ENVIRONMENTAL MONITORING METHOD:

Gnamma Monitoring

Each section can be completed separately but you should read all three parts before starting. You need to complete all three parts to finish the monitoring method.

Part 1: Getting Ready

GATHER YOUR GEAR

Equipment required for this part:

- ☐ Electronic device(s) – charge ready for use and check that it has:
  - ability to take photos
  - data collection systems (app and form) (e.g. Fulcrum)
  - navigation system (e.g. Avenza) and site maps
- ☐ Laptop or computer with software for mapping (e.g. QGIS, ArcGIS, Google Earth)
- ☐ Remote cameras(s) –check that each camera has:
  - SD cards
  - Batteries

Remember to check **GATHER YOUR GEAR** lists for **Out on Country** and **Back in the Office**. See the full list of equipment needed to complete this monitoring method on the last page.

KEEP IN MIND

Why?

Make sure there is a clear aim for your monitoring project and that the method you have selected will give you the answers you need.

When?

Prepare well before heading out on Country so that you have time to gather equipment or train staff, if needed.

Who?

At least one ranger/staff to plan and prepare.

Training and skills

Staff involved in planning are trained and competent in:

- ☐ Mapping software (e.g. QGIS, ArcGIS, Google Earth)
- ☐ Navigation systems (e.g. Avenza, GPS)
- ☐ Data collection systems (e.g. Fulcrum, datasheets)
- ☐ Checking and programming remote camera settings

Check permissions

Consult with Traditional Owners, landholders and relevant government agencies and authorities, to determine appropriate access and approvals for environmental monitoring:

1. Where you can go – consult with the owners/managers of the land.
2. What you can do – check if you need scientific licencing, approvals or ethics.
3. What or who can you take photos of
4. What can be done with data and photos – who owns them, where will they be stored and how will data be interpreted and communicated.

ACTIONS

Make a plan and prepare

1. Plan which dates you will monitor gnammas
    - Some gnammas may not have water in them all year round. Plan to sample in cooler and wetter months (e.g. winter) or soon after rain.
    - Some sites may not be accessible immediately after rain.
2. If you are using remote cameras, decide when and for how long you will deploy the cameras
    - Cameras should be deployed when animals are more likely to need to use the water, such as in dry seasons when they can't get water from other places.
3. If this is the first year you are monitoring, gather records of gnammas (rock pools, basins, holes and wells) in your area and/or identify where gnammas might be on Country Such as from Traditional Custodians , Atlas of Living Australia (ALA) or government databases.
4. Select your sites using mapping software and/or traditional knowledge
    - Gnammas are found on the slopes or summits of dome-shaped granite outcrops. Satellite imagery can be used to identify granite outcrops.
    - Aim to sample at least 2 gnammas per site.
    - A reconnaissance trip can be helpful to check that your sites have water and are accessible.
5. Give each site and gnamma a unique name, and save the location data in your data management system.
    - The site code could be a shortened form of the rocky outcrop's name, and then each gnamma could have a number. For example, there is a rocky outcrop called Flat Rock and it has 5 gnammas on it. The site code if Flat and each gnamma is numbered 1-5. When you get there, only gnamma 1 and 4 have water in them, so you only collect samples from Flat1 and Flat4.

6. Prepare maps of sites/load onto navigation devices
7. Contact a lab to organise eDNA analysis and labs and/or taxonomic experts to organise microinvertebrate and/or macroinvertebrate identification.
    - Remember to ask what the cost and timeline is for getting samples processed.
    - Macroinvertebrates can also be identified by the ranger team.
8. Plan how you will record information on Country e.g. Fulcrum electronic data forms.
9. Plan your data management system e.g. how you will store images and sampling data
10. Check **GATHER YOUR GEAR** lists for **Get Ready, Out on Country** and **Back in the Office** (complete list of equipment on last page) and get any equipment you don't have. See freshwater sampling and remote camera buying guide(s) for advice on which water quality metres, sample containers and nets, eDNA sampling kits and remote cameras may be suitable to buy.
11. Be clear on how many people will be involved and what everyone needs to do the work.
12. Check the training requirements for **Get Ready, Out on Country** and **Back in the Office** steps to ensure that rangers know how to use the devices, data collection apps, navigation systems etc. and how to find and identify gnammas.

Check sampling equipment is clean and in working order

1. Check that the water quality probe is working.
    - Read the instruction manual of your water quality probe to find out how to setup, test and calibrate it.
2. Check nets for holes and damage, and repair or replace any damaged nets before the survey.
3. Check that all sampling equipment is clean.

Prepare cameras

1. Give each camera and its SD card(s) a unique name (e.g. CAM01) and write it on the camera and SD card(s) with a permanent marker or labelling device.
    - It is a good idea that each camera has two SD cards, each uniquely identifiable (e.g. CAM01A and CAM01B)
2. Insert SD card and fully charged batteries into the cameras.
3. Turn on the camera and check that it has the correct settings:
    - Standard settings are active 24 hours, 3-5 images in rapid succession, no quiet/wait period between images, high PIR sensitivity, shutter speed ≥1/60th second
    - Date and time are correct

- Camera ID is set and matches its written label.

4. Test that the camera takes photos and they are good quality
   - Older or damaged cameras can take photos that are very dark which will make it hard to identify any animals.
5. Delete any test images off of the SD card and turn off the camera.

Next Section – Part 2: Out on Country

Part 2: Out on Country

GATHER YOUR GEAR

One set of this equipment for each site:

- ☐ Remote camera – with empty SD card and charged batteries
- ☐ Mounting hardware (e.g. bungee cord, star picket/stake, bolt)

One set of this equipment for each gnamma:

- ☐ EnviroDNA eDNA sampling kit:
  - 50mL syringe, 1.2-micron PES filter, preservative syringe, ziplock bag
  - 50mL syringe, 5-micron PES filter, preservative syringe, ziplock bag

One set of this equipment for each team:

- ☐ Electronic device(s) – charged and ready to record data, take photos and navigate to sites
- ☐ Power bank – charged and ready to charge devices (optional)
- ☐ GPS device and spare batteries (recommended)
- ☐ Reference documents or field guides: macroinvertebrate ID guide (optional)
- ☐ Handheld water quality meter (e.g. Horiba U-50)
- ☐ Measuring rod (with 10, 20 or 30 cm segments)
- ☐ Soft tape measure
- ☐ Disposable gloves – powder free and stored in a clean ziplock bag
- ☐ Esky with ice or portable car freezer
- ☐ 5L bucket with volume markings on the inside
- ☐ Conical plankton net (63µm mesh)
- ☐ Aquatic dip net (250mm mesh)
- ☐ Picking equipment (for macroinvertebrate Option 1: pick now)
  - Camping/plastic table and chairs
  - White plastic sorting tray
  - Tweezers, spoons and pipettes
- ☐ 80% ethanol
- ☐ Sticker labels
- ☐ Pencil
- ☐ Permanent marker
- ☐ Hammer or mallet
- ☐ 22L water jerry can filled with fresh tap water

ENVIRONMENTAL MONITORING METHOD:

Gnamma Monitoring

KEEP IN MIND

When?

Has recent rain made your sampling site inaccessible?

Where

Aim to take water samples from at least two gnammas per site and try to sample from ganmmas that are shallow (pan gnammas) and deep.

Consider only deploying cameras at remote sites that aren't publicly accessible to reduce the risk of camera theft.

Who?

At least two people per team

Training and skills

Make sure everyone knows the plan.

Field staff are trained and competent in:

- ☐ Navigation systems (e.g. Avenza, GPS)
- ☐ Data collection systems (e.g. Fulcrum, paper datasheets)
- ☐ Using water quality meters and understanding the readings
- ☐ Collecting eDNA, microinvertebrate and macroinvertebrate samples
- ☐ Picking macroinvertebrates
- ☐ Deploying remote cameras
- ☐ Correct storage and handling of ethanol

ACTIONS

Once you have arrived at the site, avoid disturbing or touching the water until you have finished the eDNA sampling.

Water Quality

Remember! Don't touch the water with your bare hands until you having finished the eDNA sampling

1. Prepare (e.g. connect and take off probe covers) and turn on the handheld water quality meter.
2. Put the meter into the water so that it is in the centre of the gnamma and the probe is fully covered by the water.
    - You can hold the device or hold onto the wire and dangle it into the water.

- Aim to submerge to the same depth every time, generally around 15cm deep. This is because some measurements, like temperature and dissolved oxygen, can be very different at the surface and deeper in the water, particularly in summer.
- If it is a pan gnamma or there hasn't been enough rain, the water may not be deep enough to take a water quality reading.

3. Check the LED screen and wait for the readings to stabilise.
4. Press the measure button on the LED screen to take readings of the dissolved oxygen, water temperature, pH, conductivity and turbidity.
   - Dissolved oxygen is measured in milligrams per litre (mg/L) or percentage (%)
   - Water temperature is measured in degrees Celsius (˚C)
   - pH values will be between 0 -14. A reading of 1 is very acidic, 7 is neutral and 14 is very basic (or alkaline).
   - Conductivity is measured in microsiemens per centimetre (µS/cm)
   - Turbidity is measured in Nephelometric Turbidity Units (NTU)
5. Check whether the readings look normal or atypical. If the readings are atypical:
   a. Check if there are obvious equipment problems like a broken cable, dirty sensor or low batteries.
   b. If there aren't any obvious equipment problems, check that the device has been calibrated properly and take measurements from another gnamma at the site to see if it takes similar atypical readings.
   - Dissolved oxygen is usually 6-10 mg/L but may be higher if there are algal blooms or lower if there are anoxic conditions.
   - Conductivity is usually <1500 µS/cm
   - pH is usually 6-8.5 but may be lower if acid rock drainage or acid sulfate soils are present
6. Record **water quality data**
   - Some meters store the data which you can download later when you're back in the office, but it is a good idea to also record the data on your electronic device in case something happens to the meter.

eDNA

Remember! Don't touch the water with your bare hands until you having finished the eDNA sampling

7. Put on a fresh pair of gloves
8. Using a fresh syringe, pull 50ml of water into the syringe from 5-15 cm below the water surface.
9. Screw the filter onto the syringe

- Use 1.2-micron PES filters for surface samples and 5-micron PES filters for benthic samples

10. Push the water from the syringe through the filter
11. Continue collecting and filtering water from various locations in the gnamma until no more water can be pushed through the filter.
    a. Remove the filter from the syringe before collecting more water, and then screw the same filter back on
    b. Keep track of how much total water is pushed through the syringe, it will be about 100-300 mL total.
12. Unscrew the filter.
13. Uncap the preservative syringe, screw it onto the filter and push the preservative in. Leave the preservative syringe attached and put the preservative cap onto the other end of the filter.
14. Place the filter into a ziplock bag, label the bag and put it in an esky on ice/in a portable car freezer.
    - Labels need to include site/gnamma code, type of water source (gnamma), coordinates, date, volume of water filtered.
15. Using a stick, gently disturb the sediment layer at the bottom of the pool.
16. Put on a fresh pair of gloves
17. Using a fresh syringe, pull 50ml of water into the syringe from the bottom of the pool (benthic zone)
    - If the water is too deep, collect the water in a falcon tube first by attaching the falcon tube onto an extendable pole and scooping water up from the bottom of the pool.
18. Repeat steps 7-17 but using a 5-micron PES filter
19. Record **eDNA data**

Microinvertebrates (Zooplankton)

Remember! Don't touch the water with your bare hands until you having finished the eDNA sampling

20. Attach a 40ml specimen container onto the cod end of the conical plankton net.
21. Using a 5L bucket, collect water from the bottom of the pool where the sediment has been disturbed.
    - Keep track of how much water you collect.
22. Hold the conical plankton net over the gnamma and pour most of the water from the bucket into the net.
    - Keep 10% of the water in the bucket

23. Unscrew the collection container at the bottom of the net and empty it into a 40mL specimen container.
24. Add the last of the water from the bucket, including any sediment, into the specimen container
25. Fill up the rest of the container with 80% ethanol, screw the cap back on and label it.
    - Labels need to be written in pencil because ethanol can wash away pen and permanent marker.
    - Labels need to include site/gnamma code, type of water source (gnamma), coordinates, date
26. Record **microinvertebrate data**

Macroinvertebrates

27. Drag a handheld net through the water to collect any visible water beetles, insects and worms.
    - Do not collect tadpoles or frogs.
28. Collect the samples with either *Option 1: Pick Now* or *Option 2: Pick Later*
29. Take photos of any tadpoles to identify them later.
30. Record **macroinvertebrate date data**

Option 1: Pick Now

1. Set up table and chairs with the trays, picking tools (tweezers, spoons, pipettes), specimen container and 80% ethanol.
2. Empty the net into a tray
3. Splash water onto the net to wash any remaining invertebrates off the net and into the tray.
4. Spend 15 minutes looking for invertebrates in the bucket/tray. Use tweezers, spoons or pipettes to pick them up and put them into a specimen container.
5. Spend 5 minutes looking for the most common and active species, then the next 10 minutes looking for new species.
    - If you think you have already collected 10 of the same species, look for something different.
    - Make sure you look for cryptic or small species, as well as the more obvious or bigger ones.
    - Check that nothing is stuck at the bottom of the bucket/tray like flat worms and snails.
6. Fill the container with 80% ethanol, screw the cap on and label it.
    - Labels need to be written in pencil because ethanol can wash away pen and permanent marker.

- Labels need to include date and the site/gnamma code

Option 2: Pick Later

1. Empty the net into a specimen container.
2. Splash water onto the net to wash any remaining invertebrates into the container.
3. Fill the rest of the container with 80% ethanol, screw the cap on and label it.
   - Labels need to be written in pencil because ethanol wash away pen and permanent marker
   - Labels need to include date and the site/gnamma code

Site and gnamma data

31. Lower a stick down into the water until it touches the bottom and then lift the stick out and see how high the water mark goes.
32. Line up the stick next the measuring rod and estimate the depth by counting the number of segments up to the water mark.
    - The segments are usually 10, 20 or 30 cm
    - You can also take a photo to estimate the depth when you're back at the office
33. Find the longest distance across the gnamma, and measure this part with the measuring tape.
    - This measurement is the length of the gnamma.
34. Find the widest part of the gnamma that crosses the length at a right angle (make a cross shape), and measure this part with the measuring tape.
    - This measurement is the width of the gnamma.
35. Record **site data**
36. Once you have finished sampling, clean the water quality meter, bucket and nets by rinsing them with fresh tap water
    - Rinse equipment away from the gnammas so that the water won't run into the gnamma.

Remote cameras

31. Choose which gnamma you will deploy the camera on.
    - Choose a gnamma that is deep (>1m) and can hold water even during dry periods.
    - The gnamma needs to be near (1-2m) a tree or rock that the remote camera can be tied to, or soft ground so that a star picket/stake can be hammered into the ground.
32. Attach the remote camera to a tree or rock with a bungee cord or to a star picket/stake with a bolt or bracket so that the camera is:
    a. 1-2m away from the gnamma

b. facing the gnamma
c. about 1m off the ground
d. secure so that it won't move or sway

33. Turn on the camera, check that the batteries are full and SD card is empty.
34. Use the 'walk test' mode to check the camera is facing the correct direction.
35. Arm the camera.
    - It is a good idea to walk in front of the camera once it is armed to trigger an image. This image can be used to confirm the camera was working when it was deployed.

37. Record **camera deployment data**
38. After the cameras have been deployed for the set period of time (e.g. 2-4 weeks), come back to collect them. If you are leaving the cameras deployed for longer than one month, consider scheduling in time to check that the cameras are still working and to swap out batteries and SD cards.
39. Open the camera and check if it is still on and taking photos.
40. Turn off the camera.
41. Collect the camera and its mounting equipment.
42. Record **camera collection data**

RECORD DATA

Data to record when taking water samples/measurements

What to record	Required?	Notes
Information to record about each gnamma sampled		
Site and gnamma name/number	Yes	Record the individual name/number of the site and gnamma that was sampled
Information to record about water quality		
Water quality reading taken?	Yes	Record whether you did or didn't take a water quality reading and if you didn't, why (e.g. water not deep enough)
Water quality reading normal?	Yes	Record whether the readings looked typical/normal or not)
Dissolved oxygen	Recommended	Record the dissolved oxygen reading, in mg/L or %
Water temperature	Recommended	Record the water temperature reading, in ˚C
pH	Recommended	Record the pH reading, 0-14
Conductivity	Recommended	Record the conductivity reading, in µS/m
Turbidity	Recommended	Record the turbidity reading, in NTU
Information to record about eDNA samples		

eDNA samples taken?	Yes	Record whether you did or didn't take the three eDNA sample types (surface sample, filter membrane sample, benthic sample) and if you didn't, why
eDNA sampling method	Yes	Record whether you used Option 1 (filter now) or Option 2 (filter later) to collect the eDNA water samples
Total water filtered for surface sample	Option 1(filter now) only	Record how much water was filtered for the eDNA water sample collected from near the surface of the water
Total water filtered for benthic sample	Option 1(filter now) only	Record how much water was filtered for the eDNA water sample collected from near the bottom of the gnamma
Information to record about microinvertebrate samples		
Microinvertebrate sample taken?	Yes	Record whether you did or didn't take the microinvertebrate sample and if you didn't, why
Total water filtered	Yes	Record how much water was collected in the bucket
Information to record about macroinvertebrate samples		
Macroinvertebrate sample taken?	Yes	Record whether you did or didn't take the macroinvertebrate sample and if you didn't, why
Macroinvertebrate sampling method	Yes	Record whether you used Option 1 (pick now) or Option 2 (pick later) to collect the macroinvertebrate sample
Photos of tadpoles	Optional	Take a photo any tadpoles, and make a note of which camera/tablet/phone it was taken on, and the filename of the photo (usually ends in .JPG)

Data to record when measuring gnamma size

What to record	Required?	Notes
Information to record about each site		
Project name	Yes	Make it clear which project this data belongs to and its purpose
Date	Yes	Record the date the gnammas were sampled
Personnel	Yes	Record the name of the people who did the sampling- this is helpful if any questions come up about the data
Site and gnamma name/number	Yes	Record the individual name/number of the site and, if not already mapped, give each gnamma an individual name/number
Gnamma location coordinates	Yes	If not already mapped, record an accurate location (using a handheld GPS if possible) (latitude and longitude or eastings and northings) for each gnamma
Gnamma description	Yes	If not already described, record the type (e.g. pan or pit) of each gnamma
Water depth	Optional	Record the estimated depth of the water. This can be estimated back at the office if you took a photo of the wet stick and measuring rod.
Gnamma length and width	Optional	Record the length and width of the gnamma.
Recent rainfall	Optional	Record information about the most recent rainfall (e.g. amount in mm, date(s), unusual rain events)

Signs of disturbance	Optional	Record the types and causes of disturbance at the site, e.g. presence of weed species, signs of introduced species like cats, or human activities like rock removal or rubbish,
Habitat description	Optional	Record the vegetation type and landscape features at the site; record species of any plants growing in the gnammas
Photos of site and gnammas	Optional	Take a photo of the outctop and gnammas, and make a note of which camera/tablet/phone it was taken on, and the filename of the photo (usually ends in .JPG)
Stories and notes	Optional	Record information or stories from Elders, and anything else worth noting about the site, such as when the gnamma was last cleaned/maintained, presence of capping rocks
Video	Optional	Record videos of information or stories from Elders, and rangers performing or describing the work they are doing.

Data to record when deploying and collecting cameras

What to record	Required?	Notes
Information to record about each camera deployed and collected		
Site and gnamma name/number	Yes	Record the individual name/number of the site and gnamma that has a camera deployed
Camera ID	Yes	Record the individual name/number of the camera
Deployment date	Yes	Record the date that the camera was deployed
Collection date	Yes	Record the date that the camera was collected
Deployment comments	Optional	Record anything of note about the deployment, including details about where it has been deployed (e.g. tree 2m to south of gnamma)
Collection comments	Optional	Record any issues with the camera on collection (e.g. camera not on, SD card full, camera facing wrong direction, camera wet inside))

Next section – Part 3: Back in the Office

Part 3: Back in the Office

GATHER YOUR GEAR

Equipment required for this part:

- ☐ Electronic device(s) that you used to record your data
- ☐ Data management system, e.g. cloud storage
- ☐ Laptop or computer with software for spreadsheets (e.g. Microsoft Excel) and mapping (e.g. QGIS, ArcGIS, Google Earth) and image processing (e.g. Timelapse, CPW Camera Warehouse)
- ☐ Freezer (less than -20˚C)
- ☐ Reference documents or field guides: macroinvertebrate and tadpole ID guide (optional)
- ☐ Picking equipment (for macroinvertebrate Option 2: pick later)
    - White plastic sorting tray
    - Sieve
    - Tweezers, spoons and pipettes
- ☐ 80% ethanol
- ☐ Sticker labels
- ☐ Pencil
- ☐ Macroinvertebrate identification equipment:
    - Microscope
    - Squeeze bottle with 70% ethanol
    - 60ml glass or plastic petri dishes
    - Stereo microscope with 10X magnification
- ☐ SD cards from cameras

KEEP IN MIND

When?

Always try to complete this work as soon as you can after returning from your time on Country so that samples are stored correctly, photos on SD cards don't get deleted and what you did and what you saw is fresh in your memory.

Who?

At least one person to manage the data and samples

ENVIRONMENTAL MONITORING METHOD:

Gnamma Monitoring

Training and skills

Staff managing data are trained and competent in:

- ☐ Mapping software (e.g. QGIS, ArcGIS, Google Earth)
- ☐ Spreadsheet software (e.g. Microsoft Excel)
- ☐ Data collection systems (e.g. Fulcrum, datasheets)
- ☐ Data management systems (e.g. databases, cloud storage, external hard drives)
- ☐ Image processing software and identifying animals from images
- ☐ Correct storage and handling of ethanol
- ☐ Picking macroinvertebrates

ACTIONS

Clean equipment

1. Rinse all equipment used to sample water with fresh tap water
2. Read the instruction manual for the water quality probe to find out how to clean, service and store the device.
3. Check nets for holes and damage, and flag them with pink flagging tape.
    - Consider repairing or replacing damaged nets now, so that they are ready to go when you do the next survey.

Store and send samples

4. On return to the office, transfer the eDNA samples from the esky/car freezer into a -20C freezer so that they stay frozen, and keep microinvertebrate and macroinvertebrate samples in a cool room.
5. As soon as possible, send the eDNA samples via courier to the eDNA lab for analysis, the microinvertebrate samples to an expert in microinvertebrate taxonomy for processing, and if you aren't planning to ID them yourselves, the macoinvertebrate samples to an expert in macroinvertebrate taxonomy for processing
    - The eDNA lab and/or experts will be able to give you instructions on packaging and sending samples.
6. Wait for the results
7. Update the data in your data management system with the eDNA results and microinvertebrate and macroinvertebrate IDs.

Pick macroinvertebrate samples

If you didn't pick the macroinvertebrate samples in the field, you will need to pick them when you are back at the office. If you have a microscope and can you identification keys,

you can decide to identify macroinvertebrate samples yourself instead of sending them away to an expert.

8. Empty the macroinvertebrate sample container into a sieve and rinse it with tap water.
9. Empty the sieve into a tray.
10. Use tweezers, spoons or pipettes to pick up invertebrates, sorting different species into separate small petri dishes for later identification (or into specimen containers if sending away for ID), until all specimens have been removed from the tray.
    - Make sure you look for cryptic or small species, as well as the more obvious or bigger ones.
    - Check that nothing is stuck at the bottom of the bucket/tray like flat worms and snails.
11. Fill the container with 80% ethanol, screw the cap on and label it.
    - Labels need to be written in pencil because ethanol can wash away pen and permanent marker.
    - Labels need to include date and the site/gnamma code

Process camera images

12. Remove SD cards from cameras and copy images from the SD cards to your data management system.
13. Import the images into the image processing software.
14. Review images and identify the species detected in the images.
    - If you have enough time and people, get somebody else to proof the data including species identification.
15. Export the data from the image processing software.

Data entry, analysis and reporting

16. Record a summary of what you did and why, any observations (e.g. weather conditions, fire history, site condition), anything that went wrong or didn't work and things that worked well.
17. Upload the **gnamma sampling data** to your data management system.
    - Recommended: get someone else to proof the data to check for mistakes.
18. Upload any photos or videos taken during the survey to your data management system.
19. Use reference materials like frog or tadpole ID books or apps to identify species from photos taken of tadpoles.

- Narrow down what species it could be by finding our what frog species are known or likely to occur on Countr. You can also contact a frog expert to get help with the identification.

20. Your data analysis will depend on the project purpose and the data collected. It could include:
    a. Camera data might give you enough information to estimate occupancy or calculate activity rates.
    b. Use GIS software to map where gnammas are and where species were detected to see if there are patterns in their distribution across the landscape.
    c. Calculate species richness – count how many species you detected. Consider splitting it up into different taxonomic groups (e.g. mammals, reptiles, birds, invertebrates, plants).
    d. Create bar graphs in excel to compare measurements across different sites (e.g. water quality measurement, species).
    e. Create line or bar graphs in excel to track changes in measurements over time (e.g. line graphs for water quality measurements, bar graphs for species richness). Add reference lines to show things like baseline data or healthy water quality ranges. If you have implemented a management action, add in a line along the time axis to see if there are differences in the before/after management.
21. Discuss with the ranger team or community the results of the monitoring, any reasons for the water quality results and species detected, and if there have been any changes to previous years.
    - Consider whether trends might be related to your management (e.g. fencing gnammas) to check how well management is working, or if you need to make adjustments.
22. Share the data according to any data sharing or funding agreements you have made

Next section – Full Equipment List

Gather Your Gear – Complete List

The complete **GATHER YOUR GEAR** lists for **Get Ready**, **Out on Country** and **Back in the Office**.

Gear List	Required?	Get Ready	On Country	In Office
Electronic device(s): • Charged • Ability to take photos • App for data collection (e.g. Fulcrum) • App for navigation (e.g. Avenza)	✓	✓	✓	✓
Power bank • Charged	**Recommended**		✓	
Laptop or computer with software for: • Mapping (e.g. QGIS, ArcGIS, Google Earth) • Spreadsheets (e.g. Microsoft Excel) • Image processing (e.g. Timelapse, CPW)	✓	✓		✓
GPS (e.g. Garmin handheld device) & spare batteries	**Recommended**	✓	✓	
Macroinvertebrate and tadpole reference documents and/or field guides	✓		✓	
Remote cameras • SD cards • Batteries	✓	✓	✓	✓
Camera mounting equipment (e.g. bungee cords, star pickets/stakes, brackets, bolts)	✓		✓	
EnviroDNA eDNA sampling kits • 50mL syringe, 1.2-micron PES filter, preservative syringe, ziplock bag • 50mL syringe, 5-micron PES filter, preservative syringe, ziplock bag	✓		✓	
Handheld water quality meter (e.g. Horiba U-50)	✓		✓	
Measuring rod • 10, 20 or 30 cm segments	✓		✓	
Soft tape measure	✓		✓	
Disposable gloves • Powder free • Stored in clean, ziplock bag	✓		✓	
Esky with ice or portable car fridge/freezer	✓		✓	
5L bucket • Volume markings on side	✓		✓	
Conical plankton net • 63µm mesh	✓		✓	
Aquatic dip net	✓		✓	

• 250mm mesh				
Picking equipment: • Camping/plastic table and chairs • Sieve • White plastic sorting tray • Tweezers, spoons and pipettes	**Optional**		✓	✓
80% ethanol	✓		✓	
Stationery: Sticker labels, pencil, permanent marker	✓		✓	
Hammer or mallet	✓		✓	
22L water jerry can • Filled with fresh tap water	✓		✓	
Freezer • <-20˚C	✓			✓
Macroinvertebrate identification equipment: • Microscope • Squeeze bottle with 70% ethanol • 60ml glass or plastic petri dishes • Stereo microscope with 10X magnification	**Optional**			✓
Data management system (e.g. cloud storage)	✓			✓