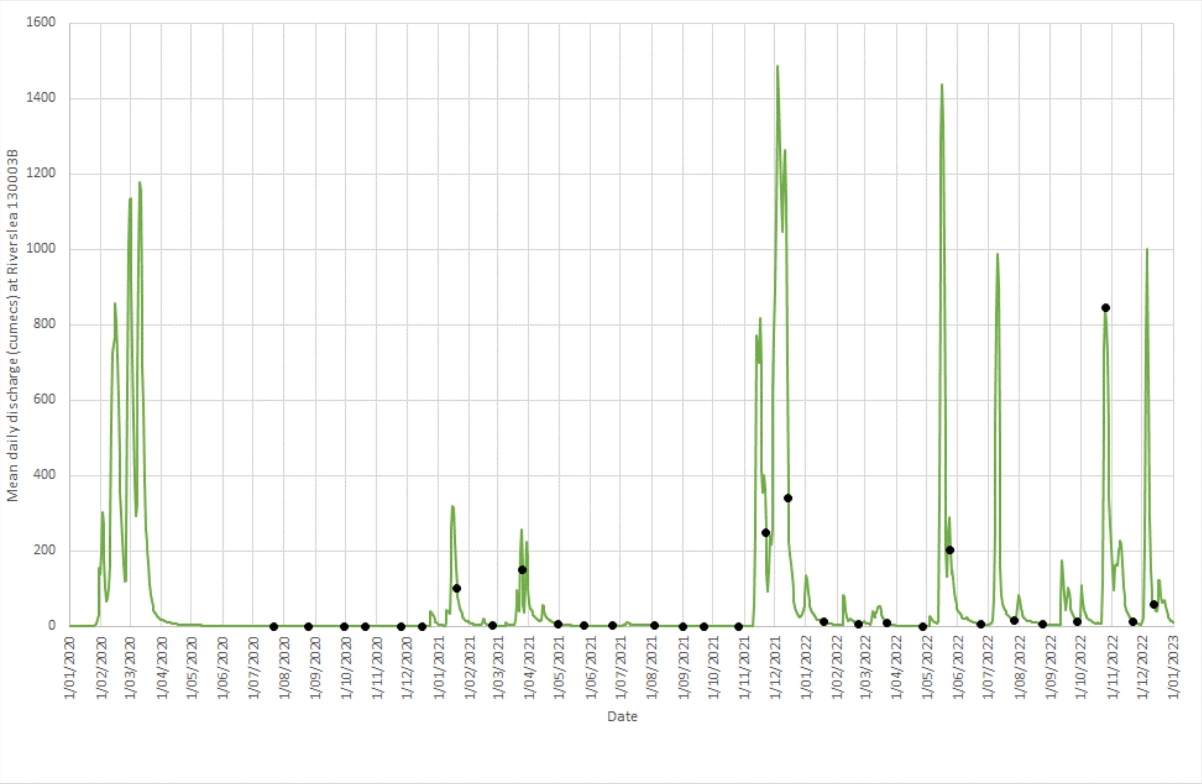


Figure 1. Dates of Sunwater sampling events from July 2020 to December 2022, and mean daily discharge (cumecs) at Riverslea.

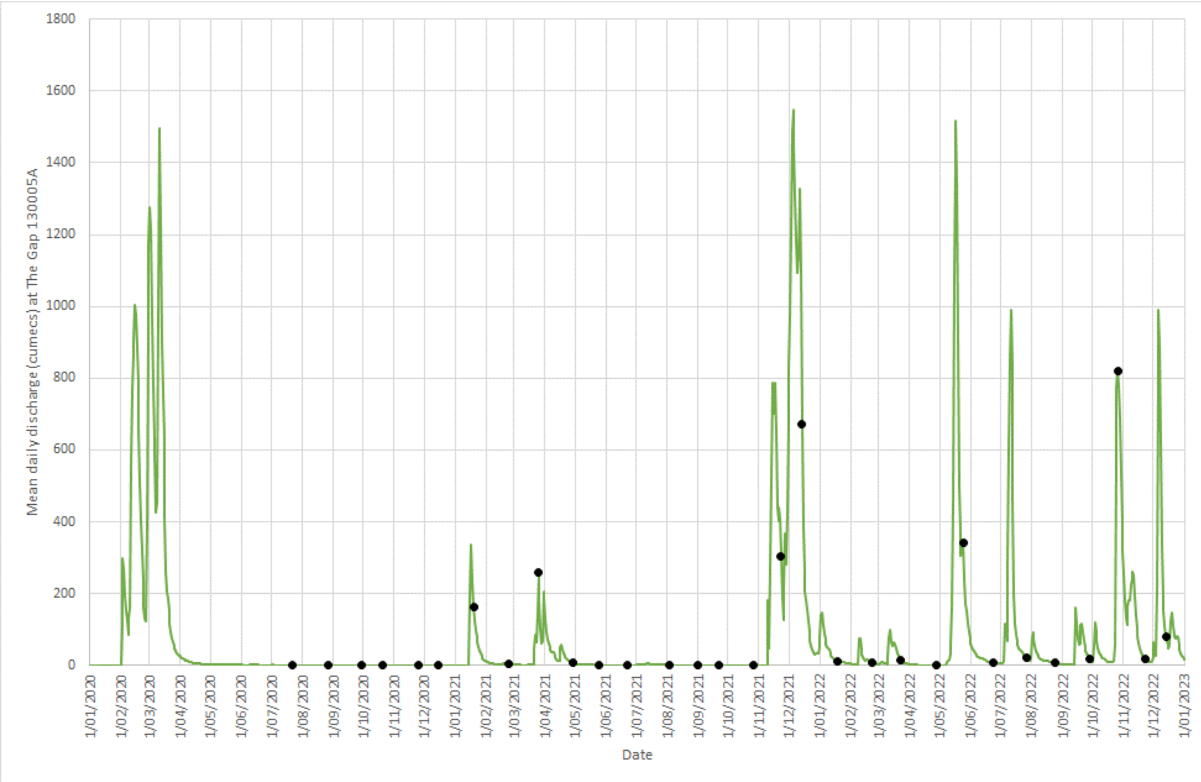


Figure 2. Dates of Sunwater sampling events from July 2020 to December 2022, and mean daily discharge (cumecs) at The Gap.

Appendix 6 – Consultation on Program Design

Appendix 6 Details of consultation

To ensure the water quality monitoring and reporting program meets current recognised standards, consultation with water quality experts and stakeholders has been undertaken as detailed in the following table.

Date	Forum	Name	Department/organisation and section
12/9/2019	Emailed draft program design and invitation to provide written comments and/or attend the workshop	Dane Moulton David Waters Dr Mark Silburn Dr Ryan Turner Arran Corbett Rohan Wallace Sam Tarlinton Brendan Tyndall Sam Smith Dr Andrew Moss A/Prof Eva Abal Dr Roger Shaw A/Prof Helen Stratton Dr Sue Vink Dr Barbara Robson Dr John Platten	DES, Environmental Policy and Programs DNRME, Water Quality Modelling DNRME, P2R Reef Project Leader DES, Water Quality & Investigations DNRME, Hydrographic Support Unit DES, Water Quality & Investigations DNRME, Regional Manager Water Services DES, Utilities (Assessment) DES, Utilities (Assessment) DES, Aquatic Ecosystem Health International River Foundation and Chair FPRH Science Panel Chair, Independent Science Panel for Reef 2050, and FPRH Science Panel Aquatic microbiologist Griffith University and FPRH Science Panel Biogeochemist and mine water quality The University of Queensland, and FPRH Science Panel Australian Institute of Marine Science and FPRH Science Panel Aquatic ecologist, FPRH Science Panel
12/9/2019	Email response with written comments	Dr Mark Silburn	DNRME, P2R Reef Project Leader
16/9/2019	Email response with written comments	Dr Andrew Moss	DES, Aquatic Ecosystem Health
16/9/2019	Email response with written comments	Dr John Platten	Aquatic ecologist, FPRH Science Panel
18/9/2019	In-person attendance at workshop, held at CQUniversity Brisbane Campus, 160 Ann Street, Brisbane	Arran Corbett Rohan Wallace Dr Andrew Moss Brendan Tyndall Sam Tarlinton Sam Smith A/Prof Eva Abal Dr Barbara Robson	DNRME, Hydrographic Support Unit DES, Water Quality & Investigations DES, Aquatic Ecosystem Health DES, Utilities (Assessment) DNRME, Regional Manager Water Services DES, Utilities (Assessment) International River Foundation and Chair FPRH Science Panel Australian Institute of Marine Science and FPRH Science Panel

		Project team attendees: Nicole Flint, John Rolfe, Catherine Jones (all CQU), Craig Davenport (Fitzroy Basin Association)	
1/6/2020	Emailed revised monitoring schedule and received comments in reply	Dr Mark Silburn	DNRME, P2R Reef Project Leader
1/6/2020	Emailed revised monitoring schedule and received comments in reply	David Waters	DNRME, Reef Water Quality Monitoring
9/6/2020	Emailed draft of monitoring schedule	Dr Ryan Turner (forwarded to Rohan Wallace)	DES, Water Quality & Investigations
10/6/2020	Emailed draft of monitoring schedule and received comments in reply	Dr Roger Shaw	Chair, Independent Science Panel for Reef 2050, and FPRH Science Panel
Following DCCEEW feedback on draft Program Design			
11/10/2022	Emails regarding sediment resuspension, event monitoring regimes, contaminant load calculations	David Waters Shawn Darr	DES, Reef Water Quality Modelling DES, Catchment Modelling
18/10/2022	Zoom meeting to discuss water quality modelling, monitoring, loads	David Waters Shawn Darr Also attended by project team from CQU, FBA and Sunwater	DES, Reef Water Quality Modelling DES, Catchment Modelling
5/12/2022	Phone discussion of event monitoring	Catherine Neelamraju	DES, Water Quality & Investigations
5/12/2022	Zoom meeting to discuss event	David Orr Dr Reinier Mann	DES, Water Quality & Investigations DES, Water Quality & Investigations

	monitoring regimes and pesticides	Also attended by project team from CQU and Sunwater	
15/5/2023	Emailed to discuss water quality monitoring and reporting program	Julia Chandler Kevin Edison	GBRMPA, Environmental Protection and Assessment GBRMPA, Environmental Protection and Assessment
22/5/2023	Emailed to discuss upcoming stakeholder review of water quality monitoring and reporting program	Timothy Moravek Kevin McCosker	DAF, Agriculture DAF, Program Leader (Reef)
31/5/2023	Email clarification of Queensland Government event monitoring for reef loads	David Orr	DES, Water Quality & Investigations
16/01/2024	Presentation of revised water quality and reporting program to stakeholders, for additional feedback	Reinier Mann Shawn Darr Christian White Giuditta Bonetti Andrew Moss David Orr Adam Northey Kevin McCosker	DESI DESI DESI DESI DESI DESI DAF DAF

Appendix 7 – Water quality Monitoring Schedules

Chart A: Inundation Monitoring -Routine

Alternative Sites (sampled when main sites are inaccessible)

Commences during operational phase **before** water is sold to customers

Upstream

- Coolmaringa (alternative: Apis Creek)
- Rannes
- Beckers (alternative: Baralaba)
- Boolburra

Within impoundment

- Yarra Road
- The Pocket
- Riverslea
- Weir US (alternative: At Rookwood)

Downstream

- Weir DS
- Glenroy Road (alternative: Craiglee Road)
- Hanrahan
- Fitzroy at FRW (alternatives: The Gap, Etna Creek)

Field Observations (all sites)

Photos Required: Looking Upstream, Across Stream and Downstream

Other Readings: Air Temperature, Catchment Rainfall in the Last 24 hours, Presence of Visible debris in the water

Monthly Sampling (Upstream and Downstream)

Required instrument readings (In-situ surface) : Oxidation-Reduction Potential (mV), Temperature (C), Dissolved Oxygen (mg/L), Dissolved Oxygen Saturation (%),Total Dissolved Solids (mg/L), Electrical Conductivity (us/cm), Turbidity (NTU), pH

Monthly Sampling (Within impoundment)

Required instrument readings (In situ surface) : Oxidation-Reduction Potential (mV), Temperature (^{0}C), Dissolved Oxygen (mg/L), Dissolved Oxygen Saturation (%),Total Dissolved Solids (mg/L), Electrical Conductivity (us/cm), Turbidity (NTU), pH

Required instrument readings (In situ depth profile): Temperature depth profile of 1m intervals from the surface to 0.5m from the bottom of the impoundment.

Monthly Lab Sampling (Surface Grab)

Ammonia as N (mg/L), Chlorophyll-a (mg/L), Nitrate (as N) (mg/L), Nitrite + Nitrate as N (mg/L) (Dissolved inorganic N, DIN), Nitrite (as N) (mg/L), Total Suspended Solids (mg/L), Particle Size Analysis (PSA), Total Dissolved Solids (mg/L), Kjeldahl Nitrogen Total (mg/L) (TKN, Total organic N), Total Nitrogen (mg/L) (TN), Total Phosphorus as P (mg/L) (TP), Phosphorous Reactive (as P) (mg/L) (FRP, dissolved inorganic P, DIP), Total Nitrogen (filtered) (mg/L), Kjeldahl Nitrogen Total (filtered) (mg/L) (Dissolved organic N, DON), Total Phosphorus as P (filtered) (mg/L), Calculated tests: [TN]- [TN-filtered], [TKN] – [TKN-filtered], [TP] – [TP-filtered]

Bi-Monthly Lab Sampling (Surface Grab)

Metals/Hardness: Aluminium (filtered) (mg/L), Copper (filtered) (mg/L), Iron (filtered) (mg/L), Manganese (filtered) (mg/L), Zinc (filtered) (mg/L), Hardness as CaCO3 (mg/L), Alkalinity (Bicarbonate as CaCO3) (mg/L), Alkalinity (Carbonate as CaCO3) (mg/L), Alkalinity (Hydroxide) as CaCO3 (mg/L), Alkalinity (total) as CaCO3 (mg/L)

Pesticide testing: Chlorpyrifos, Fipronil, Imidacloprid, Haloxyfop, Imazapic, Metsulfuron-methyl, Pendimethalin, Metolachlor, Ametryn, Atrazine, Terbuthylazine, Tebuthiuron, Simazine, Diuron, Terbutryn, Hexazinone, Metribuzin, 2,4-D, MCPA, Fluroxypyr, Triclopyr,Isoxaflutole

Prepared by Sunwater

Chart B : Agricultural and Inundation Monitoring -Routine

Commences during operational phase **when** water is sold to customers

Agricultural Monitoring sites only

Alternative Sites (sampled when main sites are inaccessible)

Upstream

Coolmaringa
Rannes
Beckers
Boolburra
Apis Creek Road
Baralaba

Within impoundment and Downstream

Yarra Road
The Pocket
Riverslea
Weir US
Weir DS
The Gap
Hanrahan
Glenroy Road
Etna Creek
At Rookwood

Downstream of Land Use Change

Craiglee Road
Fitzroy at FRW

Field Observations (all sites)

Photos Required: Looking Upstream, Across Stream and Downstream

Other Readings: Air Temperature, Catchment Rainfall in the Last 24 hours, Presence of Visible debris in the water

Monthly Sampling (Upstream, downstream and downstream of land use change)

Required instrument readings (In situ surface): Oxidation-Reduction Potential (mV), Temperature (C), Dissolved Oxygen (mg/L), Dissolved Oxygen Saturation (%),Total Dissolved Solids (mg/L), Electrical Conductivity (us/cm), Turbidity (NTU), pH

Monthly Sampling (Within impoundment)

Required instrument readings (In situ surface): Oxidation-Reduction Potential (mV), Temperature (C), Dissolved Oxygen (mg/L), Dissolved Oxygen Saturation (%),Total Dissolved Solids (mg/L), Electrical Conductivity (us/cm), Turbidity (NTU), pH

Required instrument readings (In situ depth profile): Temperature depth profile of 1m intervals from the surface to 0.5m from the bottom of the impoundment.

Monthly Lab Sampling (Surface Grab)

Ammonia as N (mg/L), Chlorophyll-a (mg/L), Nitrate (as N) (mg/L), Nitrite + Nitrate as N (mg/L) (Dissolved inorganic N, DIN), Nitrite (as N) (mg/L), Total Suspended Solids (mg/L), Particle Size Analysis (PSA), Total Dissolved Solids (mg/L), Kjeldahl Nitrogen Total (mg/L) (TKN, Total organic N), Total Nitrogen (mg/L) (TN), Total Phosphorus as P (mg/L) (TP), Phosphorous Reactive (as P) (mg/L) (FRP, dissolved inorganic P, DIP), Total Nitrogen (filtered) (mg/L), Kjeldahl Nitrogen Total (filtered) (mg/L) (Dissolved organic N, DON), Total Phosphorus as P (filtered) (mg/L), Calculated tests: [TN]- [TN-filtered], [TKN] – [TKN-filtered], [TP] – [TP-filtered]

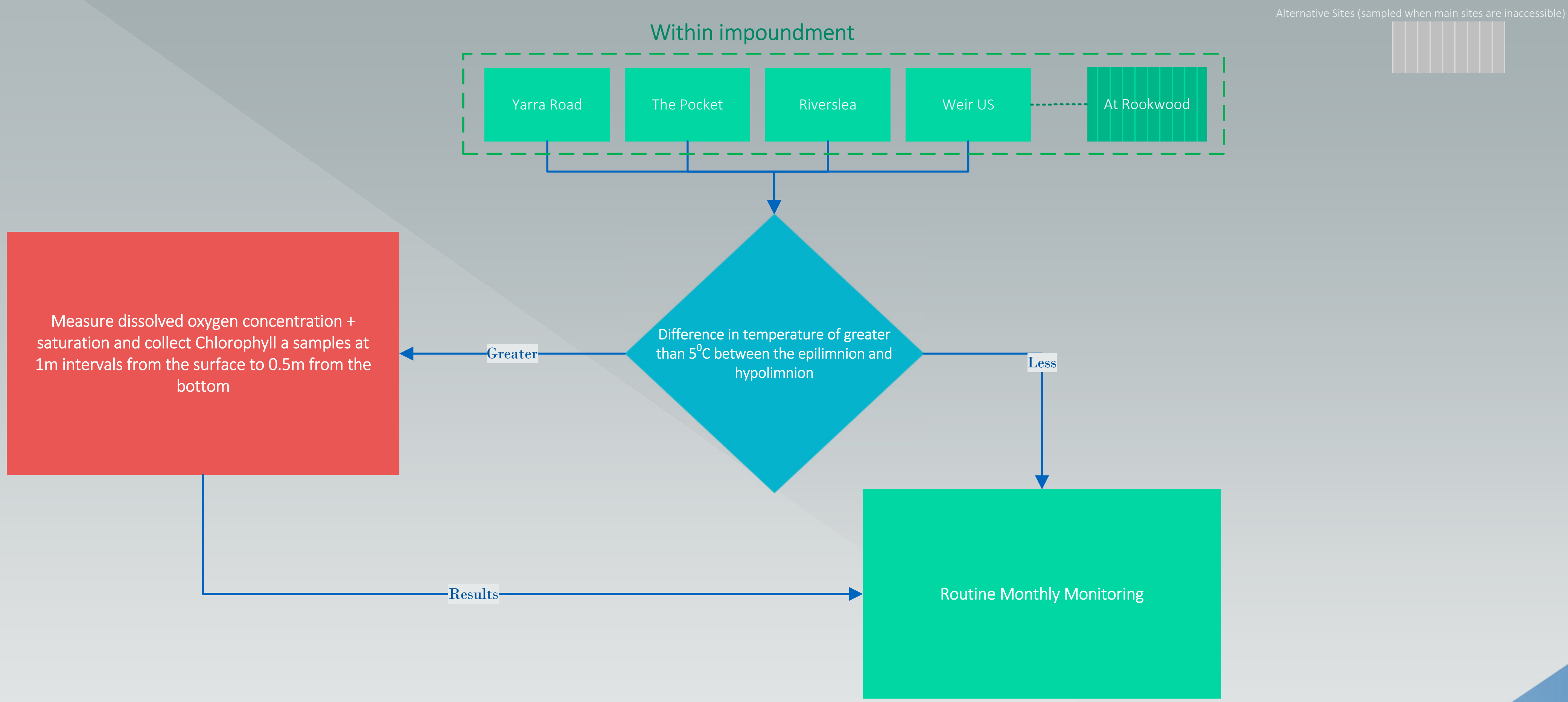
Bi-Monthly Lab Sampling (Surface Grab)

Metals/Hardness: Aluminium (filtered) (mg/L), Copper (filtered) (mg/L), Iron (filtered) (mg/L), Manganese (filtered) (mg/L), Zinc (filtered) (mg/L), Hardness as CaCO3 (mg/L), Alkalinity (Bicarbonate as CaCO3) (mg/L), Alkalinity (Carbonate as CaCO3) (mg/L), Alkalinity (Hydroxide) as CaCO3 (mg/L), Alkalinity (total) as CaCO3 (mg/L)

Pesticide testing: Chlorpyrifos, Fipronil, Imidacloprid, Haloxyfop, Imazapic, Metsulfuron-methyl, Pendimethalin, Metolachlor, Ametryn, Atrazine, Terbuthylazine, Tebuthiuron, Simazine, Diuron, Terbutryn, Hexazinone, Metribuzin, 2,4-D, MCPA, Fluroxypyr, Triclopyr,Isoxaflutole

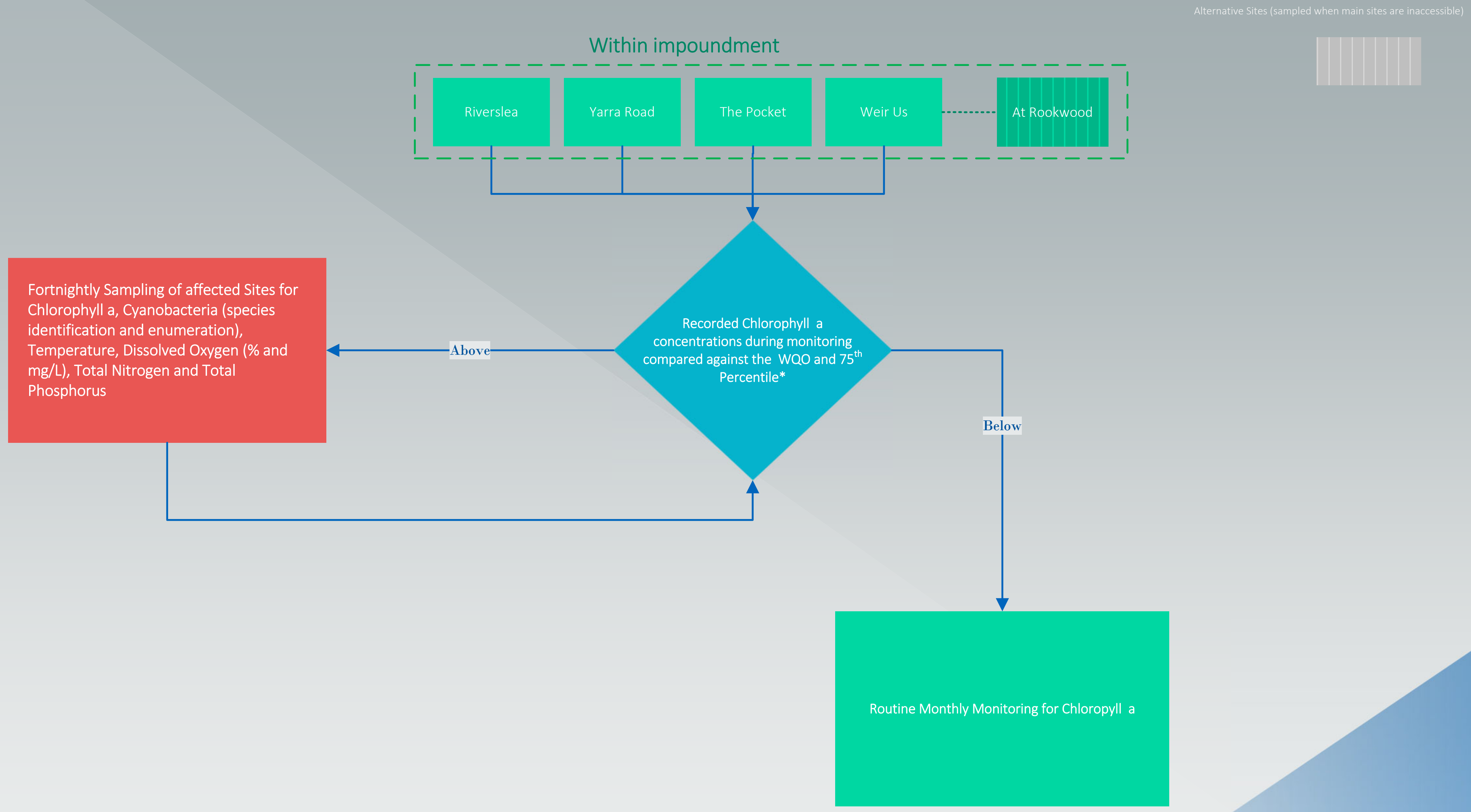
Prepared by Sunwater

Chart C: Inundation Monitoring - Event Triggers, Stratification



Prepared by Sunwater

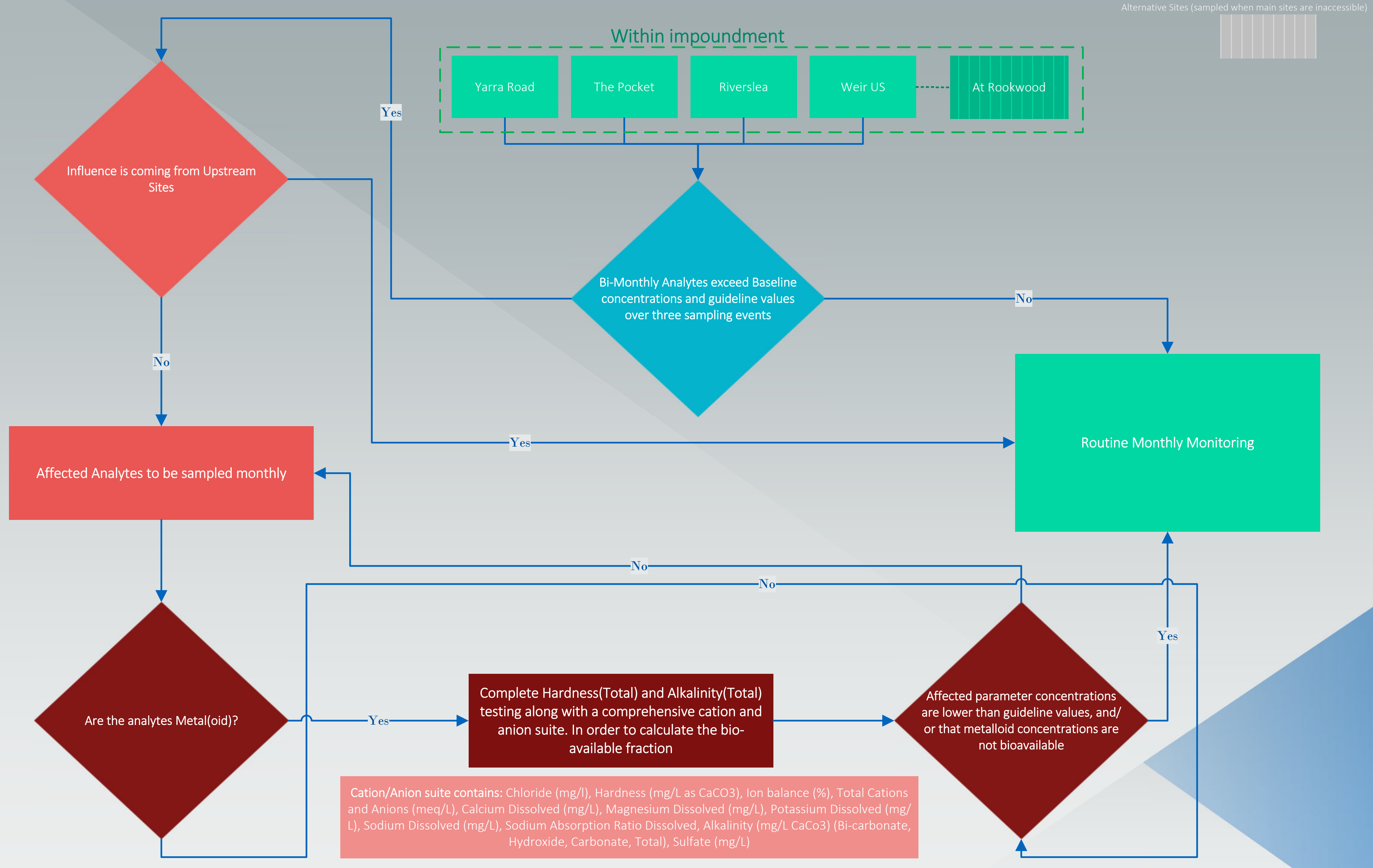
Chart D: Inundation Monitoring - Event Triggers, Algal Blooms



*The Chlorophyll a trigger limit is the WQO for Lower Fitzroy (0.005 mg/L) and the 75th percentile of baseline data before inundation (0.007 mg/L)

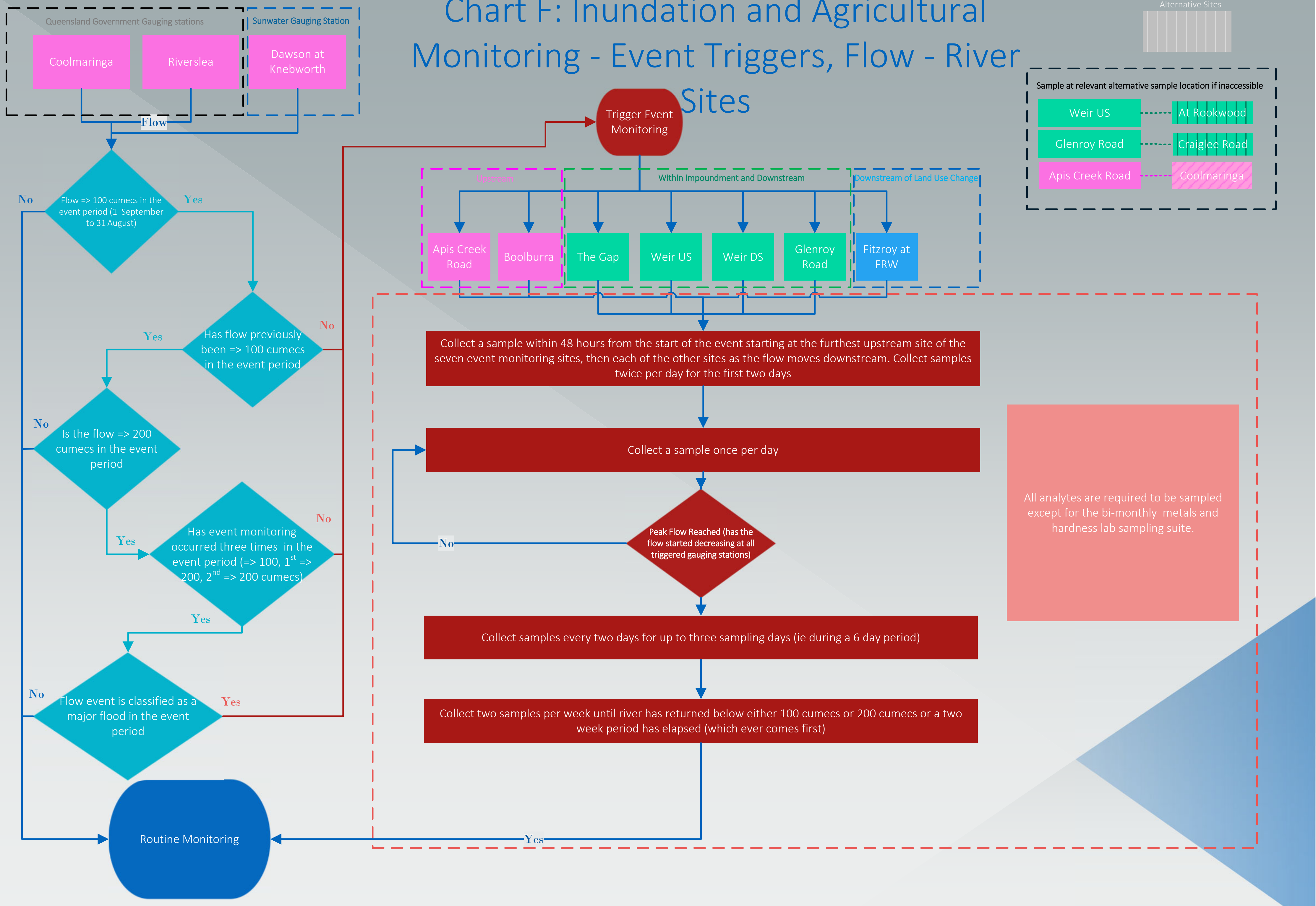
Prepared by Sunwater

Chart E: Inundation Monitoring - Event Triggers, Bi Monthly Analytes exceed baseline concentrations



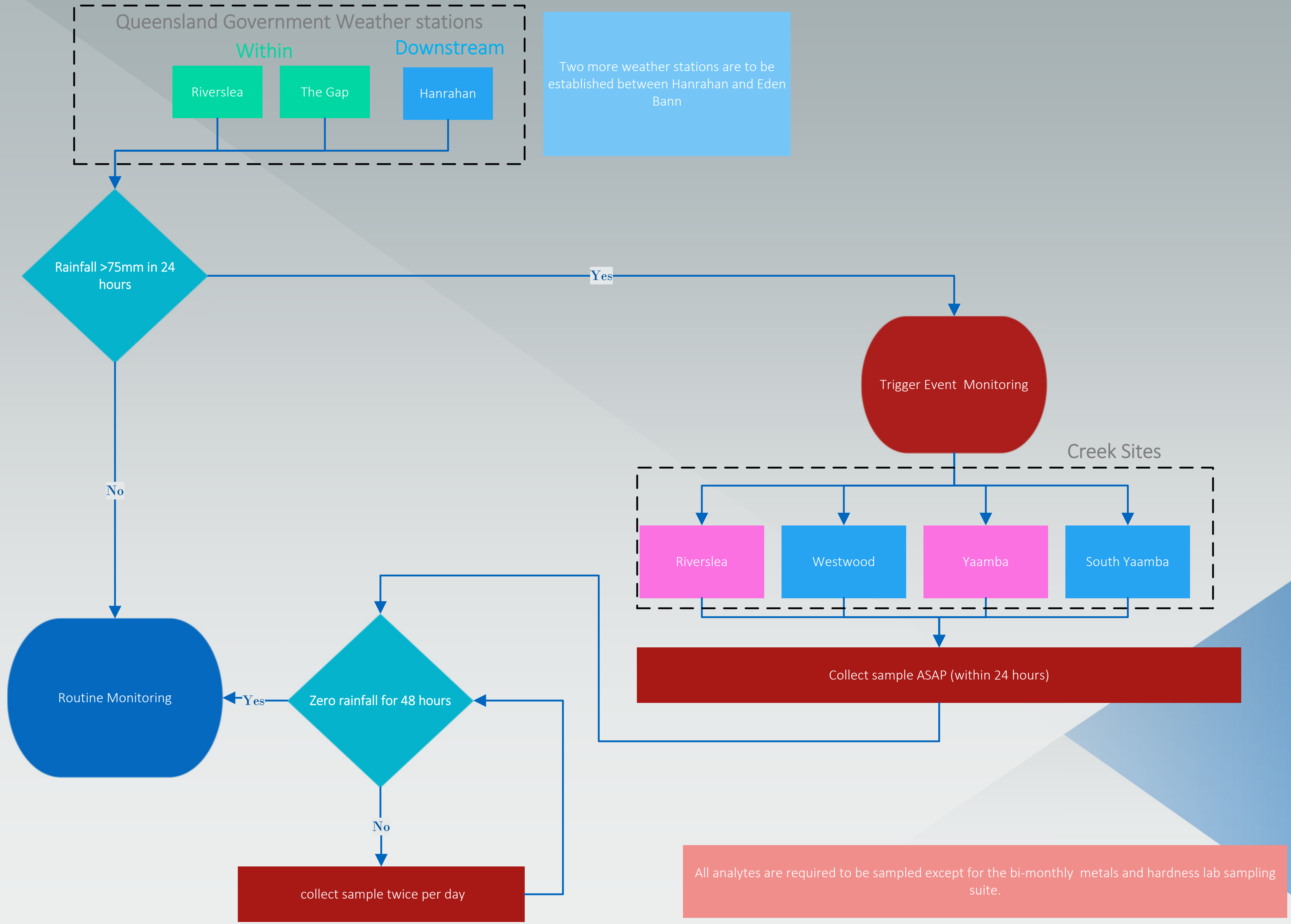
Prepared by Sunwater

Chart F: Inundation and Agricultural Monitoring - Event Triggers, Flow - River Sites



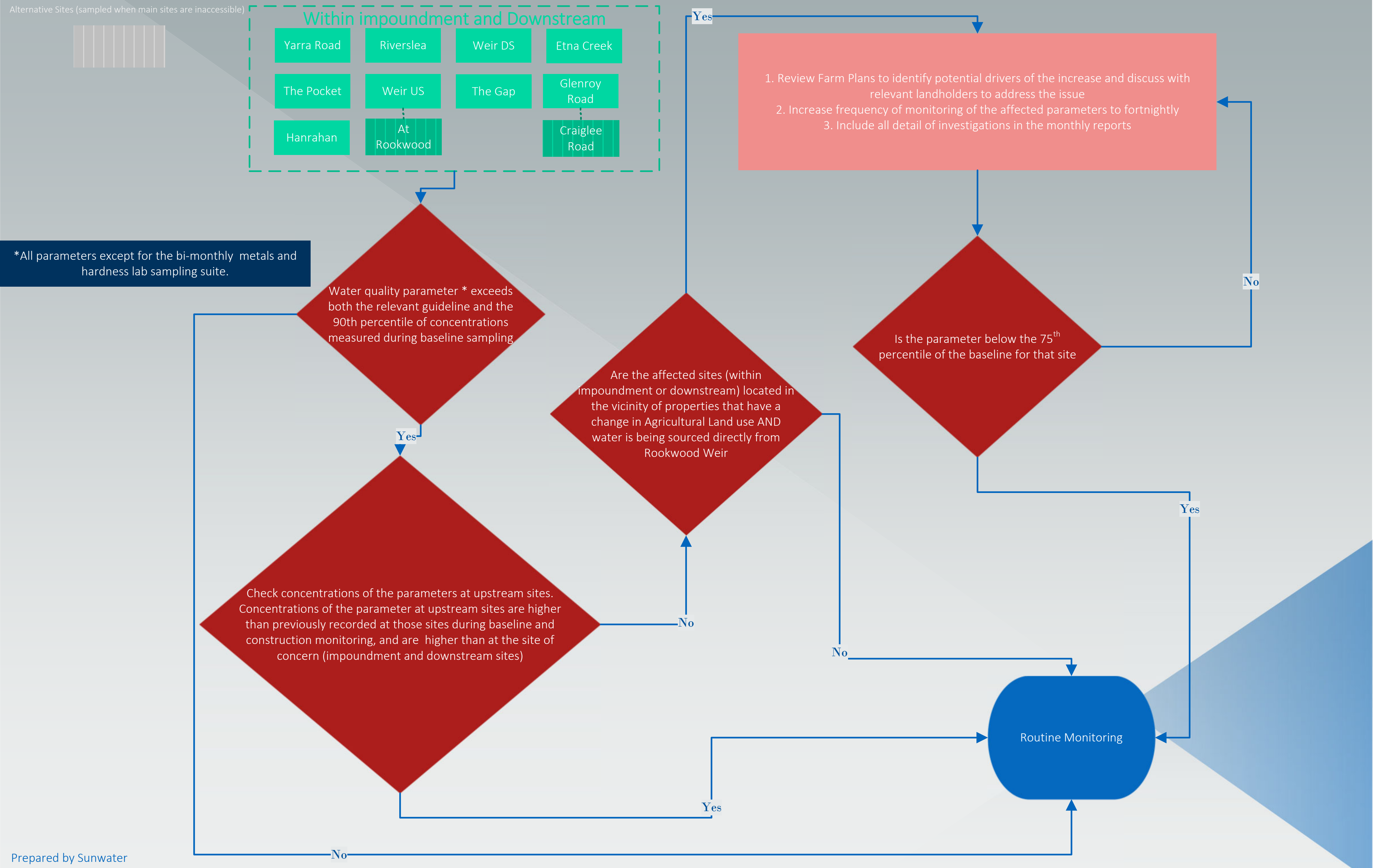
Prepared by Sunwater

Chart G: Agricultural Monitoring - Event Triggers, High Rainfall - Creek Sites



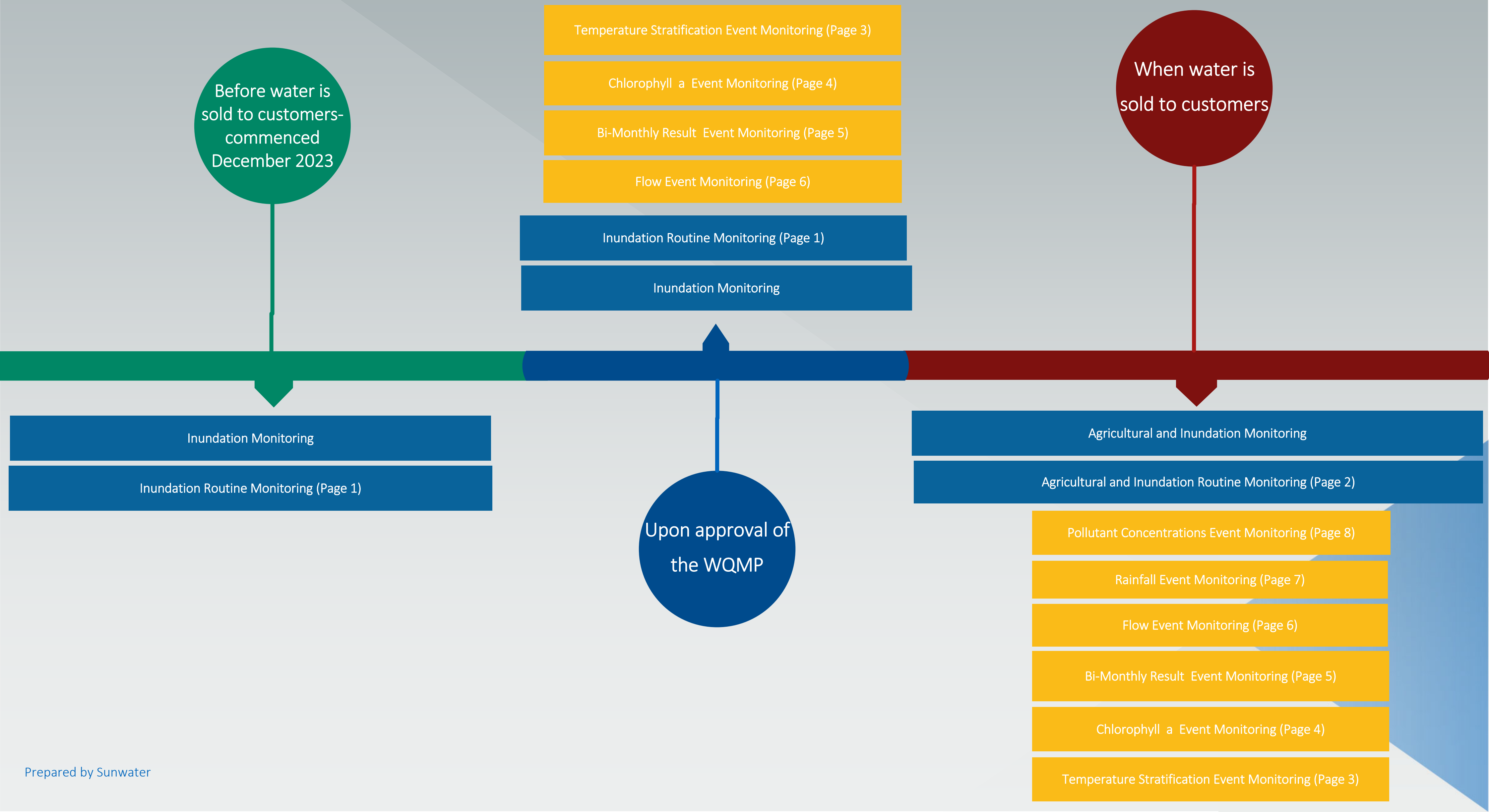
Prepared by Sunwater

Chart H: Agricultural Monitoring - Event Triggers, Increase in pollutant concentrations



Prepared by Sunwater

Chart I: Water Quality Monitoring Plan-Timeline



Prepared by Sunwater

Appendix 8 – Sunwater Monitoring Pre-action Baseline

Sunwater Monitoring Data

Location	Site No	Catchment	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Coolmaringa	1a	Mackenzie																														
Apis Ck Rd	1b	Mackenzie																														
Rannes	2	Callide																														
Beckers	3a	Lower Dawson																														
Baralaba	3b	Lower Dawson																														
Boolburra	4	Fitzroy																														
Yarra	5	Fitzroy																														
The Pocket	6	Fitzroy																														
Riverslea	7	Fitzroy																														
Weir US	8b	Fitzroy																														
Rookwood	8a / 9a	Fitzroy																														
Weir DS	9b	Fitzroy																														
Hanrahan	10	Fitzroy																														
Glenroy Rd	11a	Fitzroy																														
Craiglee	11b	Fitzroy																														
The Gap	12a	Fitzroy																														
Etna Ck	12b	Fitzroy																														
Rockhampton	12c	Fitzroy																														

Start EPBC Action

Early works Rookwood Weir site

Commencement In River works Rookwood

All data included in Pre-action baseline

All data included in Pre-action baseline except for TSS and Turbidity

Pesticide data only included in Pre action baseline