



Independent Expert Scientific Committee
on Coal Seam Gas and Large Coal Mining Development

summary guide

Deriving site-specific guideline values for physico-chemical parameters and toxicants

Background

The coal resource industry is a highly diverse sector that encompasses activities such as drilling, mining, extraction and transportation of products, all of which have the potential to impact on aquatic systems. Appropriate water management is therefore critical during mine construction, operation and associated rehabilitation/restoration phases to minimise impacts.

In coal seam gas and large coal mine developments, the quality of existing water and sediment in the receiving environments varies. Site-specific guideline values are often calculated and used as a general tool for assessing water quality and are the key to determining water quality objectives.

Context

This Explanatory Note introduces the use of a water and sediment quality management framework (WQMF, Figure 1) to assist with the design of appropriate monitoring programs and site-specific guideline values consistent with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (the ANZG 2018 Guidelines) (ANZG 2018). How to design a monitoring program and then derive site-specific guidelines values for water and sediment is explained within the context of the coal resource industry.

Why derive site-specific guideline values?

The ANZG 2018 Guidelines provide default guideline values as a generic starting point for assessing water quality to protect aquatic ecosystems for a range of water types. They emphasise that site-specific guideline values for physico-chemical stressors should be derived and used in preference to default guideline values. Site-specific guideline values are also useful when there are no default values and when waters and sediments contain naturally high background concentrations that exceed default guideline values.

Approaches to deriving guideline values

There are two approaches to deriving water and sediment quality guideline values for aquatic ecosystems:

1. Acceptable departure from reference condition—guideline values are based on

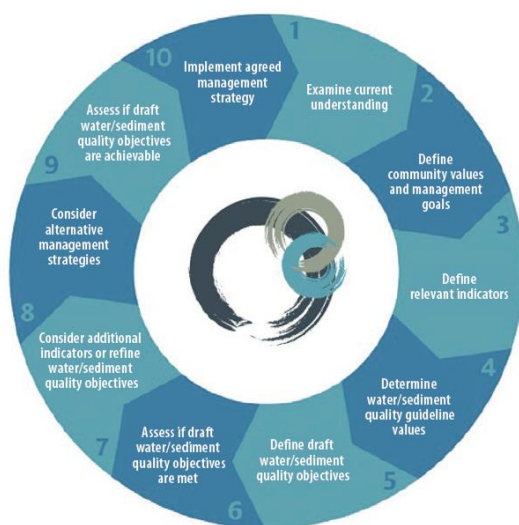


Figure 1. Water Quality Management Framework

the premise that some departure from the reference condition is acceptable.

2. Direct measurement of biological impacts— guideline values are based on the results of direct testing of the impacts of an indicator (e.g. a toxicant) on a target organism (usually by laboratory studies). This approach, using a species sensitivity distribution, is used to derive guideline values for toxicants.

How do we derive and apply site-specific guideline values?

Data availability will often vary across different stages of the development of a coal mine or coal seam gas field. Therefore the assessment process for a development application is also different from site to site (Figure 2).

Step 1: An initial assessment is undertaken to select the appropriate physico-chemical and toxicant indicators relevant to the activity to support the management goals.

Step 2: Design an appropriate monitoring program for the selected indicators.

Step 3: Collect and analyse data.

- *Physico-chemical indicators:* For indicators with suitable local reference data, derive site-specific guidelines values from the percentile distribution of the reference data. Any agreed percentile can be used, but for unimpacted reference sites, usually the 80th percentile is used as the guideline value for application to slightly to moderately disturbed areas. For indicators without suitable local reference data, apply regional or national default values until local data become available to derive site-specific guidelines.
- *Toxicant indicators:* Apply default guideline values if they are available. If there are no default water quality guideline values available for the selected toxicants, use ecotoxicity data from the

literature to derive interim values until default guideline values are developed. Where background data from local reference sites exceed a default guideline value, derive a site-specific value using local reference site data.

Step 4: Compare routine monitoring data to the appropriate guideline values.



Ephemeral stream, Queensland

Using reference site monitoring data to derive site-specific water quality guideline values is especially suited to water quality parameters that indirectly affect aquatic ecosystem health rather than parameters that are directly or acutely toxic.

A reference site is a site considered to be in an unimpacted or minimally impacted condition that can serve as a suitable baseline or benchmark for the assessment and management of impacted sites in similar water bodies. The condition of the reference site is the 'reference condition'.

Reference sites should meet the following criteria:

- Minimal disturbance to local and upstream environments (e.g. from dense urban and industrial activity, extractive industry, intensive livestock or cropping areas)
- No significant point source and diffuse source discharges nearby or upstream (e.g. mine discharges, sewage treatment plant discharges, industrial discharges, major agricultural or storm water drains, agricultural discharges such as those from dairies)

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- Flow or water regime not significantly altered. If the site is classified as temporary, water body types and wet and dry phase guideline values should be defined.
- Sufficient water quality monitoring data available, and data from these sites collected, stored and analysed using approved protocols.

Large coal mines and coal seam gas projects are often located in regions with a range of pre-existing land uses including cropping, grazing, townships and other extractive activities. Using more than one reference site will better characterise the local region than using a single site.

The preferred approach for the derivation of site-specific guideline values for physico-chemical indicators is based on at least two years of monthly monitoring data from appropriate reference site(s) at a frequency sufficient to capture likely changes in the system.



View of Lee's Reserve on the McIntyre River

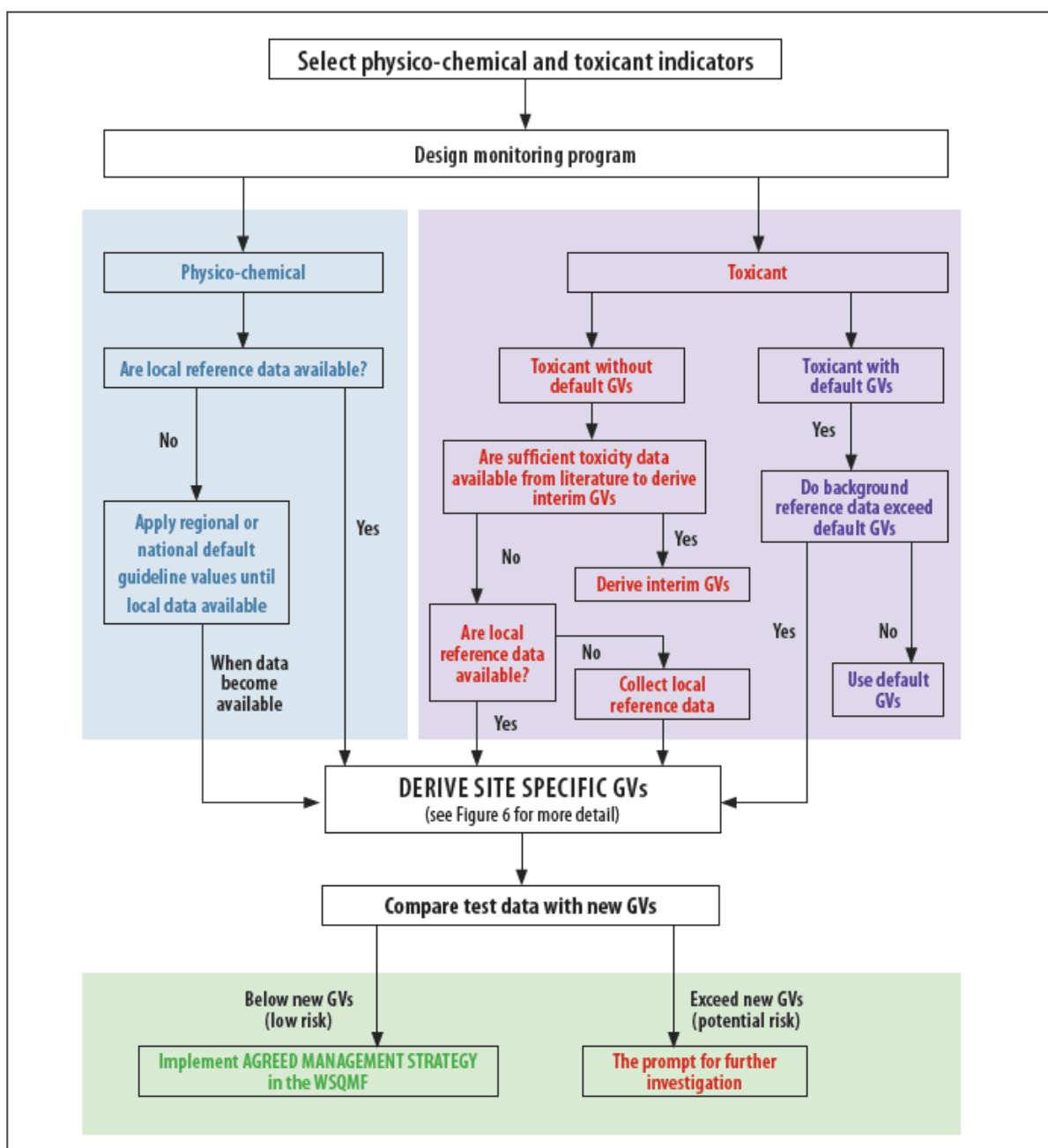


Figure 2. A decision tree to derive site specific guideline values for physico-chemical stressors and toxicants in coal seam gas and large coal mining industry water and sediment.

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