

Descriptions of indicators

The descriptions and techniques for listed indicators are a guide only.

Item	Group and title of Indicator	Brief description of technique and key purpose/s
1.0 Water		
1.1	Water pH	<p>Field testing of water sample using handheld regularly calibrated pH meter for determining immediate use of water source, informing management action and/or for monitoring longer term* trend [used in association with other data such as flow and rainfall]</p> <p>Water sources: a bore; a piezometer or other groundwater monitoring equipment; a wetland or other seasonally wet area; a salinity discharge area; drainage lines; a creek, gully or river; a lake, dam or other water storage.</p>
1.2	Salinity of water	<p>Field testing of water sample using handheld regularly calibrated Electrical Conductivity (EC) meter for determining immediate use of water source, informing management action and/or for monitoring longer term* trend [Used in association with other data such as flow and rainfall]</p> <p>Water sources: a bore; a piezometer or other groundwater monitoring equipment; a wetland or other seasonally wet area; a salinity discharge area; drainage lines; a creek, gully or river; a lake, dam or other water storage.</p>
1.3	Turbidity of water	Recommend use of 1.4 in preference
1.4	Fine sediment in water	Laboratory testing of water sample for monitoring short and long term* trends in total suspended solids resulting from impacts of fine sediment management actions [eg. ground cover] on property [Used in association with other data such as flow and rainfall].

1.5 Phosphates in water Field testing of water sample using spectrophotometer or colorimeter of orthophosphate (soluble reactive phosphate (SRP), free or bioavailable phosphates - dissolved and suspended - not sediment) to inform fertiliser management action and/or for short and long term* trend monitoring [Used in association with other data such as flow and rainfall] Level 2 monitoring using laboratory analysis.

Water sources: a bore; a piezometer or other groundwater monitoring equipment; a wetland or other seasonally wet area; a salinity discharge area; drainage lines; a creek, gully or river; a lake, dam or other water storage.

1.6 Nitrates in water Field testing of water sample for nitrates and nitrites using cadmium reduction method with spectrophotometer or colorimeter to inform fertiliser management action and for short and/or long term* trend monitoring [along with other data such as flow and rainfall] Level 2 monitoring using laboratory analysis.

Water sources: a bore; a piezometer or other groundwater monitoring equipment; a wetland or other seasonally wet area; a salinity discharge area; drainage lines; a creek, gully or river; a lake, dam or other water storage.

1.7 Dissolved oxygen Field-testing of water sample for dissolved oxygen using handheld meter and probe to inform management action and for short and long term* trend monitoring [Used in association with minimum temperature data; time of day data; and preferably water flow & rainfall data]. Level 2 monitoring using in situ laboratory level testing - Azide-Winkler Method.

Water sources: a bore; a piezometer or other groundwater monitoring equipment; a wetland or other seasonally wet area; a salinity discharge area; drainage lines; a creek, gully or river; a lake, dam or other water storage.

1.8 Faecal coliforms in water Laboratory testing of water within 24 hours of sample collection, for most probable number [MPN] of faecal coliform bacteria from animal production systems to inform management action [e.g. Stock access, effluent management & waterways protection] and for event, for short and/or long term* trend monitoring. [Used in association with other data such as flow, rainfall and stock movement] Faecal coliforms in water can become an important public health issue.

Water sources: a wetland or other seasonal wet area; a salinity discharge area; drainage lines; a creek, gully or river; a lake, dam or other water storage.

1.9	Farm chemical in water	Laboratory testing of water sample for concentration of farm chemicals [pesticide, herbicides, fertilisers etc] to inform management action and/or for event or for short and long term* trend monitoring [Used in association with other data such as flow, rainfall and chemical management] Water sources: a bore; a piezometer or other groundwater monitoring equipment; a wetland or other seasonally wet area; a salinity discharge area; drainage lines; a creek, gully or river; a lake, dam or other water storage.
1.10	Water flow	To obtain supporting data for flow related monitoring activity – for each site establish cross sectional survey and routinely and event measure water velocity using a staff gauge - long term and event term data to establish relationship to rainfall data
1.11	Local rainfall	Rainfall monitoring for property to obtain supporting data on local rainfall using basic Rainfall Gauge[s] and Chart[s]. Number and necessity of monitoring points depends on the size of the property and the proximity to known Bureau of Meteorology gauges.
1.12	Temperature of water	Field testing of temperature of water body using handheld meter to inform management action and for short and/or long term* trend monitoring [along with other data such as flow]. Water sources: a wetland or other seasonally wet area; a creek, gully or river; a lake, dam or other water storage.

2.0 In-stream/Riparian Zone/Wetland

2.1	Fish	Ethically appropriate netting/trapping/handling and identifying of fish samples against photo checklist to determine presence or absence and to monitor for impact of or to inform management action and for event, short and/or long term* trend monitoring [Used in association with other data such as flow and rainfall].
2.2	River & wetland fauna	Ethically appropriate trapping/handling and identifying of terrestrial and amphibious fauna against photo checklist to determine presence or absence and /or activity/evidence of fauna. To monitor for impact of or to inform management action. Monitoring may be event based or short and long term* trend monitoring [Used in association with other data such as flow and rainfall].

2.3	Aquatic macro-invertebrates	Ethically appropriate sampling/handling and identifying of community assemblages of benthic macro-invertebrates against identification chart for presence or absence and to monitor for impact of management action and for event, short and/or long term* trend monitoring [Used in association with other data such as flow and rainfall].
2.4	Microalgae in water	Observation [level 1] and/or laboratory analysis [level 2] of microalgae for presence or absence [e.g. Blue Green Algae] and to monitor for impact of or to inform management action (e.g. fertiliser and water flow management) and for event, short and/or long term* trend monitoring [Used in association with other data such as flow and rainfall].
2.5	In-stream habitat	Undertaking permanent sample site surveys against checklist for in-stream habitat structure including woody debris, aquatic plants, weeds etc. to monitor for impact of or to inform management action and/or for event or short] and long term* trend monitoring [Used in association with other data such as flow and rainfall].
2.6	Wetland area	Using surveys, aerial photos and photo point analysis of change in wetland or waterlogged areas to monitor for impact of or to inform management action and for event, short and/or long term* trend monitoring [Used in association with other data such as depth to groundwater, rainfall and climate].
2.7	Impact on wetlands	Using permanent traverse surveys and photo point analysis of various wetland events [drainage, damming, grazing, fire etc] to monitor for impact of or to inform management action (e.g. water harvesting, burning or grazing) and for event, short and/or long term* trend monitoring [Used in association with other data such as rainfall and climate].

3.0 Soil

3.1	Soil pH	Using in field testing soil pH kit [level 1] or pH pen [level 2] on representative soil samples. Measurements carried out every 2-3 years to monitor for impact of or to inform management action and for event and/or long term* trend monitoring [Used in association with other data such as history of land use – e.g. clearing, cropping, horticulture and hay production].
3.3	Soil structure	Using in field assessment of soil structure on representative soil samples annually to monitor for impact of or to inform management action and for event, short and/or long term* trend monitoring [Used in association with other data such as cropping, horticulture, hay production and stubble management methods, salinity and ground cover].

3.4	Plant available water content	Use of accredited laboratory analysis of representative soil samples for plant available water content to monitor for impact of or to inform management action and for event, short and/or long term* trend monitoring [Used in association with other data such as cropping, horticulture, hay production and stubble management methods, salinity and ground cover].
3.5	Soil chemistry	Use of accredited laboratory analysis of representative soil samples for plant available nutrients and toxic elements. Measured every 2-3 years to monitor for impact of or to inform management action and for event and/or long term* trend monitoring [Used in association with other data such as production methods, chemical use, salinity, and ground cover] [e.g. N, P, K, Mg, Ca, labile C, Al, Mg etc].
3.6	Soil life	Testing (technique to be determined) from representative and repeatable soil samples and conditions. Measured every 2-3 years to monitor for impact of or to inform management action and for event and/or long term* trend monitoring [Used in association with other data such as production methods, chemical use, salinity and ground cover].
3.7	Ground cover	Use of representative transect quadrat surveys & photo points for ground vegetation, organic matter, biological or physical crust soil cover to monitor for impact of or to inform management action [e.g. pasture management] and for event, short and/or long term* trend monitoring [Used in association with other data such as production methods, rainfall and other climatic data].
3.8	Gully erosion	Using permanent transect surveys against checklist and photo point analysis of rill, gully and/or stream bank erosion to monitor for impact or to inform management action and for event, short and/or long term* trend monitoring [Used in association with other data such as flow and rainfall] Level 2 monitoring measures change in width / unit length of gully, creek or river.
3.9	Hillslope erosion	Using representative permanent 'erosion pins' [calibrated star pickets] for measurement of soil accumulation or loss to monitor for impact or to inform management action [e.g. pasture management or stubble retention] and for event, short and/or long term* trend monitoring]. Used in association with other data such as flow and rainfall] Level 2 monitoring may use soil sediment traps.
3.10	Soil infiltration	Using in field [pasture or crop] infiltration test to measure the soil's ability to take in water to monitor for impact or to inform management action [e.g. pasture management or controlled traffic] and for event, short and/or long term* trend monitoring [used in association with other data such as production methods].

- 3.11 Wind erosion Change in soil loss from wind erosion using wind vane sampler for locally derived particles. Procedures developed with Dustwatch – Desert Knowledge CRC & Griffith University.

4.0 Salinity

4.1 Deep-rooted perennials Use of surveys, aerial photos, photo points and management records to determine change in area occupied by deep-rooted perennials to monitor for impact of or to inform management action and/or long term* trend monitoring [Used in association with other data such as production methods].

4.2 Saline land Use of transect surveys, aerial photos and photo points to determine change in area affected by stated salinity related condition [perhaps bare, patchy and slightly affected areas in hectares, surface salt crystals, vegetation composition] to monitor for impact of or to inform management action and/or long term* trend monitoring [Used in association with other data such as production methods].

4.3 Depth to Groundwater Using a representative number of monitoring bores to monitor for impact of or to inform management action and/or long term* trend monitoring [Used in association with other data such as rainfall, other climate data and production history].

4.4 Salinity of soil water Using 1:5 dilution in field technique with electrical conductivity meter testing of representative samples of surface soil to monitor for impact of or to inform management action and/or long term* trend monitoring [Used in association with other data such as rainfall, other climate data and production history].

5.0 Vegetation

5.1 Native vegetation area Using surveys, aerial photos and /or photo points to determine change in area of native vegetation [including streambank, wetlands and saline areas,] to monitor for impact of or to inform management action and/or long term* trend monitoring.

5.2	Vegetation density	Using data from permanent transects surveying of shrub cover (see below) compared to standard for the vegetation type and optionally supplemented with photopoint data to monitor for impact of or to inform management action and/or long term* trend monitoring. Consistent with Queensland Department of Environment and Resource Management BioCondition Assessment Framework.
5.3	Native plant richness	Using permanent transect surveys, specimen/photo identification and flora data sheet grouped by plant form to detect change in native plant richness and to monitor for impact of or to inform management action, and events [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity]. Consistent with Queensland Department of Environment and Resource Management BioCondition Assessment Framework.
5.4	Impact on native vegetation	Using permanent traverse surveys, photo points and flora response sheets analysis of impacts upon native vegetation [including grazing, fire, chemical damage and harvesting impact] to monitor impact of change in management practices or to inform management action.
5.5	Weed species	Using permanent traverse surveys, specimen/photo identification and flora data sheet to determine change in ecologically invasive weed species composition and to monitor for impact of or to inform management action and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity].
5.6	Weed cover	Using permanent 50 x 10 m plot to monitor change in extent of ecologically invasive weed species, for impact of or to inform management action, and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity].
5.7	Used exotic plants	
5.8	Recruitment of woody plants	Using permanent 100 x 50 m transects to periodically assess the presence and recruitment of the dominant overstorey of woody tree species to monitor for impact of or to inform management action and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity]. Consistent with Queensland Department of Environment and Resource Management BioCondition Assessment Framework.

5.9	Tree canopy cover & health	Periodic assessment of canopy cover and health along a 100 m transect of the living tree layer using the line intercept method and canopy health categories respectively. Undertaken to monitor for impact of or to inform management action, and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity]. Consistent with Queensland Department of Environment and Resource Management BioCondition Assessment Framework.
5.10	Shrub cover	Periodic assessment of shrub canopy cover along a 100 m transect of the living shrub layer using the line intercept method to monitor for impact of or to inform management action, and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity]. Consistent with Queensland Department of Environment and Resource Management BioCondition Assessment Framework.
5.11	Large trees	Using the number of large trees (above a standard diameter at breast height for the vegetation type or a selected diameter) and number of observable hollows (above 10 cm in diameter) in large trees within a 100 x 50 m transect area to monitor for impact of or to inform management action, and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity]. Consistent with Queensland Department of Environment and Resource Management BioCondition Assessment Framework.
5.12	Organic litter	Using the average cover of fine and coarse organic material of fallen leaves, twigs and branches above 10 cm diameter within five 1 x 1 m quadrats to monitor for impact of or to inform management action, and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity]. Consistent with Queensland Department of Environment and Resource Management BioCondition Assessment Framework.
5.13	Fallen woody material	Using the number of fallen woody logs and other debris above 10 cm and longer than 0.5 m in permanent 50 x 10 m plots. Additional data collection could include assessment of degree of decay to monitor for impact of or to inform management action, and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity]. Consistent with Queensland Department of Environment and Resource Management BioCondition Assessment Framework.
5.14	Pasture species	Using permanent transect surveys and specimen/photo identification to detect change in pasture species and to monitor for impact of or to inform management action, and event [e.g. fire, grazing, fencing] or long term* trend monitoring [e.g. salinity]. Consistent with Queensland Department of Employment, Economic Development and Innovation (Primary Industries) Stocktake and Grazing Land Management program and Queensland Department of Environment and Resource Management BioCondition Assessment Framework.

5.15	Yearly pasture use	Monitoring yearly use of pasture using quadrats, traverse surveys & photo points to assess pasture utilisation. Consistent with Queensland Department of Employment, Economic Development and Innovation (Primary Industries) Stocktake and Grazing Land Management program.
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6.0 Fire

6.1	Fire events	Obtaining data on fire behaviour [may include: fuel load, fire height, fire movement, rate of spread, ignition, recording time, date, area burnt, location, scorch height, percentage crown scorch, percentage burnt, fire intensity and weather data such as wind speed, wind direction, temperature, relative humidity, cloud cover to monitor impact of or to inform management action and support vegetation impact monitoring.
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7.0 Fauna - land

7.1	Native land fauna	Using opportunistic observation, fauna checklists and photo identification [level 1] and/or representative transect quadrat surveys, activity evidence and specialist knowledge [level 2] of presence or absence of land fauna to monitor impact of or to inform management action and/or for event or short or long term trend monitoring.
7.2	Fauna events	Using permanent transect surveys involving observation of fauna and evidence of fauna activity and fauna response sheets analysis of impacts upon fauna [including grazing, burning, weed invasion, animal pest pressure, chemical damage, harvesting impact] to monitor impact of or to inform management action.
7.3	Fauna behaviour	Using representative transects surveys involving observation of fauna behaviour and evidence of activity to monitor impact of or to inform management action.

- 7.4 Exotic pest fauna Use of opportunistic observation, fauna checklists and photo identification [level 1] and/or representative transect quadrats surveys, activity evidence and specialist knowledge [level 2] of terrestrial fauna and invertebrates for presence & absence to monitor impact of or to inform management action and/or for event or trend monitoring.

8.0 Greenhouse Accounting

- 8.1 Greenhouse emissions Using methods from Australian Greenhouse Office Factors and Methods Workbook for energy use component of enterprise greenhouse gas emissions [not including land use/production, vegetation change, carbon, methane or fertiliser] to monitor impact of or to inform management action.
- 8.2 Carbon sequestration Using methods from Australian Greenhouse Office Factors and Methods Workbook for estimated carbon sequestration for whole enterprise to monitor impact of or to inform management action.

9.0 General technique

- 9.1 Photopoints A simple supplementary technique using permanently marked locations, directions and other repeatability measures to periodically take photographic records of the change in a particular attribute such a vegetation density.

* Short term refers to less than five years and long term refers to longer than five years.

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