# Water quality

Information sheet

# Aquatic ecosystem condition reports

## 2021 panel assessment of creeks and rivers from the Western Mount Lofty Ranges, Barossa Valley and Clare Valley

**Issued August 2022**

*EPA 1129/22: This information sheet describes the outcome of the panel assessment of creeks and rivers sampled in spring 2021 from the Western Mount Lofty Ranges, Barossa Valley and Clare Valley.*

## Introduction

The Environment Protection Authority (EPA) coordinates a monitoring, evaluation and reporting (MER) program on the aquatic ecosystem condition of South Australian creeks and rivers. This MER program is designed to meet several objectives:

- Providing a statewide monitoring framework for creeks and rivers that revolves through the Landscape Boards SA regions with sufficient frequency to allow for 'state of the environment' reporting purposes.
- Describing aquatic ecosystem condition for broad general public understanding.
- Identifying the key pressures and management responses.
- Providing a useful reporting format to support environmental decision making within government, community and industry.

This information sheet provides a summary of the scientific work used in assessing monitoring data from creeks and rivers. Aquatic ecosystem science is not always rigid and precise; it is often open to different interpretations in several respects. The EPA has decided that the best way to assess the condition of streams is through an expert panel deliberation that uses a consistent descriptive modelling approach. The panel members comprised an environmental consultant and two biologists from the EPA. All have at least 20 years' experience in monitoring and assessing a range of streams across South Australia.

The panel members were:

- Peter Goonan, EPA
- Tracy Corbin, EPA
- Chris Madden, Freshwater Macroinvertebrates

This information sheet is a technical document that contains relatively sophisticated concepts and content. It summarises the scientific assessment of data collected from creeks and rivers throughout the Western Mount Lofty Ranges (within the Green Adelaide and Hills and Fleurieu Landscape SA boundaries) and the Barossa Valley and Clare Valley (both within Northern and Yorke Landscape SA boundary) during spring 2021.

In the past, these regions aligned well with the natural resources management (NRM) areas defined under the *Natural Resources Management Act 2004*. However, this changed on 1 July 2020 when the *Landscape South Australia Act 2019* was enacted as the key framework for managing the state's land, water, pest plants and animals, and biodiversity across the state. Green Adelaide was established to help Adelaide become a sustainable, green and climate-resilient city and eight regional Landscape SA boards were established to facilitate the sustainable management of our landscapes (see https://www.landscape.sa.gov.au/).

The Landscape SA and Green Adelaide boundaries are different to the NRM areas, and in places cut across stream catchments and the drainage basins that they discharge into, so reporting for creeks and rivers will continue to describe results across drainage basin regions as well as sample sites from different Landscape SA or Green Adelaide.

In 2021, sites from the Barossa Valley are now included within the Northern and Yorke Landscape SA boundary, along with sites from the Clare Valley. The Hills and Fleurieu Landscape SA northern boundary extends into the South Para River and the Torrens River at Birdwood, resulting in the sharing of sites with the Northern and Yorke Landscape SA from within the Western Mount Lofty Ranges that all drain and discharge towards the sea.

## Site selection and sampling design

A total of 36 sites were sampled during spring 2021, comprising 26 sites from the Western Mount Lofty Ranges within the Green Adelaide and the Hills and Fleurieu Landscape regions, and five sites each in the Barossa and Clare Valleys within the Northern and Yorke Landscape region. Sampling was carried out from 2 November to 3 December 2021 in the Western Mount Lofty Ranges, 29 to 30 November 2021 in the Barossa Valley, and 2 to 3 December 2021 in the Clare Valley.

In previous years, sampling was also carried out in autumn to provide data from what is often the most water stressed season but the decision was made in 2018 to omit the autumn sampling period because most of the pattern in the assessments were evident using just the spring data. This approach has allowed the results to be published soon after data had been analysed and enabled funds to be directed to sampling just in spring of each year.

**Western Mount Lofty Ranges region (incorporating sites from Green Adelaide, and Hills and Fleurieu Landscape SA)**

Dr Kristian Peters (Green Adelaide) recommended sites for sampling from catchments across Green Adelaide and the Hills and Fleurieu boundaries which had not been assessed for 10–20 years. Wherever possible, sites from both the upper and lower reaches of target streams were included to provide an understanding of any changes that occur across stream catchments. Most sites were located in cleared agricultural or urban catchments which are different from recent survey work in the Western Mount Lofty Ranges (2016–20) that focused on streams from well-vegetated areas in mostly good condition. Consequently, targeted sites were distributed from the Inman River in the south to the Gawler and South Para Rivers in the north, and included sites from Little Para River, Torrens River, Sturt River and Onkaparinga River catchments, and several smaller coastal streams draining into Gulf St Vincent and the Southern Ocean.

**Barossa Valley and Clare Valley**

Dr Anthelia Bond and Ms Jennifer Munro (Northern and Yorke Landscape SA) recommended five priority sites from both the Barossa and Clare Valleys for sampling to provide an update on the condition of streams in both valleys. Both areas had not been assessed recently, and the data and ratings would contribute towards future water resource planning and on-ground works by the Landscape Board. A subset of previously sampled fixed sites in the 1990s or nearby reaches were included from the North Para River catchment in the Barossa Valley, and from the Wakefield and Broughton River catchments in the Clare Valley.

### Fixed sites versus random site selection

It is important to note that selecting fixed sites provides targeted information about the sampled sites and only gives a broad indication of the general condition of waters in a catchment or region. The lack of randomly selected sites limits the ability for this type of study design to provide a statistically valid assessment of all waters in a region with some measure of known error (Steven and Olsen 2004).

The EPA has developed a database covering all stream reaches found in South Australia that can be used to identify randomly selected sites (Catchment Simulations Solution 2011), which would allow the findings to be statistically scaled up to report on the number or proportion of stream reaches in different condition classes or subject to a water quality or habitat disturbance. If this type of information is required in the future then sites can be selected using this approach. As part of negotiations with our partner organisations, the fixed and selected site sampling approach was endorsed and used in sampling sites in 2021.

## Sampling strategy

Each site comprised a 100-m section of stream which was selected to represent the typical physical conditions present in the stream to be assessed. Site coordinates were taken from the middle of each site using a Garmin GPS.

Aquatic macroinvertebrates (invertebrates visible to the naked eye) were sampled using a 250-µm meshed triangular dip-net to sample both non-flowing edge habitat and fast-flowing riffle habitat, whenever they extend over at least 10 m within the site to be sampled. The majority of South Australian streams have edge or pool habitats present but some of the wetter catchments also maintain sufficient riffle habitat to enable an additional sample to be taken of the organisms that inhabit flowing waters. In cases where the available habitat does not meet the 10-m distance threshold, no sample is generally taken at the site but notes are recorded of the animals seen in the field with the naked eye from whatever habitat is present.

A rapid field processing method was used to identify collected macroinvertebrates, which ensured that the results are capable of being reported soon after the completion of the sampling campaign. Each sample was placed in a white tray and specimens were sorted and identified for at least 30-minutes and an estimate of the total abundance of each taxon was made at the conclusion of processing. If a new taxon was recorded within the last 5-minute period, then an additional 5-minutes was added to the sorting period to continue to search for new species. Representative specimens of each taxon were preserved in a labelled container for each habitat, and all identifications were later verified using microscopes and identification keys and publications in the laboratory soon after the completion of field sampling.

The data for each sampled habitat was entered separately onto an Excel spreadsheet, which includes a possible 815 macroinvertebrate taxa that are listed on the current inland waters database for South Australia. Consequently, well-watered sites had data available from both edge and riffle habitats; whereas in the drier sites lacking flowing water and comprised edge, data is taken from non-flowing connected channel or isolated pool habitats or were dry when visited.

A total of 101 observations were also recorded of the vegetation in the channel on the riparian edge and from the surrounding buffer zone to provide an additional biotic data layer to contribute to any assessment of stream condition. This enables dry sites that lack aquatic macroinvertebrates to be given an interim assessment of condition based on the vegetation present at the site and the degree of catchment disturbance upstream. An additional 156 measurements and observations were also taken at each site comprising data about the water quality, flow rate, sediment composition, habitat extent, and adjacent land use which were adopted to characterise the stressors that potentially affect each sampled site.

Field water quality was recorded at the site using a calibrated YSI multimeter and included measurements of the electrical conductivity (surrogate for salinity), dissolved oxygen content, pH and temperature.

A water sample was also taken at each site by compositing several 1-litre samples taken from different depths and parts of the stream site into a clean bucket. One black 1-L PET bottle was filled with water from the well-mixed bucket for chlorophyll *a* and *b* analysis, and two 125-mL PET bottles were also filled with water from the same bucket; one was field filtered using a syringe and 0.45 um filter discs for dissolved nitrogen determination (part of the total nitrogen analysis) and the other was unfiltered for total nutrient analyses. All analyses were carried out by the National Association of Testing Authorities (NATA) accredited Australian Water Quality Centre in Adelaide.

All data collected using this approach was collected and verified within two months after the completion of sampling, which enables the results to be fully analysed and reported within a few months from collection.

## The assessment

Members of the expert panel individually rated each site using a descriptive model for interpreting change in aquatic ecosystems in relation to increasing levels of disturbance (Davies and Jackson 2006). The assumption in this assessment is that biological (ecological) condition deteriorates as the degree of human disturbance in the catchment increases, and conversely the best condition occurs where there is little to no human disturbance of the environment (Figure 1).

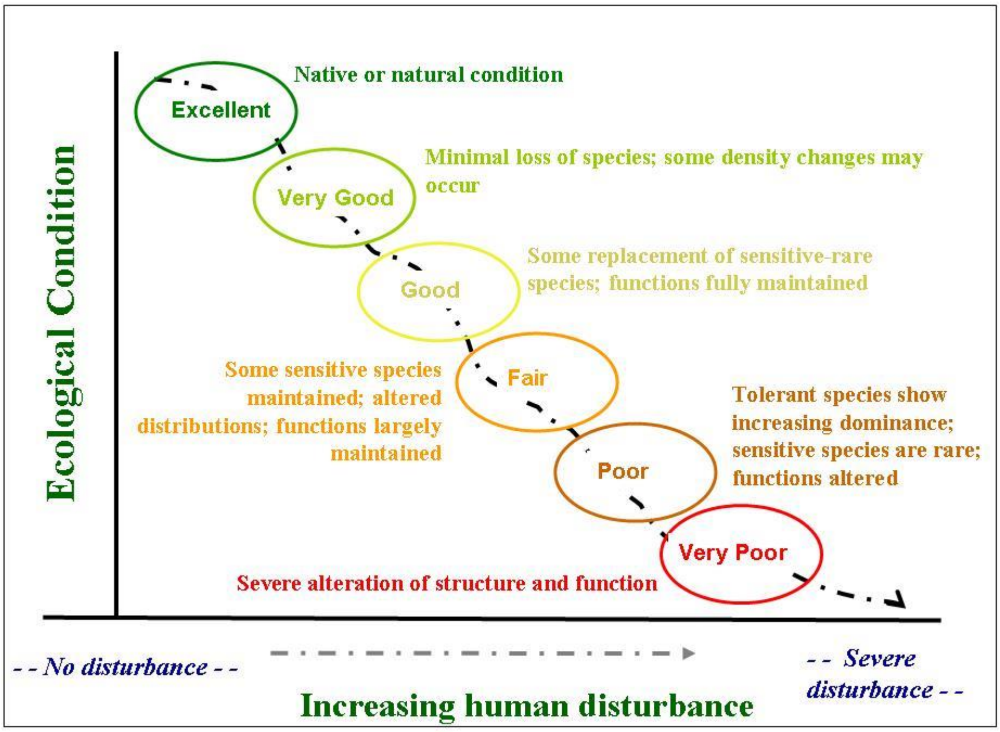


**Figure 1** **Human disturbance gradient showing the six different ecological condition grades or ratings ranging from excellent (best) to very poor (worst) with a brief definition of each condition**

The process used to grade or rate sites involved the following steps. Firstly, a conceptual model describing the biological and environmental responses to a general disturbance gradient was developed, reviewed and updated by the panel (Table 2). Secondly, species lists were compiled which described the expected biotic assemblage for up to six potential condition ratings, based on the data that was collected in 2021 (Table 3). Thirdly, each site was given a rating based on the macroinvertebrate communities, vegetation assemblages, water chemistry and sediment features that were recorded during the spring sampling period. Lastly, the individual ratings derived by the panel members were combined to produce an overall, or final, rating for each site (Table 4).

The final reported ratings were derived by determining the mode (ie the most common rating from the panel ratings for each site). In the interests of being transparent about the final ratings derived using this process, all results have been included in Table 3 to show where the panel agreed or showed some difference of opinion in terms of rating individual sites.

The ratings in the model range from Excellent to Very Poor. However, given the extent of vegetation clearance, land-use modifications, widespread grazing by stock and feral animals, and presence of introduced aquatic species in the region, the panel considered that Excellent probably no longer occurs and was certainly not evident from the sites sampled in 2021. No site was considered to be in a Very Good condition but previous sampling in the Western Mount Lofty Ranges had reported sites in this condition in the past, mostly from First Creek at Waterfall Gully and a few small coastal streams from the Fleurieu Peninsula.

The expected condition ratings (called Tier 1 assessments) of most sampled stream reaches have also been estimated in the past based solely on land-use mapping, remotely sensed and other state-based datasets (dams, soils) without any specific site data, using a modified version of Bryce *et al* (1999). Those ratings are included in Table 3 to show that in areas heavily modified by human disturbances (eg land-use clearing, dam construction, roads, agricultural and urban runoff) streams are likely to be significantly degraded compared to streams flowing in less modified landscapes.

The EPA is also testing a new approach to estimating the expected condition of streams using boosted regression trees (Edith *et al* 2008, Waite and Van Metre 2017) as part of the assessment process. Tier 1 ratings in the future will be generated by identifying the most significant map-based variables (eg land use, climate, and soils) that correlate with previous site condition assessment ratings, and will use the predictor variables to estimate the condition of both sampled and unsampled reaches of targeted streams (see https://www.epa.sa.gov.au/files/14069_inland_waters_methods.pdf).

## 2021 results and discussion

Table 1 provides a summary of the overall condition rating for each site sampled in 2021. No sites were in Excellent or Very Good conditions, 31% were in Good condition, 53% in Fair condition, 14% in Poor condition and 3% in Very Poor condition. Note that these results refer to the sampled sites and should not be extrapolated to infer any regional patterns due to the process used to target only fixed sites. Nevertheless, 31% of sites were in reasonable condition and 69% of sites were in a degraded state when sampled.

**Table 1 Summary of condition ratings (number (%) for Western Mount Lofty Ranges and the Barossa Valley and Clare Valley**

| Condition rating | Western Mt Lofty Ranges | Barossa Valley | Clare Valley | Total |
|---|---|---|---|---|
| **Excellent** | 0 | 0 | 0 | 0 |
| **Very Good** | 0 | 0 | 0 | 0 |
| **Good** | 10 | 1 | 0 | 11 (30.6%) |
| **Fair** | 13 | 3 | 3 | 19 (52.8%) |
| **Poor** | 2 | 1 | 2 | 5 (13.9%) |
| **Very Poor** | 1 | 0 | 0 | 1 (2.8%) |
| **TOTAL** | 26 | 5 | 5 | 36 |

The sites that were assigned a Good rating included Little Para River off One Tree Hill, Chambers Creek, Sturt River at Coromandel Valley and Bedford, Scott's Creek at Scott's Bottom, Onkaparinga River near Baker's Gully, Echunga Creek, Wirra Creek in Willunga, Waterfall Creek and Congeratinga River. These stream sites occur in well-vegetated grazing landscapes and on the edges of urban development in the Western Mount Lofty Ranges. Only the mid-reach Jacobs Creek site at the gauge station rated in Good condition from the Barossa Valley, and no site from the Clare Valley was assigned this condition rating. These sites showed evidence of slight nutrient enrichment but were characterised by the presence of large areas of native vegetation within their catchments, functioning riparian zones, and each provided habitat for several rare, sensitive and flow-dependent macroinvertebrates.

The Fair sites included the Gawler River, South Para River, Chain of Ponds creek, Field River, Panatalinga Creek, Scott's Creek off Matthews Rd, the mid- and lower Onkaparinga River, Jupiter Creek, lower Christies Creek, Waitpinga River and the mid- and lower Inman River in the Western Mount Lofty Ranges. Three sites from the upper, middle and lower North Para River in the Barossa Valley and Hutt River, Skillogallee River and Wakefield River in the Clare Valley were also assigned a Fair rating. These sites showed evidence of obvious nutrient enrichment, some with moderate salinity, and a number had degraded riparian zones and/or were located in urbanised areas, and each only provided habitat for a limited number of significant aquatic species and were dominated by generalist and tolerant macroinvertebrates.

The Poor sites included the mid-reach of Christies Creek and Parananacooka Creek in the Western Mount Lofty Ranges, Greenock Creek in the Barossa Valley, and Eyre Creek and Wakefield River at Mintaro in the Clare Valley. These stream sites showed evidence of either significant nutrient enrichment or were salinised, had limited native vegetation remaining in their catchments, ineffective riparian zones dominated by introduced grasses and weeds, and supported a sparse community of pollution tolerant macroinvertebrates.

The Very Poor site was located in the lower reach of the Little Para River in Burton, surrounded by housing in a channelised section of stream that receives stormwater inflows. Only a very sparse community of pollution tolerant macroinvertebrates was collected from this site when sampled.

## Variability in panel member ratings

The expert panel assigned the same condition rating to 20 of the 36 sites sampled (56%) and the remaining 16 sites (44%) only differed by one condition rating of each other (Table 4). Consequently, the panel showed considerable consistency in rating the condition of sites using this approach, which indicated that the conceptual model provided an accurate representation of the range of streams that occurred in each landscape region in 2021.

It is important to note that it would be unrealistic to obtain complete agreement in rating sites using an expert panel, or indeed any approach to assessing stream condition (eg classifying sites using indices or reference-based models, gradient analysis, guideline comparisons), due to problems associated with separating groups along a continuum of possible groups using environmental data that is often inherently highly variable.

## Comparison of field-based condition ratings and map-based Tier 1 expected condition ratings

The expected condition ratings shown in Table 4 were either consistent with or underestimated the actual site condition based on 2021 field data. Ten sites (28%) were assigned the same rating as the assessment panel ratings, 23 sites (64%) were rated one condition rating worse than actual, and three sites (8%) were given two condition ratings worse than the actual condition. Further refinements using boosted regression tree models and incorporating newly released climate and water modelling data (eg using the newly released Australian Landscape Water Balance Model: AWRA-L v6 via http://www.bom.gov.au/water/landscape/) are expected to provide more comparable expected condition ratings for inclusion in future reports.

## Water chemistry of South Australian streams

Table 5 provides a statistical summary of the major chemistry and algal biomass (estimated using chlorophyll measurements) parameters recorded from the sites sampled in spring 2020. The median values indicate that the streams sampled from the Western Mount Lofty Ranges, Barossa Valley and Clare Valley were moderately fresh (electrical conductivity 1,908 uS/cm or salinity of about 1,145 mg/L), alkaline (pH 7.8), well-oxygenated (86% saturated), had moderate to high concentrations of phosphorus (0.03 mg/L) and nitrogen (0.7 mg/L), and moderate chlorophyll biomass (5 µg/L).

There are few undisturbed with more than 50% native vegetation that can provide a water quality benchmark or reference for streams in the Mount Lofty Ranges and Fleurieu Peninsula. They are largely confined to conservation reserves (eg First Creek in Cleland Conservation Park in the Western Mount Lofty Ranges) or small coastal streams (eg First Creek, Fleurieu Peninsula) in often upland, rocky and steeply sloping landscapes that have historically been unsuitable for development. There are however, too few of these streams distributed across the southern part of South Australia that can provide an undisturbed reference for the many streams that occur among catchments that were substantially cleared and modified for agriculture and residential housing over 100 years ago.

To overcome this problem, the US EPA (2000) advocated using the 25th percentile of all data from a region to help set nutrient thresholds, which were expected to approximate the tipping point where streams were likely to be at increased risk of being degraded by excess nutrients. Using this approach, the data provided in Table 5 indicates that the nutrient thresholds for the sites sampled in spring 2021 were as follows.

| | **Total nitrogen (TN mg/L)** | **Total phosphorus (TP mg/L)** |
|---|---|---|
| **All sites** | 0.5 | 0.02 |
| **Western Mount Lofty Ranges** | 0.5 | 0.02 |
| **Barossa Valley** | 0.7 | 0.02 |
| **Clare Valley** | 0.4 | 0.08 |

These concentrations are comparable to those cited in the scientific literature using the same statistical criterion (see Chambers *et al* 2012 and Smucker *et al* 2013), and the same as those proposed for the protection of sensitive mayflies and stoneflies from South Australian waters (Corbin and Goonan 2010). Recent analyses of macroinvertebrate community thresholds associated with nutrients have shown that the ecological change points occurred at 0.3 mgTN/L and 0.01 mgTP/L for Northern and Southern Mount Lofty streams including Fleurieu Peninsula streams, and 0.6 mgTN/L and 0.02 mgTP/L for urbanised areas (EPA unpublished data). These results suggest that the nitrogen and phosphorus concentrations recorded in 2021 are high enough in each of the areas sampled to cause impacts to aquatic ecosystems and potentially degrade stream condition. This explains why 69% of sites showed some signs of nutrient enrichment.

Recent sampling in the Western Mount Lofty Ranges has shown some variation with the $25^{th}$ percentile TN concentration, with values of 0.6 mg/L in 2013 (46 sites sampled), 0.37 mg/L in 2015 (17 sites), 0.45 mg/L in 2016 (38 sites), 0.3 mg/L in 2018 (15 sites) and 0.6 mg/L in 2020 (14 sites). The $25^{th}$ percentile TP concentration has consistently been 0.02 mg/L until 2020, when 0.03mg/L was derived.

## Conceptual model issues

A central assumption of the conceptual model is that the high nutrient concentrations (eg nitrogen and phosphorus) recorded from many South Australian streams originates from human activities in each catchment, rather than from a natural source (NLWRA 2001). This is consistent with the general poor nutrient status of ancient Australian soils and the need for native plants to conserve and recycle nutrients, rather than allow the regular export of nitrogen and phosphorus from the land into streams, where the nutrients may eventually be deposited many kilometres away further downstream.

Consequently, it was assumed that historical and present stock and feral animal grazing land-uses and cropping activities post-European settlement have contributed towards the nutrient enrichment of many streams in each region in modern times. This may be evident through measuring higher than expected concentrations of nutrients in water samples (eg TN > 0.5 mg/L or TP > 0.02 mg/L as described above) and/or noting signs of enrichment due to the presence of large growths of phytoplankton, filamentous algae or aquatic plants. Under such conditions, a generalist assemblage of aquatic macroinvertebrates typically dominates because they are capable of exploiting the high plant productivity and tolerating occasional poor water quality events that often occur in such streams. In contrast, few if any, of the regionally rare, sensitive and/or habitat specialists would be expected to occur in such streams, and never in large numbers. These types of enrichment responses were subsequently incorporated into the conceptual model to represent the biological and chemical patterns that have been described in the scientific literature for well over 100 years.

Similarly, another assumption of the model is that the high salinity of some streams has been caused, or at least exacerbated, by the extent of native vegetation clearance and replacement by cropping and grazing practices in some catchments in the past, which has often created conditions that has promoted the secondary salinisation of streams due to inflow of saline groundwater. High salinity has been recognised as a major factor for the loss of salt-sensitive species and creation of conditions that favour only the more salt tolerant species to be able to colonise and subsequently complete their life-cycles. Recent research indicates that most freshwater species are generally replaced by salt-tolerant species when salinities exceed about 5,000–10,000 mg/L, and that different threshold effects are evident with different taxonomic groups at often lower concentrations (eg Nielsen *et al* 2008, Kefford *et al* 2011). While it is possible that the salinity of some Mount Lofty Ranges streams may have approached or exceeded this concentration prior to European settlement, it was assumed as part of this assessment that the extensive land-use changes brought about by farming has mobilised more salt into streams, and that streams with a salinity at or above 5,000 mg/L represent a highly disturbed state in any conceptual model developed that describes South Australian inland waters.

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# Further information

## Legislation

Online legislation is freely available. Copies of legislation are available for purchase from:

## General information

Environment Protection Authority
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|---|---|
| Telephone: | (08) 8204 2004 |
| Facsimile: | (08) 8124 4670 |
| Freecall: | 1800 623 445 (country) |
| Website: | https://www.epa.sa.gov.au |
| Email: | epainfo@sa.gov.au |

**Table 2 Conceptual model of ecological responses to a disturbance gradient in the Western Mount Lofty Ranges, and the Barossa and Clare Valleys**

| Rating | Excellent | Very Good | Good | Fair | Poor | Very Poor |
|---|---|---|---|---|---|---|
| **Stressor description** | As naturally occurs; probably no longer present in the western Mount Lofty Ranges due to the level of vegetation clearance and landscape modification. Streams with natural vegetation communities, such as First and Sixth creeks and low-order streams in the upper South Para River in the Mount Lofty Ranges, and coastal creeks on the southern Fleurieu Peninsula (eg Aaron Creek, lower reaches of Deep Creek and First Creek) may represent this state on occasions but the presence of introduced species and nutrient enrichment associated with human uses in the catchment precludes rating sites in the region as Excellent. | Least impacted streams with largely natural vegetation and low levels of human disturbance are not common in the region and may only include First and Sixth creeks and low-order streams in the upper South Para River in the Mount Lofty Ranges, and coastal creeks on the southern Fleurieu Peninsula (eg Aaron Creek, lower reaches of The Deep Creek and First Creek). Apart from marron in Deep Creek, these streams have few introduced species present and show little sign of nutrient enrichment. | Best condition sites showing initial signs of enrichment; likely to occur in streams with large areas of natural vegetation remaining in their catchments and generally characterised by permanent/near permanent, flowing, freshwater habitats but may also include more ephemeral habitats. Numerous streams in the watersheds of all the reservoirs in the region would be expected to represent this condition in most years. | Moderate nutrient enrichment; likely to commonly occur in the region due to the extent of vegetation clearance and associated agricultural development. This is likely to result in significant nutrient enrichment and sediment effects, and result in poorer ratings being assigned. | Gross nutrient enrichment or degradation; likely to commonly occur in the region due to the extent of vegetation clearance and associated agricultural development and urbanisation. Ephemeral and saline streams in the region are likely to show extensive enrichment effects due to the lack of substantial dilution flows in most years. | Severely altered; may occur in the region in urban stream reaches, downstream from wastewater discharges, and highly degraded ephemeral and more permanent streams in extensively cleared agricultural settings. Sites assigned to this rating will be affected by a toxicant or other disturbance that significantly limits the diversity and abundance of aquatic life present in a stream. |

| Rating | Excellent | Very Good | Good | Fair | Poor | Very Poor |
|---|---|---|---|---|---|---|
| **Biological assemblages** | Native assemblages of plants and animals; usually with many rare or sensitive species present; typically high Ephemeroptera, Plecoptera and Trichoptera (EPT) richness; no symptoms of stress or introduced aquatic species present. Temporary and ephemeral habitats have a low EPT richness but provide habitat for many colonising insects (eg beetles, waterbugs and dipterans); abundances of all species generally low. | Best of what is left; least disturbed assemblages, high richness, intolerants and specialist taxa dominate abundances. May include some introduced species present in low abundances. | Typical assemblages for least impacted streams; good richness, generalist assemblage that includes at least some rare and sensitive species. Emerging symptoms of stress in relation to nutrients and fine sediments. At least some remnant native vegetation present. | Impaired assemblages; generalists and tolerant taxa dominate numbers which usually includes some very abundant taxa. Sensitive and rare taxa present in very low numbers; usual absence of some taxa expected for the available habitats present. At least some trees present in the local catchment and on the banks. | Degraded assemblages; tolerant and generalist species dominate but numbers usually reduced. Although 1–2 generalist taxa may be present in high abundances; only 1–2 rare or sensitive species present in low abundances or absent. Often only few scattered trees in the catchment and on the banks. | Severely degraded assemblages with few taxa and generally low abundances; may have large numbers of one tolerant taxon, such as worms, mosquito larvae, amphipods (*Austrochiltonia*) or midges (*Chironomus, Tanytarsus or Procladius)*. Can include organic feeders in highly polluted waters (eg syrphid larvae). Vegetation often completely comprised introduced or planted species. |
| **Water chemistry conditions** | As naturally occurs; no human sources of contaminants present and pest species not impacting on water quality (eg nutrient enrichment, deposits of waste with high levels of hormones). | Least disturbed; high proportion natural features means waters are well oxygenated and low in nutrients and turbidity; may be coloured due to tannins sourced from native plants. | Largely unremarkable water quality with at least some nutrients present at higher concentrations than expected, coupled with at least one plant indicator showing emerging signs of enrichment effects (eg chlorophyll *a* >10 ug/L, | Fair water quality with generally saturated dissolved oxygen (when sampled during the day). At least one nutrient present at a high concentration and high plant productivity (eg chlorophyll *a* >10ug/L, filamentous algae >10% cover | Poor water quality with generally saturated dissolved oxygen (when sampled during the day), nutrients present at high concentrations and high plant productivity evident at the site (eg usually chlorophyll *a* >10ug/L, filamentous algae >10% | Very poor water quality with at least one parameter at a toxicant concentration that is likely to limit the aquatic diversity of a stream; often very low dissolved oxygen and may be saline and enriched in nutrients but algal and plant growth limited. |

| Rating | Excellent | Very Good | Good | Fair | Poor | Very Poor |
|---|---|---|---|---|---|---|
| | | | filamentous algae >10% cover and/or macrophytes >35% cover); but site not overwhelmed. | and/or macrophytes >35% cover) evident on occasions. | cover and macrophytes >35% cover) most of the time. | |
| **Physical habitat and flow patterns** | Natural habitat and flow patterns; no or few farm dams present; range of sediment types present and not always anaerobic. | Near natural habitat and flow regimes; mostly well vegetated catchments with few dams present; range of sediment types present and not always anaerobic. | Good habitat structure and flow patterns; extent of dam development has not caused an obvious loss of riffle (flowing) habitats; range of sediment types present and not always anaerobic. | Fair habitat structure and flow patterns; many dams may be present in the catchment and likely to affect flow patterns; anaerobic fine sediments usually present, except when large algal growths occur and oxygenate the sediments. | Poor habitat structure and flow patterns; may have many dams present in the catchment and obviously affect flow patterns; anaerobic fine sediments usually present, except when large algal growths occur and oxygenate the sediments. | Severe modifications to physical habitat and usually with unnatural flow patterns due to abstraction or discharges; little to no remnant native vegetation remaining; cleared agricultural or urban sites; anaerobic fine sediments, rip-rap or alien sediments often present. |
| **Human activities and sources in the catchment** | No obvious human disturbances but may include roads and sparse rural housing; no point sources and diffuse pollution not detectable, largely due to the extent of vegetation surrounding each stream. | No significant human disturbances but may include some rural housing and roads; no point source discharges and diffuse pollution not obviously affecting the aquatic ecosystem due to the extent of native vegetation surrounding each stream. | Effects of human disturbance becoming obvious; point sources may be present but do not dominate flows. Good buffer zones and/or riparian vegetation present that help to mitigate diffuse pollution effects from surrounding land uses. | Point and diffuse source enrichment effects evident. Riparian zone not effective at mitigating nutrients and fine sediment typically entering these streams. | Obvious point and/or diffuse source enrichment effects present; unbuffered channel with ineffective riparian vegetation other than introduced grasses. Major changes to catchment land use with little remnant vegetation remaining and agriculture and/or urban uses dominate. | Severe point and/or diffuse source effects that may include toxicant responses; effects dominate water quality and biological response with little signs of the original waterway evident; unbuffered channel that has undergone extreme modifications in an urban or agricultural setting. |

**Table 3 List of biota expected to occur for each site rating in the Western Mount Lofty Ranges, Barossa Valley and Clare Valley**

Streams in an Excellent condition probably no longer occur in the region; these would be expected to support several rare and sensitive species, often dominating or co-dominant with generalist and tolerant species, similar to sites in Very Good condition but lacking any introduced species.

A number of species were not collected in 2021 but had been recorded in 2020, included: molluscs *Isidorella* and *Plotiopsis* (translocated from River Murray); mites Momoniidae and Hygrobatidae; crustacean *Cherax cainii* (introduced species); beetle Haliplidae; dipterans *Paracnephia, Stictocladius,* Empididae and Psychodidae; mayfly *Tasmanophlebia;* odonates *Austrogomphus* and *Pseudagrion;* stonefly *Newmanoperla*; and caddisflies Tasimiidae, *Atriplectides* and *Oxyethira columba*.

Several other species not collected in 2021 but recorded from the region in the past five years included: the beetle *Limnoxenus*, mayflies *Centroptilum* and *Nousia fuscula*, hemipteran *Hydrometra*, caddisflies *Apsilochorema*, *Orthotrichia*, *Orphninotrichia*, *Anisocentropus* and *Leptorussa*, and the native fish *Galaxias olidus*. Note that some taxa identified to species previously using more intensive laboratory sorting protocols (eg blackfly *Simulium melatum*) may still be among the collected specimens but is not being recognised using our current rapid-field processing methods that only identify some taxa to genus level (eg *Simulium* species).

| | Very Good | Good | Fair | Poor | Very Poor |
|---|---|---|---|---|---|
| **Attribute 1 Rare and/or regionally endemic** | Most taxa from the following list typically present from flowing freshwater riffle habitats: **Acarina** Hygrobatidae *Australiobates, Coaustraliobates;* **Trichoptera** *Ulmerochorema;* **Odonata** *Hemigomphus***;** **Diptera** Thaumaliidae (*Austrothaumalea*); Chironomidae *Stempellina* | One or more taxa from the following list present, typically from flowing freshwater riffle habitats: **Acarina** Hygrobatidae *Australiobates, Coaustraliobates;* **Trichoptera** *Ulmerochorema;* **Odonata** *Hemigomphus;* **Diptera** Thaumaliidae (*Austrothaumalea*); Chironomidae *Stempellina* | None present | None present | None present |
| **Attribute 2 Sensitive, rare or vulnerable specialist taxa with narrow environmental requirements** | Several taxa from the following list present, typically from freshwater streams with a riffle-pool sequence in low to moderate numbers: **Coleoptera** *Simsonia* and *Sclerocyphon*; **Ephemeroptera** *Offadens*, | One or more taxa from the following list present, typically from freshwater streams with a riffle-pool sequence in low numbers: **Coleoptera** *Simsonia* and *Sclerocyphon;* **Ephemeroptera** *Offadens*, *Atalophlebia australasica;* | Absent or low numbers of 1–2 taxa from the following list may be present: **Ephemeroptera** *Offadens*; *Atalophlebia australasica;* **Plecoptera** *Illiesoperla;* **Trichoptera** *Lingora* (sometimes in large numbers | None present | None present |

| | Very Good | Good | Fair | Poor | Very Poor |
|---|---|---|---|---|---|
| | *Atalophlebia australasica;* **Plecoptera** *Illiesoperla* **Trichoptera** *Lingora* (sometimes in large numbers in riffles), *Triplectides similis, Taschorema;* **Diptera** Chironomidae *Riethia* and *Cardiocladius* | **Plecoptera** *Illiesoperla* **Trichoptera** *Lingora* (sometimes in large numbers in riffles), *Triplectides similis, Taschorema;* **Diptera** Chironomidae *Riethia* and *Cardiocladius* | in riffles), *Triplectides similis, Taschorema;* **Diptera** Chironomidae *Riethia* | | |
| **Attribute 3 Sensitive, ubiquitous taxa** | Several taxa from the following list present, typically in low to moderate numbers from flowing streams: **Acarina** Hygrobatidae, *Procorticacarus;* **Mollusca** *Austropygrus*; **Ephemeroptera** *Thraulophlebia, Atalophlebia australis*; **Plecoptera** *Dinotoperla, Riekoperla, Austrocerca;* **Diptera** Dixidae, *Austrosimulium,* Ceratopogonidae (*Alluauodomia, Ceratopogon*)*;* Chironomidae *Rheotanytarsus;* **Trichoptera** *Cheumatopsyche* | One or more taxa from the following list present, typically in low to moderate numbers: **Acarina** Hygrobatidae, *Procorticacarus;* **Mollusca** *Austropygrus*; **Ephemeroptera** *Thraulophlebia, Atalophlebia australis*; **Plecoptera** *Dinotoperla, Riekoperla, Austrocerca;* **Diptera** Dixidae, *Austrosimulium*; Ceratopogonidae (*Alluauodomia, Ceratopogon*); Chironomidae *Rheotanytarsus;* **Trichoptera** *Cheumatopsyche* | Absent or low numbers of 1–2 taxa from the following list may be present usually in low numbers: **Mollusca** *Austropygrus*; **Ephemeroptera** *Thraulophlebia, Atalophlebia australis*; **Plecoptera** *Dinotoperla, Riekoperla, Austrocerca;* **Diptera** Dixidae, *Austrosimulium*; Ceratopogonidae (*Ceratopogon*); Chironomidae *Rheotanytarsus;* **Trichoptera** *Cheumatopsyche* (sometimes in large numbers in riffles) | Absent or low numbers of one of the following may be present: **Ephemeroptera** *Atalophlebia australis;* **Plecoptera** *Austrocerca;* **Trichoptera** *Cheumatopsyche* (sometimes in large numbers in riffles), *Hellyethira* | None present |

| | Very Good | Good | Fair | Poor | Very Poor |
|---|---|---|---|---|---|
| **Attribute 4 Opportunistic or generalist taxa** | Not numerically dominant but may include several taxa from the following list in low to moderate numbers: **Hydracarina** Oxidae, *Piona,* Hydryphantidae, *Limnesia,* Unionicolidae, Arrenuridae, Oribatidae; **Mollusca** *Ferrissia, Corbiculina;* **Ephemeroptera** *Cloeon*, *Tasmanocoenis*; **Trichoptera** *Notalina*, *Oecetis, Triplectides, Hydroptila, Hellyethira, Ecnomus, Lectrides;* **Odonata** Aeschnidae, Telephlebiidae*;* **Diptera** Dixidae, Ceratopogonidae, *Forcipomyia,* Chironomidae *Parakiefferiella, Corynoneura, Thienemaniella;* **Coleoptera** low numbers of aquatic beetles may be present | May numerically dominate or co-dominate with tolerant taxa, and include moderate numbers of several taxa of the following: **Hydracarina** Oxidae, *Piona,* Hydryphantidae, *Limnesia,* Unionicolidae, Arrenuridae, Oribatidae; **Mollusca** *Ferrissia, Corbiculina, Posticobia;* **Crustacea** *Isopoda Heterias*; **Ephemeroptera** *Cloeon*, *Tasmanocoenis*; **Trichoptera** *Notalina, Oecetis, Triplectides, Hydroptila, Hellyethira, Ecnomus, Lectrides;* **Odonata** *Xanthagrion*, *Orthetrum, Hemicordulia,* Aeschnidae, Telephlebiidae*;* **Diptera** Dixidae, Ceratopogonidae, *Forcipomyia,* Chironomidae *Parakiefferiella, Nanocladius, Corynoneura, Thienemaniella, Cladotanytarsus, Paratantarsus, Cryptochironomus, Parachironomus;* **Coleoptera** *Sternopriscus, Macrogyrus, Platynectes, Anacaena, Gymnocthebius,* Scirtidae | Often abundant representation of several of the following commonly occurring taxa: **Hydracarina** Oxidae, *Piona,* Hydryphantidae*, Limnesia* Unionicolidae*,* Arrenuridae, Oribatidae*;* **Mollusca** *Ferrissia, Glyptophysa* (often in high numbers), *Corbiculina, Posticobia;* **Crustacea** *Isopoda Heterias*; **Ephemeroptera** *Cloeon*, *Tasmanocoenis*; **Trichoptera** *Notalina, Oecetis, Triplectides, Hydroptila, Hellyethira, Ecnomus, Lectrides;* **Odonata** *Xanthagrion*, *Orthetrum*, *Hemicordulia,* Aeschnidae*;* **Diptera** Dixidae, *Nanocladius, Corynoneura, Thienemaniella, Cladotanytarsus, Paratantarsus, Cryptochironomus, Parachironomus*; **Coleoptera** *Sternopriscus, Macrogyrus, Platynectes, Anacaena, Gymnocthebius,* Scirtidae | Often high numbers of several of the following commonly occurring taxa: **Hydracarina** Oxidae*, Piona,* Oribatidae*;* **Mollusca** *Ferrissia, Glyptophysa*, *Posticobia;* **Crustacea** Is*opoda Heterias;* **Ephemeroptera** (in low numbers) *Cloeon*, *Tasmanocoenis*; **Trichoptera** *Notalina, Triplectides, Hellyethira;* **Odonata** *Xanthagrion*, *Hemicordulia,* Aeschnidae*;* **Diptera** Chironomidae *Cladotanytarsus,* **Coleoptera** *Sternopriscus, Platynectes,* Scirtidae | None present |

| | Very Good | Good | Fair | Poor | Very Poor |
|---|---|---|---|---|---|
| **Attribute 5 Tolerant taxa** | Low numbers of several taxa, always in low numbers, from the following list: **Turbellaria**; **Nematoda**; **Annelida** Oligochaeta; **Acarina** (*Arrenurus, Koenikea*); **Amphipoda** *Austrochiltonia, Australomicroprotopus*; **Decapoda** *Paratya, Cherax;* **Diptera** *Simulium,* Culicidae (low numbers), Ceratopogonidae *Nilobezzia, Bezzia, Culicoides*; Chironomidae *Procladius, Paramerina, dark Paralimnophyes, Cricotopus, Chironomus, Dicrotendipes, Polypedilum;* **Hemiptera** (low numbers) *Microvelia, Nesidovelia, Micronecta, Agraptocorixa, Sigara, Anisops, Enithares;* **Odonata** *Ischnura* | May numerically dominate or be co-dominant with generalist taxa, and include several of the following: **Turbellaria**; **Nematoda**; **Oligochaeta**; **Acarina** (*Arrenurus, Koenikea*); **Amphipoda** *Austrochiltonia, Australomicroprotopus*; **Decapoda** *Paratya, Cherax;* **Coleoptera** *Necterosoma;* **Diptera** *Simulium*, Culicidae (low numbers), Stratiomyidae, Tipulidae, Ceratopogonidae *Nilobezzia, Bezzia, Culicoides*, Chironomidae *Procladius, Tanytarsus, Paramerina, dark Paralimnophyes, Cricotopus, Chironomus, Dicrotendipes, Polypedilum;* **Hemiptera** (moderate numbers) *Microvelia, Nesidovelia, Micronecta, Agraptocorixa, Sigara, Anisops, Enithares;* **Odonata** *Ischnura, Austrolestes* | Usually numerically dominate the community, with at least one highly abundant taxon, from the following list: **Turbellaria**; **Nematoda**; **Annelida** Oligochaeta**,** Glossiphonidae**; Acarina** (*Arrenurus, Koenikea*); **Amphipoda** *Austrochiltonia* (often high numbers), *Australomicroprotopus*; **Decapoda** *Paratya, Cherax*; **Collembola; Coleoptera** *Necterosoma;* **Diptera** *Simulium* and Culicidae (often high numbers), Ephydridae, Stratiomyidae, Tipulidae, Ceratopogonidae *Bezzia, Culicoides*, Chironomidae *Procladius, Tanytarsus, Paramerina, dark Paralimnophyes, Cricotopus, Chironomus, Dicrotendipes, Polypedilum;* **Hemiptera** (often high numbers) *Microvelia, Nesidovelia, Micronecta, Agraptocorixa, Sigara, Anisops, Enithares;* **Odonata** *Ischnura, Austrolestes* | Usually dominate the community with high abundances of several of the following taxa: **Turbellaria**; **Nematoda**; **Annelida** Oligochaeta**,** *Glossiphonidae*; **Acarina** (*Arrenurus, Koenikea*); **Amphipoda** *Austrochiltonia* (often high numbers), *Australomicroprotopus*; **Decapoda** *Paratya, Cherax*; **Collembola; Coleoptera** *Necterosoma;* **Diptera** *Simulium* and Culicidae (often high numbers), Ephydridae, Stratiomyidae, Tipulidae, Ceratopogonidae *Bezzia, Culicoides*, Chironomidae *Procladius, Tanytarsus, Paramerina, Cricotopus, Chironomus, Dicrotendipes, Polypedilum;* **Hemiptera** (often high numbers) *Microvelia, Micronecta, Agraptocorixa, Anisops, Enithares;* **Odonata** *Ischnura, Austrolestes* | Dominate and often comprise the entire community, with low or high numbers of the following taxa: **Annelida** Oligochaeta (often in high numbers); **Amphipoda** *Austrochiltonia* (often high numbers); **Collembola**; **Coleoptera** *Necterosoma* larvae and adults (often dominate saline waters); **Diptera** Culicidae, Ephydridae, Stratiomyidae, Ceratopogonidae *Bezzia, Culicoides,* Chironomidae *Procladius*, *Tanytarsus, Chironomus* (often in high numbers); **Hemiptera** *Micronecta, Anisops, Enithares* |

| | Very Good | Good | Fair | Poor | Very Poor |
|---|---|---|---|---|---|
| **Attribute 6 Non-endemic or introduced taxa** | Absent or low numbers of the following:<br>**Mollusca** *Physa, Potamopyrgus* | Absent or present in low to moderate numbers of the following:<br>**Mollusca** *Physa, Potamopyrgus* | Absent or present in moderate to high numbers of the following:<br>**Mollusca** *Physa, Potamopyrgus* (moderate to high numbers)*;* **Fish** *Gambusia* | Absent or present in high numbers of the following**:**<br>**Mollusca** *Physa Potamopyrgus (*moderate to high numbers); **Fish** *Gambusia* | Absent or low numbers of the following:<br>**Mollusca** *Physa;* **Fish** *Gambusia* (rarely present due to poor water quality) |

**Table 4 Condition ratings given by each panel member and final overall rating for the 36 sites assessed from the Western Mount Lofty Ranges, Barossa and Clare Valleys in 2021**

Included for comparison are the expected condition ratings for each site based on map-based variables using mostly 2015 Tier 1 estimated ratings or extrapolated from nearby sites with similar land uses.

Note: Refer to the EPA website for the site map coordinates and the reports.

[1] denotes the habitats at each site [eg if edge (E) only or if both edge and riffle (ER) aquatic habitats were present].

| Site codes | Site name | Tier 1 rating | Habitats[1] | Very Good | Good | Fair | Poor | Very Poor | Final rating |
|---|---|---|---|---|---|---|---|---|---|
| 2021WML01 (c0046) | Panalatinga Creek, Panalatinga Road | Poor | E | | | 2 | 1 | | **Fair** |
| 2021WML02 (c0510) | Field River, Heritage Drive, Sheidow Pk | Fair | E | | | 3 | | | **Fair** |
| 2021WML03 (c0464) | Little Para River, One Tree Hill Rd crossing | Poor | ER | | 3 | | | | **Good** |
| 2021WML04 (c0039) | Little Para River, Burton Rd | Very Poor | E | | | | 1 | 2 | **Very Poor** |
| 2021WML05 (c0021) | Gawler River, cnr Broster & Clements Rds, Virginia Park | Poor | E | | | 3 | | | **Fair** |
| 2021WML06 (c0419) | South Para River, First St, Gawler | Poor | ER | | | 2 | 1 | | **Fair** |
| 2021WML07 (c0511) | Chain of Ponds Creek at GS, Adelaide Gully Rd | Poor | E | | | 3 | | | **Fair** |
| 2021WML08 (c0007) | Chambers Creek, The Walk crossing | Fair | ER | | 2 | 1 | | | **Good** |
| 2021WML09 (c0512) | Sturt River, opposite 23 Riverside Drive, Bedford Park | Fair | ER | | 3 | | | | **Good** |
| 2021WML10 (c0056) | Sturt River, Horner's Bridge Coromandel Pde | Fair | ER | | 3 | | | | **Good** |
| 2021WML11 (c0244) | Scott Creek, Scott Bottom (track 14 off Dorset Vale Rd) | Fair | E | | 2 | 1 | | | **Good** |
| 2021WML12 (c0513) | Scott Creek, adjacent Matthews Rd | Fair | E | | | 3 | | | **Fair** |

| Site codes | Site name | Tier 1 rating | Habitats[1] | Very Good | Good | Fair | Poor | Very Poor | Final rating |
|---|---|---|---|---|---|---|---|---|---|
| 2021WML13 (c0279) | Onkaparinga River, downstream from Mount Bold Reservoir | Poor | ER | | | 3 | | | **Fair** |
| 2021WML14 (c0514) | Onkaparinga River, d/s of Baker Gully junction | Poor | ER | | 3 | | | | **Good** |
| 2021WML15 (c0515) | Onkaparinga R, Malpas St, Old Noarlunga | Poor | ER | | | 3 | | | **Fair** |
| 2021WML16 (c0015) | Echunga Creek, Fire Track 43 | Fair | ER | | 3 | | | | **Good** |
| 2021WML17 (c0034) | Jupiter Creek, Fire Track 43 crossing | Fair | E | | | 3 | | | **Fair** |
| 2021WML18 (c0516) | Christie Creek, Bagshaw Rd, Christies Beach | Poor | ER | | | 3 | | | **Fair** |
| 2021WML19 (c0517) | Christies Ck, Scottsglade Road, Christie Downs | Poor | ER | | | 1 | 2 | | **Poor** |
| 2021WML20 (c0518) | Wirra Creek, Old Courthouse Park, Willunga | Fair | ER | | 3 | | | | **Good** |
| 2021WML21 (c0519) | Parananacooka R, Finniss Vale Dr. | Fair | E | | | | 3 | | **Poor** |
| 2021WML22 (c0009) | Congeratinga River, South Rd | Fair | ER | | 2 | 1 | | | **Good** |
| 2021WML23 (c0520) | Waterfall Creek, Hay Flat Rd | Good | ER | | 2 | 1 | | | **Good** |
| 2021WML24 (c0065) | Waitpinga Creek, Waitpinga Rd | Fair | ER | | 1 | 2 | | | **Fair** |
| 2021WML25 (c0274) | Inman River, Inman Valley Rd | Poor | E | | | 2 | 1 | | **Fair** |
| 2021WML26 (c0521) | Inman R, Sawpit Rd | Poor | E | | | 3 | | | **Fair** |
| WMLBV01 (c0421) | North Para River, opposite Mt McKenzie Rd, Mt McKenzie | Poor | E | | | 2 | 1 | | **Fair** |

| Site codes | Site name | Tier 1 rating | Habitats[1] | Very Good | Good | Fair | Poor | Very Poor | Final rating |
|---|---|---|---|---|---|---|---|---|---|
| WMLBV01 (c0421) | North Para River, opposite Mt McKenzie Rd, Mt McKenzie | Poor | E | | | 2 | 1 | | **Fair** |
| WMLBV02 (c0522) | North Para River, Gomersal Rd | Poor | ER | | | 3 | | | **Fair** |
| WMLBV03 (c0423) | Jacobs Creek, Kaiserstuhl GS 505518 | Fair | ER | | 3 | | | | **Good** |
| WMLBV04 (c0426) | Greenock Creek, Roenfeldt Rd | Poor | E | | | 1 | 2 | | **Poor** |
| WMLBV05 (c0422) | North Para R, Penrice GS 505517 | Poor | E | | | 2 | 1 | | **Fair** |
| WMLCV01 (c0029) | Hutt River, Phoenix Ave, Clare | Very Poor | E | | | 2 | 1 | | **Fair** |
| WMLCV02 (c0523) | Wakefield R, Riley Rd. Mintaro | Poor | E | | | 1 | 2 | | **Poor** |
| WMLCV03 (c0524) | Eyre Creek, Finns Rd, Auburn | Poor | E | | | | 3 | | **Poor** |
| WMLCV04 (c0525) | Skillogalee Creek, Goodonga Rd, Watervale | Poor | E | | | 3 | | | **Fair** |
| WMLCV05 (c0526) | Wakefield River, Woolshed Flat Rd, Woolshed Flat | Poor | ER | | 1 | 2 | | | **Fair** |

**Table 5 Water chemistry and algal statistics from sites sampled from the Western Mount Lofty Ranges, Barossa and Clare Valleys in spring 2021**

| Parameter | All sites (n=36) | | | |
|---|---|---|---|---|
| | mean | 25th %ile | 50th %ile | 75th %ile |
| Chlorophyll *a* (µg/L) | 7.5 | 3.0 | 4.8 | 8.0 |
| Chlorophyll *b* (µg/L) | 0.7 | 0.1 | 0.2 | 0.5 |
| Oxidised N NOx (mg/L) | 0.1 | 0.002 | 0.01 | 0.004 |
| Total nitrogen (mg/L) | 0.8 | 0.5 | 0.7 | 0.9 |
| Total phosphorus (mg/L) | 0.1 | 0.02 | 0.003 | 0.1 |
| Water temperature (°C) | 18.8 | 17.3 | 18.7 | 20.2 |
| Conductivity (µS/cm) | 2026 | 867 | 1908 | 2965 |
| Dissolved oxygen (mg/L) | 8.0 | 8.1 | 8.1 | 8.4 |
| pH (pH units) | 7.7 | 7.6 | 7.8 | 7.9 |