

Monitoring Plan

Priority Neighbourhood Catchments

Water Quality Monitoring – a multi-farm, event monitoring program



Summary

Government initiatives over the years, such as the former National Action Plan for Salinity and Water Quality, and the Reef Water Quality Protection Plan (currently version 2009), have the common objective to reverse the decline in water quality entering streams, coastal and inner reef lagoons. The Fitzroy Basin Association (FBA), through a regional planning process, is required to develop water quality targets for our region, identify hotspot areas and prioritise management actions.

This monitoring program focuses on sediment, salinity and nutrient (nitrogen and phosphorus) parameters. Simple load and concentration calculations are derived for these parameters. Monitoring is conducted at the Neighbourhood Catchment scale (approximately a 300km² to 2000km² catchment or group of small catchments).

Initially, due to budget constraints and the higher level of data quality required, a representative site was targeted for monitoring in every second priority neighbourhood catchment that FBA's sub-regional network had identified. This meant a targeted total of 25 sites monitored. Current sites are depicted in *Figure 1, FBA PNCWQM monitoring sites*. There is scope, with extra resources, to use this framework to expand the program to monitor additional hot spot catchments and catchments identified as potential reference or comparator sites throughout the Fitzroy basin and associated coastal catchments. Monitoring partnerships have been and will continue to be developed where possible to complement this program.

This monitoring focuses on event sampling and captures data over the hydrograph for basic load calculations. This is being conducted to provide baseline data and eventually a baseline trend supporting NRM improvements brought about by stakeholders in at the Neighbourhood Catchment scale



Support for regionally focused catchment-based sediment and nutrient load monitoring is important as the need for validating modelled outputs and tracking water quality improvements in line with on-ground action grows.

Other objectives of this monitoring program include: engagement and involvement of landholders and stakeholders able to bring about management change at the Neighbourhood Catchment scale; input to FBA's Monitoring Evaluation Reporting and Improvement (MERI) water quality requirements; and refinement of water quality models

used to aid in the setting of water quality targets.

Project management is the responsibility of the Healthy Waterways staff and management is supervised by the Healthy Waterways Manager. Property managers who live near strategically selected sites are recruited to sample floodwaters over the hydrograph. FBA network staff provide training, support and feedback to property managers as well as organising sampling logistics.

Monitoring partnerships are established with parties conducting water monitoring programs with common objectives between the monitoring programs. These partnerships include brokerage of financial or other in-kind understandings depending on the unique needs of each partner. Samples are analysed by Queensland Health Forensic and Scientific Services for total nitrogen (TN), total phosphorus (TP)



Version 5

and total suspended solids (TSS). FBA staff analyse samples for Turbidity, pH and Salinity. There is potential for additional sampling, including pesticide and herbicide monitoring and detailed nutrient analysis depending on future needs and funding avenues. Cross-sectional analysis, level and load calculations are conducted by FBA staff using techniques established by Department of Environment and Resource Management (DERM) Hydrographical Services.

Data is stored on FBA's server and into the future will be stored on the uniDap WaterQ database. Reporting is conducted annually by FBA staff. Reports are aimed at two distinct audiences. The primary audience are those able to take the information and make a landscape change, including land managers, catchment officers, field officers, industry staff and the general community. In addition reporting is targeted to address organisational monitoring, evaluation, reporting and improvement planning.

For a copy of the 'Priority Neighbourhood Catchments Water Quality Monitoring' monitoring plan, visit www.fba.org.au or, contact one of the following staff: Luke Ukkola, by email at Luke.Ukkola@fba.org.au or by phone on (07) 4999 2819, or Rachel Bryan, Senior Healthy Waterways Officer, by email at Rachel.Bryan@fba.org.au or by phone on (07) 4975 6555.



CARING
FOR
OUR
COUNTRY

Fitzroy Basin Association PNCWQM is funded by Australian
and Queensland Government initiatives



www.fba.org.au

Why Monitor? (Project Objectives)

Sediments and nutrients entering our waterways have a major impact on in-stream habitat and coastal and reef environs. Along with this, land managers are concerned about losing excess soil and fertilisers above natural levels due to the impact on production and associated on-farm costs. Stakeholders from the mining, industry and urban sector are also aiming for best management and continuous improvement measures to minimise their impact on waterway health.

Objective 1: Many private, commercial and government initiatives are in place to deal with the entry of sediments and nutrients to waterways, with many opportunities for new initiatives. The FBA and its network of partners are committed to co-investing initiative funding with the region's various stakeholders to reduce sediment and nutrients entering our waterways. Information gathered as part of this program will contribute to other programs inputting to an overall Reef Plan monitoring and evaluation strategy. Thus, *we need a monitoring program to input to a regionally coordinated, catchment-based Monitoring Evaluation Reporting and Improvement framework.* This is the program's first objective.



Objective 2: To meet the first objective of the program, *we need to know what the baseline sediment and nutrient loads are to guide our investment and target setting process.* This is the second objective. Modelling this information is one way of aiding this planning and investment process. Everyone knows that a model is only as accurate as the monitored data it bases its assumptions upon. There is currently no regionally focused, catchment-based monitoring program to measure load-based sediment and nutrient in the Fitzroy and associated coastal catchments.

Objective 3: Therefore, *we need to verify the modelling currently being used for planning processes to see if it actually reflects reality.* This is the third objective of the monitoring program. Model verification and refinement will aid in both current and future planning for on-ground actions as well as refining Management Action Targets and the estimates of load-based reductions of sediments resulting from these actions.



Objective 4: All of these objectives are pointless, however, unless they engage people living and working in the catchment. Therefore the fourth and most important objective is that *we will engage land managers and groups currently monitoring, to collect samples and build a level of trust in the data as well as contributing to their understanding of water quality issues within their catchment.*



Who benefits from the information, and how is it applied?

Monitoring for the sake of it wastes time, effort and resources. Similarly, collecting data that cannot be utilised is disappointing and can destroy a sampler's initial enthusiasm. That is why the data collected in this program has defined uses and beneficiaries which are tied heavily to deliver the project's objectives.

The first and most important data users are those living and working in catchments. As agricultural, industrial, urban and mining sectors move down a path of continual improvement, the health of our waterways will only improve. There is no better way to celebrate little victories than to collect information that shows our



waterways are improving over time. Reporting must meet the needs of those living in the catchments. If information is not accepted and used at the grassroots, this monitoring becomes a great planning and awareness-raising tool that results in no action.

Looking beyond the needs of those living and working in these catchments, *this data can be used to help guide those in control of common financial resources to help accelerate practice change where economic barriers hold back some from adopting best current practice.* These planners sit at various levels of government as well as

within the private sector and not-for-profit organisations. The FBA network uses data from this monitoring to plan, prioritise and pinpoint funding received to aid all sectors in the catchment to bring about practice changes that offer the best bang for the buck. We anticipate this monitoring will also help secure future funding to improve water quality throughout the entire region. Other planning groups will also have access to some information, enabling them to direct funding also.

To aid planners in the interpretation of this data, *modellers, statisticians and scientists may be contracted by FBA to deliver FBA and our subregional network interpreted data that provides further guidance on what type of management action targets we can support and what reductions in sediment and nutrients we may see in the long term as a result of these management action targets.* This data will help FBA select the best management action targets and can provide potential practice change investors with an idea of what their funding may deliver in terms of long term load-based reductions for dollars invested (water quality targets).



CARING
FOR
OUR
COUNTRY

Fitzroy Basin Association PNCWQM is funded by Australian
and Queensland Government initiatives



What is monitored and how?

In any monitoring program, there are a suite of indicators that can be used to reach the objective. Some indicators are direct measures and others are surrogates of direct measures of the issue being investigated. The objective of this monitoring program focuses on **sediment, salinity and nutrient (nitrogen and phosphorus)** parameters. Simple load and concentration calculations are derived for these parameters. Monitoring is conducted at the Neighbourhood Catchment scale. Parameters currently monitored are described below.

Sediments

Monitoring sediments suspended in water provides an indirect indication of soil lost through natural and human-accelerated processes. When soil reaches the waterway, it inhibits light penetration into the water, blocks pumps, pipes and nozzles and can lay a blanket of fine sediment over benthic organisms. The primary sediment parameter being used in this monitoring program is **Total Suspended Solids**. Total suspended solids is sampled and stored according to the 'field guide for collecting and storing samples' supplied in the appendices. These procedures meet the requirements of state and national sampling protocols. Analysis is conducted by the Queensland Health Scientific Services NATA-accredited laboratory following the Standard Methods for the Examination of Water and Wastewater 21st edn, method number 2540 C (Total Dissolved Solids Dried at 180°C). This data is of high quality.

To complement the monitoring of Total Suspended Solids, **Turbidity** is sampled according to the same procedures and measured using the Standard Methods for the Examination of Water and Wastewater 21st edn, method number 2130 B (Nephelometric Method). Data quality is high. See the FBA's 'Quality Assurance Statement for calibration and operation of FBA water monitoring equipment' supplied in the appendices.

Total Nutrients (Phosphorus and Nitrogen)

Nutrients are vital for plant growth. For this reason, the agricultural sector wants to see nutrients kept on paddock and out of the waterways. When excess nutrients reach the waterway, they promote accelerated growth of algae and aquatic plants. This can lead to environmental problems within the waterway and out to the coast. **Total Phosphorus** and **Total Nitrogen** samples are sampled and stored according to the 'Field guide for collecting and storing samples' supplied in the appendices. These procedures meet the requirements of the State and National sampling protocols. Analysis is conducted by the Queensland Health Scientific Services NATA-accredited laboratory following the Standard Methods for the Examination of Water and Wastewater 21st edn, method number 4500-N (specifically kjeldahl digestion with cadmium reduction methodology) for total nitrogen and method number 4500-P E (specifically kjeldahl digestion with ascorbic acid methodology) This data is of high quality.



Salt

Although salinity is not a major concern at a regional level at present, there is potential to value add to the monitoring already being undertaken by this monitoring program. Increased salt levels are a major concern for the agricultural sector and will impact on aquatic organisms if concentrations get high enough. **Specific Conductance** samples are sampled and stored according to the 'Field guide for collecting and storing samples' supplied in the appendices. These procedures meet the requirements of the State and National sampling protocols. Analysis is conducted by FBA staff and data is of high quality. See the FBA's 'Quality Assurance Statement for calibration and operation of FBA water monitoring equipment' supplied in the appendices.



Discharge

To calculate load-based estimates of total suspended solids, total nitrogen, total phosphorus and salinity discharge must be estimated for each event. Initially discharge are calculated using the *simple discharge equation* $Q = VA$ where Q = Discharge (L^3/min), V = Velocity (Length/min) and A = Wetted Area (calculated from water level and cross section)

There is a comprehensive network of hydrological gauging stations owned primarily by DERM. Where possible, discharge estimates from these stations are used to compare and calculate loads. Where gauging stations are not available stream height information is collected by an



Odyssey automated pressure and temperature recorder or a (under trial) Sensus Ultra depth logger, which has been installed by FBA. A cross sectional survey of the channel is also undertaken by FBA staff. Discharge is calculated using WinXSpro (available for download from <http://www.stream.fs.fed.us/publications/winxspro.html>). Sites have been selected with as uniform and as straight a river section as possible to minimise error from these calculations.

Load

Calculating a load helps to summarise the story of what happened for each flood event. Similar events can be compared over time to highlight the success practice change is having at a catchment scale and encourage the continuation of privately and publicly funded management change. *Loads are calculated using statistical programs with concentration, discharge and time data.* The error within load estimates can be quite high but can be refined using updated discharge information.

Rainfall data

Rainfall totals, duration and coverage are obtained from the Bureau of Meteorology and SILO databases. This information is critical in determining which events can be compared and which events differ so much that comparisons and assumptions arising from comparisons would produce unacceptable error.



Where is the monitoring taking place?

This is a regional monitoring program encompassing the Fitzroy Basin and associated coastal catchments. The Fitzroy Basin Association works at a Neighbourhood Catchment scale. **Neighbourhood Catchments are approximately 300km² to 2000km² in size and are defined as a single catchment or a group of smaller catchments draining into the main river stem.** The neighbourhood catchment approach aids FBA and its subregional network in prioritising effort where there is the greatest need and the highest likelihood to bring about change. It is also a natural way to break up the region and open lines of communication between agricultural, urban, industrial and mining sectors working within a neighbourhood catchment.

Each subregion has selected a handful of neighbourhood catchments to prioritise on-ground effort for the present and coming years. A number of these catchments, known as Priority Neighbourhood Catchments, are monitored within this program. This **monitoring will take place at the most representative site practical** given the following:

1. representative of the water leaving the Priority Neighbourhood Catchment
2. ease of access (including safety) to monitor the water in a flow event
3. proximity to a sampler's house.



It is recognised that monitoring is currently being undertaken by other groups. In a bid to reduce doubling up these groups are invited to partner with the FBA when monitoring needs align. Already, there are signs that monitoring being undertaken by partners can meet the needs of both parties. The potential to form a monitoring partnerships will be investigated as the opportunities arise. **Forming monitoring partnerships is the preferred approach of FBA** to reduce duplication and encourage collaboration toward the goal of detecting and encouraging management change.

FBA will establish up to 25 sites predominately within former, current or future Priority Neighbourhood Catchments, with additional monitoring by identified partners. As monitoring partners are identified or extra funding is attracted, the number of sites monitored may increase further.

Specific site information is held by FBA. This information may be available upon request, depending upon the users intended application. Requests for monitoring partner's site information must be directed to the monitoring partner in question before information is released.

Sites currently monitored by FBA are depicted in the following map.



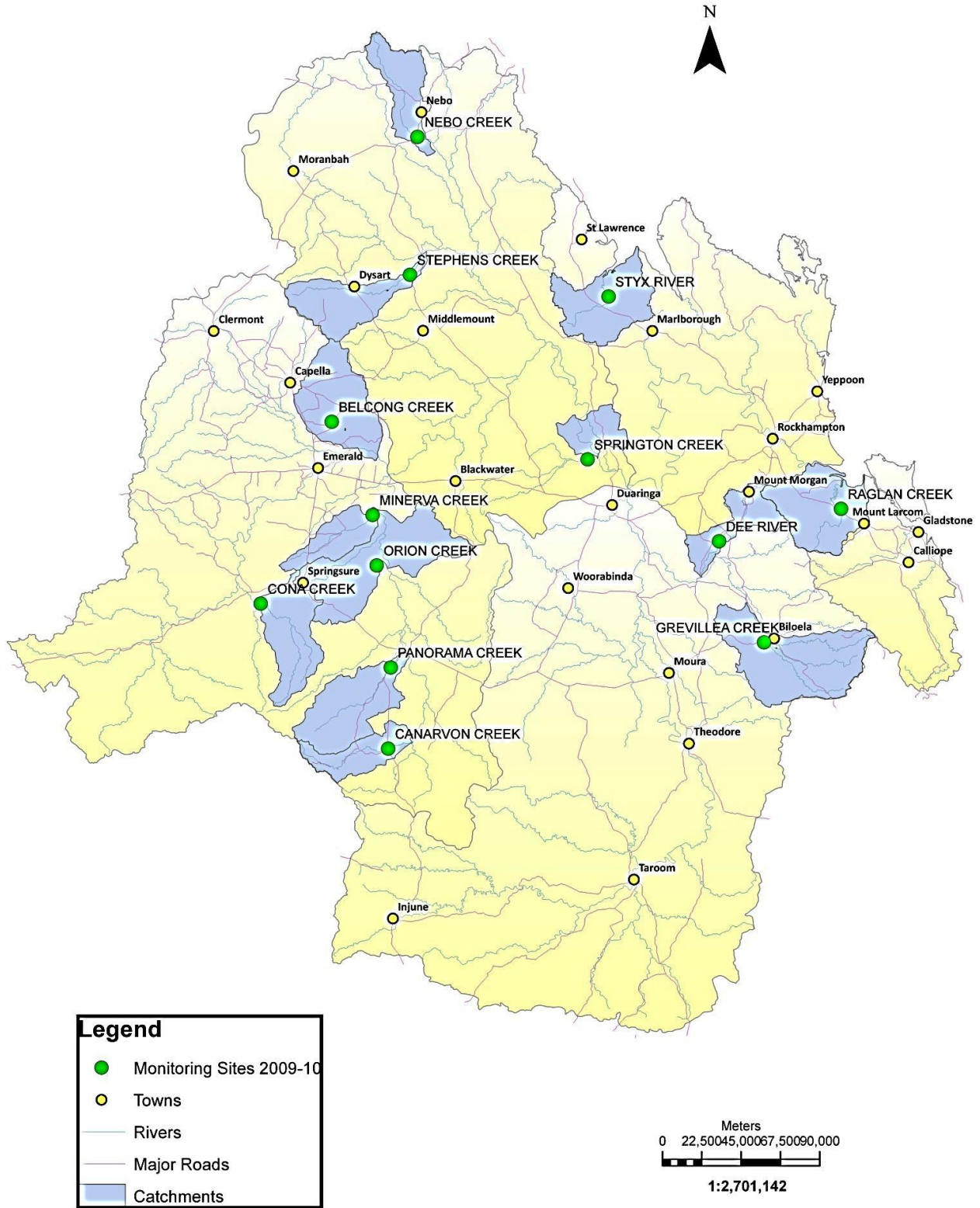


Figure 1: FBA PNCWQM monitoring sites



Fitzroy Basin Association PNCWQM is funded by Australian and Queensland Government initiatives



When and how often is the monitoring taking place?

Monitoring is primarily designed to calculate load-based estimates of TSS, TN, TP and salinity. For this reason *monitoring is event-based with the sampling trigger being a flow at the site being monitored*. Samples are collected over the hydrograph to aid in load calculations, with a minimum of six and maximum of ten samples to be collected for each flow event. Twenty samples have been allocated for each site for each wet season.

Landholders have been engaged for sampling. Each landholder will know the catchment's flow regime given rain intensity and duration better than FBA staff. For this reason the spacing of sampling has been left to the landholder to determine. This *discretionary approach allows for maximum flexibility to capture the best representative load-based estimate over the hydrograph*. There is a minimum time spacing of three hours between samples, but time between samples may range from this to once or twice a day.



How is the data quality assured, managed and reported?

Data is entered, checked and stored using spreadsheets on FBA's server. *Each sample taken has a Unique Identification Number assigned to it*. Samples and data are accounted for using this numbering system throughout the chain of custody. FBA Healthy Waterways staff are responsible for sample logistics from the collector to the laboratory. The laboratory will report back results using the Unique Identification Number as the key identifier. Data from field sheets are entered by FBA staff using the Unique Identification Number written on each field sheet as the key identifier. Analysis conducted by FBA staff is entered into spreadsheets also using the Unique Identification Number as the key identifier.



Reporting is in the form of a one page flyer, for each event, which is available to the public. There will also be a more detailed report released. Products are aimed at two distinct audiences. The first product includes interpreted data aimed at the general public, and giving the landholders feedback, with which they can make some comparisons with previous events. The later and more important product is aimed at participating landholders, and a more technical audience, giving extra explanation and greater detail of events. The data will remain the property of FBA and may be provided to other parties to help deliver contracted outcomes, but will not be available outside of this scope unless interested parties make a formal data request to the FBA Board and the

Board approves this request.

Data management protocols stated in FBA's 'Quality Assurance Statement for calibration and operation of FBA water monitoring equipment' are followed. Nutrient field blanks were included in the early days of sampling to account for potential contamination; the results showed contamination from sampler storage was insignificant. *By following this monitoring plan, supporting documentation and field guide, a high assurance can be placed on the quality of this data.*



Who is involved and how?

FBA Healthy Waterways Manager

- Co-Program management development and communication
- Organising monitoring partnerships
- Budgeting and finance
- Data management and QA/QC
- Report preparation and release
- Training

FBA Healthy Waterways Staff and interested sub-regional Staff

- Site and contract establishment
- Ongoing sampler support and feedback
- Sampling logistics
- Turbidity, salinity and pH analysis
- Information and report preparation
- Data management, entry and QA/QC Training

Monitoring Partners

- Provide input into FBA Priority Neighbourhood Catchment Monitoring Program and help guide reporting requirements that meet both parties' needs
- Continue with monitoring regime and modify where possible to enable collaboration in objectives

Sampler

- Undertake training
- Sampling and storage
- Pass on reports provided by FBA to others living and working within the Neighbourhood Catchment where data was collected

Modellers and Statisticians

- Use data and information to calculate load estimates, refine models and model monitored results

Agricultural, urban, industrial and mining sectors; funding providers; and FBA and sub-regional staff working within the Priority Neighbourhood Catchment

- Use information available to monitor how a change in management action affects a change in water quality.
- Suggest changes in reporting to the FBA so we can better meet information needs

Laboratory

- Analysis and reporting
- In-house QA/QC



Appendices



CARING
FOR
OUR
COUNTRY

Fitzroy Basin Association PNCWQM is funded by Australian and Queensland Government initiatives



FITZROY BASIN ASSOCIATION
www.fba.org.au

Field Guide: Collecting and storing samples

Introduction

This document outlines what was covered on your training day, and will help you collect quality, event-based water samples ready for electrical conductivity, pH, turbidity, total nitrogen, total phosphorus and total suspended solids analysis.

Materials required

- Container for carrying gear
- Sampling pole
- 2 x 1L plastic sample bottles
- 100mL plastic sample bottle
- Record Sheet (*FBA In situ Field Sheet*)
- Marking pen

A word about safety

As a contractor to FBA, your safety and insurance cover are your responsibility. However, we have provided you an excellent guide, *Health and Safety Guidelines for Community-based Waterway Monitoring*, produced by DERM. Above all, remember that no water quality sample is worth risking your health and safety.

Sample collection procedure

1. Record the time and date on 2 x 1litre (L) and 1 x 100 mL sample bottles.
2. On the *FBA In situ Field Sheet*, record the date, time and ‘Unique Sample Identification Number’ of the bottles you are about to fill.
3. Secure a 1L bottle in the holster on the sampling pole, remove the lid from the bottle and use the sampling pole to take a sample from the flowing section of the river, NOT in the still water at the bank’s edge. Take care not to get so close to the creek as to risk your safety — if in doubt, don’t take the sample.
4. Discard the contents of the bottle away from the sample site, and repeat the process twice more.
5. Once the collecting bottle has been rinsed three times, rinse the other collection bottles three times with water collected from the sample site.
6. Then use water from the 1L bottle to $\frac{3}{4}$ fill the 100mL sample bottle and replace the lid (air space is required to make sure the bottle doesn’t split when frozen).
7. Fill the second 1L sample bottle, using the procedure outlined above, refill the collecting bottle and replace the lids.



Notes: Photo below provides a guide for how full (**red line**) the sample bottles should be. Ensure lids are replaced as tightly as possible. Ensure fingers don’t go inside the cap or bottle and contaminate the sample.



Version 5

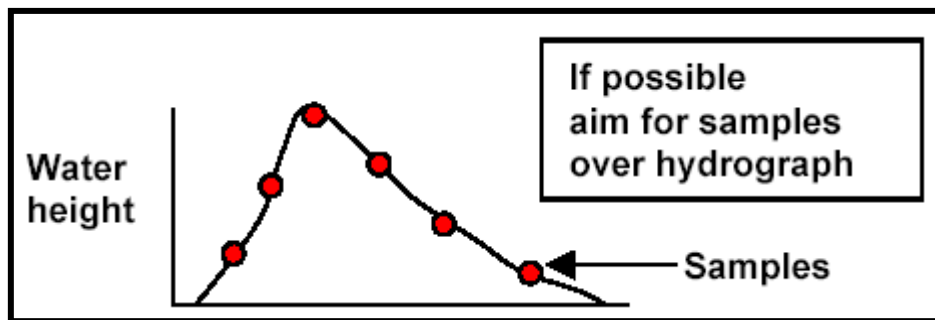
- Once you've collected the samples and filled out the *FBA In situ Field Sheet*, head back to the fridge and freezer. Refrigeration minimises known microbial and chemical activity that can alter the physical and chemical properties of the sample.
- Store the **two 1L sample bottles** used to measure Total Suspended Solids in the **refrigerator**. Store the **100mL sample bottle** used to measure Total Nutrients in the plastic tub in the **freezer**.

How many samples?

A minimum of six samples is desired for each flow event, but we will still use the samples if less than six are collected. You can collect up to 10 samples per event. As you are a local landholder, your local knowledge will affect the time you have to collect these samples, but it can range from one day to a week depending on factors such as the size of catchment, soil types and rain intensity.



Space it out: the minimum time between samples is three hours.



Graph courtesy Bob Packett, NR&M



FBA Water Quality Monitoring Program

Quality Assurance Statement for calibration and operation of FBA water monitoring equipment

1. Equipment operation manuals are followed. Exceptions will be noted in this Quality Assurance Statement or information in FBA's Field Manual: Calibration and Operation Handbook Water Quality Monitoring
2. Instruments are calibrated before field use or monthly, whichever is more frequent
3. Information on Standards, Pre-Cal Values and Post-Cal Values are captured on a 'FBA Equipment Calibration and Drift Sheet'
4. A three point calibration is used for pH, using standards 4.00, 7.00 and 10.00. Troubleshooting is engaged if the post calibration value differs from the standard by more than 0.3 pH units
5. A three point calibration is used for turbidity using standards 0, 200 and 800. Troubleshooting is engaged if the post calibration value differs from the standard by more than +/-5% of reading or 2 NTU (whichever is greater)
6. A single point calibration is used for specific conductance using a 1mS/cm standard. Troubleshooting is engaged if the post calibration value differs from the standard by more than +/- 2% of reading
7. A single point calibration is used for dissolved oxygen, with the standard being derived from a water sample using the Winkler titration method. Alternatively dissolved oxygen is calibrated against local, true barometric pressure. Troubleshooting is engaged if the post calibration value differs from the standard by more than +/- 0.5mg/L of reading
8. Temperature is compared with another thermometer. Troubleshooting is engaged if the temperature difference between the two instruments exceeds 0.3°C
9. Sensor drift is calculated within one week of in situ sampling and prior to in-house sample analysis and is captured on the FBA Equipment Calibration and Drift Sheet. Sensor drift is checked using a 0 NTU solution for turbidity, pH 7.00 solution for pH, 1ms/cm solution for specific conductance and a Winkler titration standard (if available) for DO. Data is tagged if drift exceeds:
 - a. Turbidity: +/-5% of reading or 2NTU, whichever is greater
 - b. pH: 0.3 pH units
 - c. conductivity: +/- 2% of reading
 - d. DO: +/- 0.5mg/L of reading
10. All officers using equipment will complete in-house training on operation and calibration of equipment
11. The FBA In situ sampling sheets will be filled out for every sampling site as a hard copy back-up of information
12. GPS coordinates will be collected using datum GDA 94. The GPS location will be used as the primary site identifier. Date and time will be used to separate date collected at a site with the same GPS coordinates
13. Data will be QA checked by a member of the healthy waterways team and stored on the appropriate spreadsheets and databases



***FBA Priority Neighbourhood Catchment
Water Quality Monitoring Program***



FBA “in situ” Field Sheet

Please fill out and return to a member of FBA’s Healthy Waterways team.

Name of Collector	
Property Name	
Date	
Time	
Unique Sample ID Number	

Estimated Water Level (m)	
Other Observations (e.g. days since last rain, size of event, amount of rainfall)	

FBA Staff use only:

Parameter	Result
Conductivity (ms/cm)	
Turbidity (NTU)	
pH	
DO (mg/L)	

For help or further information...

Contact our Healthy Waterways team:

Rachel Bryan: 0428 734 865

Luke Ukkola: 0408 574 129

Jackie Dupavillon: 49 992 823



Fitzroy Basin Association PNCWQM is funded by Australian and Queensland Government initiatives



www.fba.org.au

Sampling Checklist:

- ✓ Ensure sample is collected just below the surface (~30cm) with the bottle opening directed into the flow. This will avoid collecting debris from the surface and mud from the stream bed.
- ✓ Be sure to keep fingers away from the inside of the bottle and lid to avoid contamination of the sample. If you do touch the inside of the lid, wash it with the sample water to remove possible contaminants.
- ✓ Fill a set of 3 bottles (2 large and 1 small) making sure they have the same unique ID number. When filling the small bottle make sure there is enough room left so it can be frozen without splitting the bottle
- ✓ Remember to label the bottles with the date and time, and then freeze the small bottle and refrigerate the larger bottles ASAP after collection.

