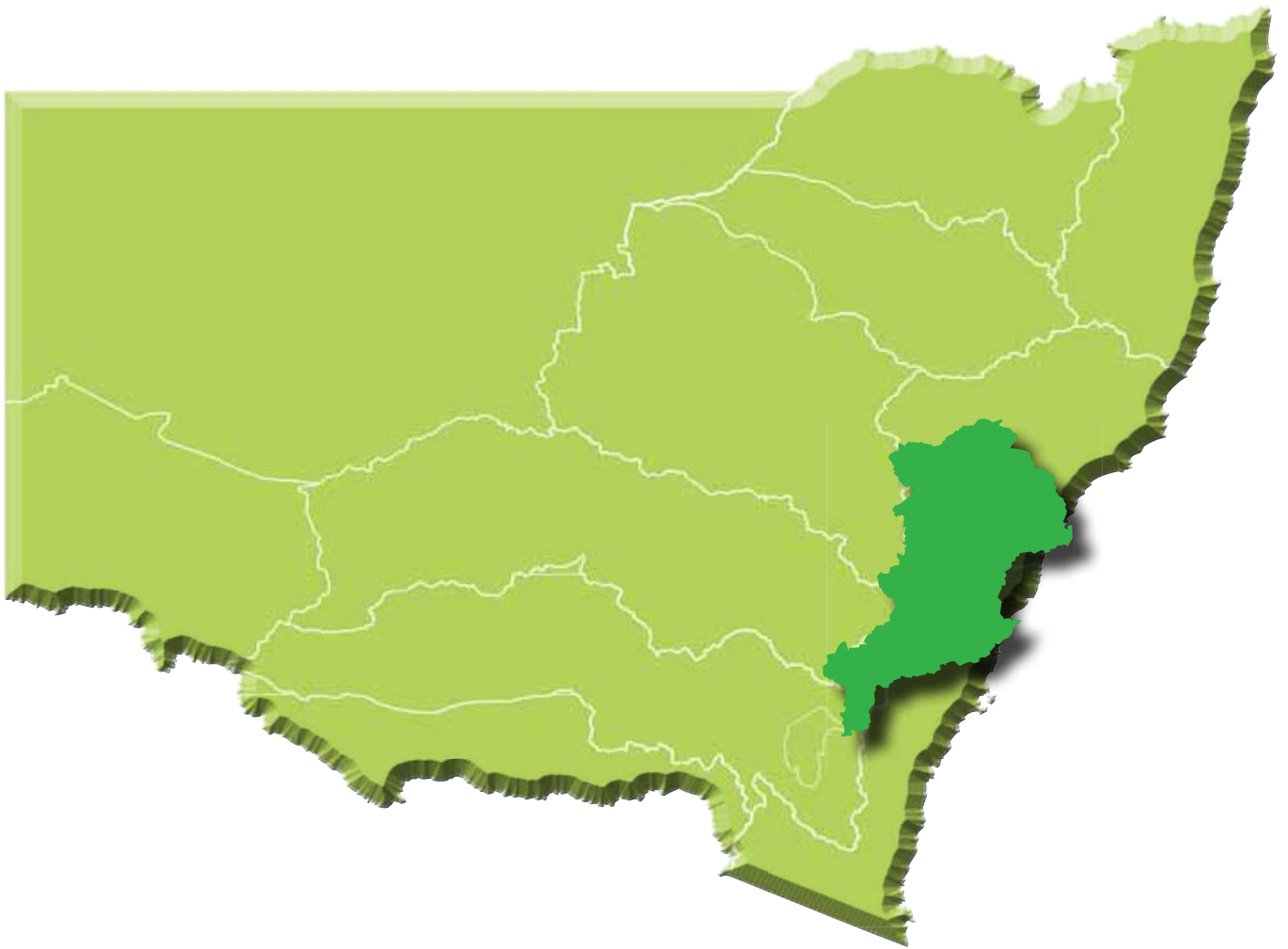


Overview

Hawkesbury–Nepean region



Background

Under the New South Wales Natural Resources monitoring, evaluation and reporting (MER) strategy (DNR 2006), a regionally based state of the catchments (SOC) report has been prepared. This report aims to provide the broad community and state and local government with information on natural resource condition and trends within a consistent reporting framework.

Reporting is based on 13 natural resource themes, in accord with the NSW state-wide natural resource management (NRM) targets (NRC 2005), which can be broadly grouped as shown in Figure 1. The targets fall under the Green State priorities and targets in the NSW State Plan 2010.

The MER strategy specifies that SOC reports will:

- provide a preliminary assessment of the condition of natural resources in the catchments of each region
- inform natural resource managers' policy and investment decisions within and between regions
- assess progress towards natural resource condition targets.

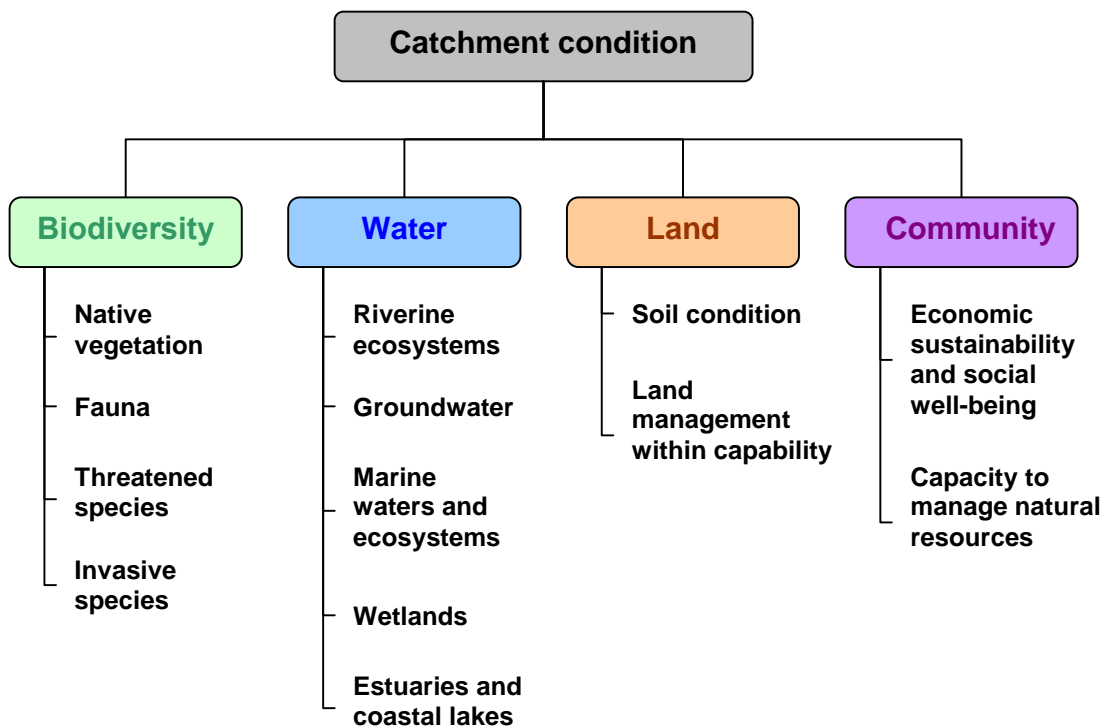


Figure 1 Resource themes categorised by state-wide targets

Detailed technical reports describe the methods used to derive the information contained in this overview report. At the time of publication of the *State of the catchments (SOC) 2010* reports, the technical reports were being prepared for public release. When complete, they will be available on the DECCW website: www.environment.nsw.gov.au/publications/reporting.htm.

Note: All data on natural resource condition, pressures and management activity included in the SOC reports, as well as the technical reports, was collected up to January 2009.

As there is limited historical data available for trend analysis, this SOC report represents the first baseline of catchment condition across the Hawkesbury–Nepean region. Ongoing data collection will allow assessment of trends in condition for future SOC reporting. The extensive data and information underlying the report will assist to inform policy, planning and investment decisions by natural resource managers.

Each SOC report is based on the geographic extent of the region in NSW managed by each of 13 catchment management authorities (CMAs). While the SOC reports use indicators of condition relevant to state-wide targets, it is recognised that CMAs will have translated these into more specific, locally relevant ‘catchment’ targets. To the extent that the state-wide and catchment targets and indicators align, these reports will aid the reporting by CMAs of progress towards catchment targets.

The reports have been prepared by the three NSW Government natural resource agencies – the Department of Environment, Climate Change and Water (DECCW), NSW Office of Water (NOW) and Industry & Investment NSW (I&I), in collaboration with CMAs and the NSW Natural Resources Commission (NRC). Report preparation is anticipated to occur on a three-year cycle to coincide with, and provide input to, the NSW state of the environment report.

Reporting structure

The SOC reporting structure consists of a hierarchy of four information products: catchment overview report (this document), individual theme reports, supporting technical reports and data links. Interested parties can choose to enter any level of the hierarchy and access the information product best suited to their needs and interest. The catchment overview report and the 13 individual theme reports (11 for inland regions) together form the SOC report for a region.

This overview report summarises the condition of the region for each theme, the pressures influencing the condition, and the management responses. It is drawn from the condition, pressure and management activity information contained in each theme report.

The *assessment* section (containing *condition* and *pressures*) of each theme report includes the following common elements:

- a statement of the state-wide target
- a brief description of what each indicator means
- a condition rating generally using a dark green, light green, yellow, orange and red colour scale representing (respectively) ‘very good’, ‘good’, ‘fair’, ‘poor’ or ‘very poor’ condition. Some themes used different colour ratings to reflect existing published reporting methods (eg the riverine theme uses sustainable rivers audit ratings). Where possible, an indicator condition rating for each spatial reporting unit is given, for example, for each wetland, estuary, soil monitoring unit (SMU) or groundwater system
- a pressure rating using the same green/red colour scale but representing ‘very low’, ‘low’, ‘moderate’, ‘high’ or ‘very high’ pressure – again by spatial reporting unit
- an indication of trend in condition, using arrows for ‘improving’, ‘no change’ or ‘declining’ trend
- an indication of trend in pressure using arrows for ‘decreasing’, ‘no change’ or ‘increasing’ trend
- a data confidence rating for condition and pressure indicators of high, medium or low
- aggregated regional condition, pressure, trend and data confidence ratings, where practical

- a comparison of the condition and pressure in each region with NSW as a whole, by indicator, where available
- maps showing spatial reporting units and ratings, where appropriate.

For some themes, indicators have been aggregated to give an overall index rating by spatial reporting unit and region, of either condition or pressure, for that theme. However, further analysis is required to test the sensitivity of the aggregated indices to differing degrees of catchment (or waterway) disturbance from human activity.

Not all of the elements listed above could be adequately assessed with the data available. Table 1 indicates where some of these data gaps occur.

Rating scores for indicators and indices

A scoring system for rating the value of a condition indicator or index has been developed for each of the 13 reporting themes. Scores have been based on a five-category system where one is regarded as 'very poor' and five as 'very good'. A 'very good' score generally relates to a resource in near pristine or 'reference' condition, whereas 'very poor' indicates the resource is highly degraded and is unlikely to ever return to reference condition.

Scoring the intervals between the very good and very poor categories represents a particular challenge. Moving down a category should correspond with a measurable biological or ecological threshold in system condition. However, sufficient data and scientific understanding is often not available, thus the adoption of simpler methods of categorisation is required. Methods may include dividing the range of indicator values into five equal groups based on values, other statistical techniques and expert opinion. Each of these methods has been used in the SOC reports, depending on the data.

Similar scoring techniques have been used for assessing pressure indicators and for scoring indicators and indices on a state-wide scale.

The Hawkesbury–Nepean region

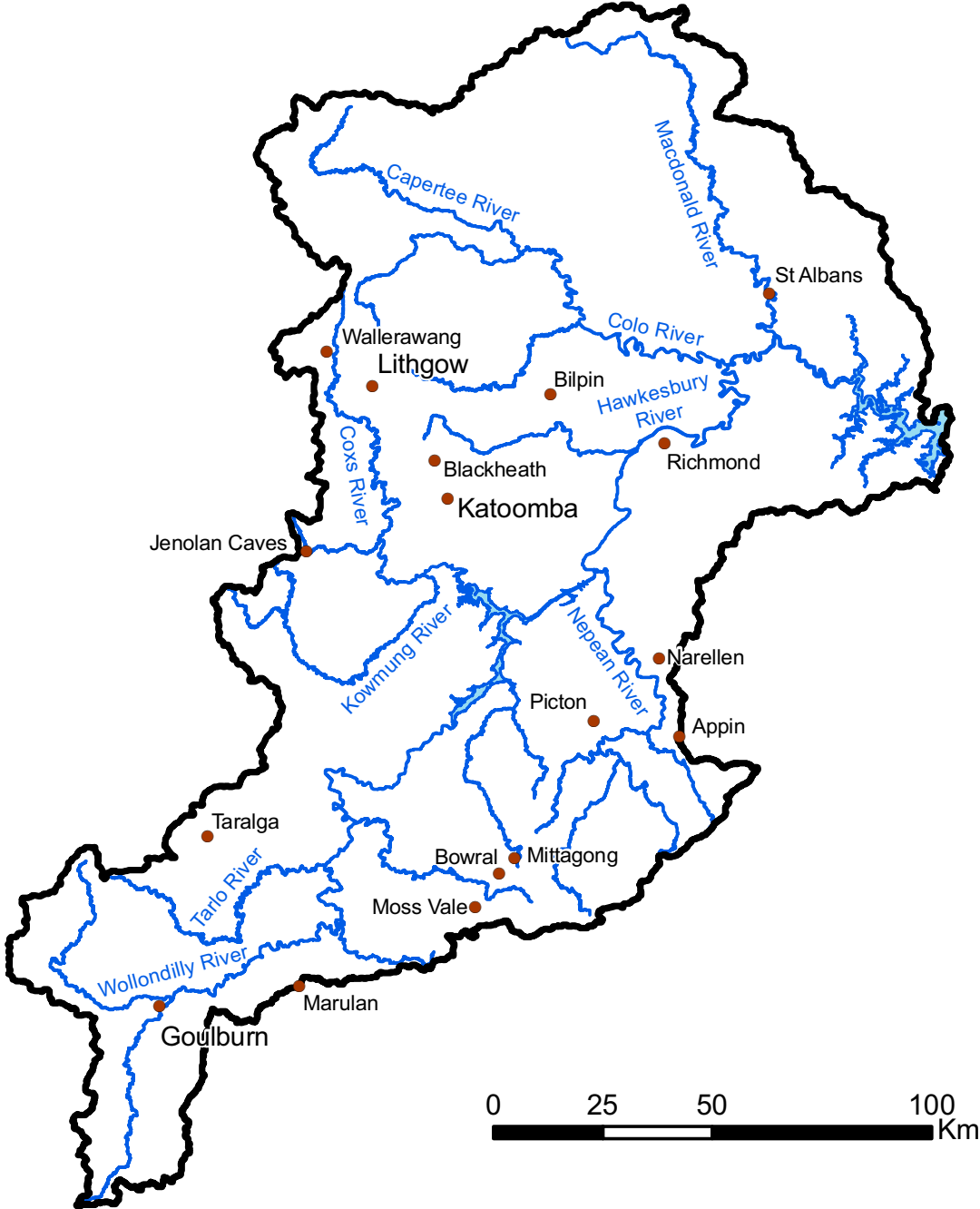
The Hawkesbury–Nepean region stretches across 22,000 km² (2.2 million hectares) from south of Goulburn to the Putty Valley in the north, and west from Lithgow to Palm Beach on the coast. Major rivers include the Hawkesbury, Nepean, Wollondilly, Mulwaree, Tarlo, Wingecarribee, Nattai, Coxs, Kowmung, Grose, Capertee, Colo and Macdonald.

Approximately one million people live in the Hawkesbury–Nepean region. Major population centres include Western Sydney, Goulburn, Southern Highlands, Lithgow and the Blue Mountains.

The region provides the majority of the drinking water for over four million people living in Sydney, the Blue Mountains, the Southern Highlands, Lithgow Valley and the Central Coast (70 per cent of the NSW population).

Land-uses include urban and residential development, mining, quarrying, power generation, industry, tourism and recreation, forestry, aquaculture and a wide range of agricultural industries.

The Hawkesbury–Nepean CMA is responsible for involving communities in the management of natural resource issues facing the region through partnerships and collaborations. The CMA is also the primary means for delivering outcomes of natural resource funding provided by the NSW and Australian governments.



Hawkesbury–Nepean region

Catchment condition for 2008

Table 1 summarises the theme-based ratings for the Hawkesbury–Nepean region. The condition ratings can be compared with those for NSW overall, where the latter rating is available. Ratings for condition and confidence, along with pressure ratings, are also shown where the data was available. (Note: the table should be read in conjunction with the theme reports which contain more contextual information including, where available, confidence ratings for pressures and the pressure ratings for NSW overall).

Table 1 Hawkesbury–Nepean region SOC ratings

| State-wide target | Region condition | Data confidence | NSW condition | Region pressure |
|---|------------------|-----------------|---------------|-----------------|
| Native vegetation | | M | | |
| Fauna | | L | | |
| Threatened species | | L | | |
| Invasive species (impact)* | | M | | |
| Riverine ecosystems | | | | |
| Groundwater | | | | |
| Marine waters and ecosystems | | | | |
| Wetlands | | L | | |
| Estuaries and coastal lakes | | M | | |
| Soil condition | | L | | See LMwC |
| Land management within capability (LMwC) | | L | | |
| Economic sustainability and social well-being | | | | |
| Capacity to manage natural resources | | L–M | | |

| Condition | Rating | Confidence | Pressure | Rating |
|-----------|--------|------------|-----------|--------|
| Very good | | H – High | Very low | |
| Good | | M – Medium | Low | |
| Fair | | L – Low | Moderate | |
| Poor | | | High | |
| Very poor | | | Very high | |
| Not rated | | | Not rated | |

* Invasive species' impact is a pressure on natural resource condition and is rated on a green/red scale of very low, low, moderate, high and very high.

Biodiversity

- **Native vegetation** – the overall status of native vegetation (extent and condition) was rated good. Intact native vegetation (primarily woody) covers over 70 per cent of the region and overall extent is above the state average. Around 60 per cent of the region consists of natural environments. Vegetation condition is rated good as most vegetation communities show a lower degree of modification compared to most other regions. Greatest modification, by area, is associated with dryland agriculture and plantations, primarily in the south west, while intensive uses are a significant pressure in, and adjacent to, the Sydney Metropolitan area.
- **Fauna** – the overall sustainability (based on a small number of species that are actively monitored) is rated very poor. Within the Hawkesbury–Nepean region, five of 606 species of terrestrial vertebrates recorded since European settlement have become extinct. A further 11 species (14 per cent) of mammals, 42 species (11 per cent) of birds, 10 species (20 per cent) of amphibians and 16 species (17 per cent) of reptiles are estimated to have lost at least half of their pre-European distribution under a variety of pressures.
- **Threatened species** – recovery of threatened species in the region rated very poor (based on data available for only six of the 306 threatened species, excluding extinct, within the region). Five fauna species and three flora species are presumed extinct; one fauna species and three flora species are critically endangered; 43 fauna species and 70 flora species are endangered. There are one critically endangered, 34 endangered and one vulnerable ecological communities.
- **Invasive species** – the impact of invasive species in the region is rated moderate. While the relative impact of individual invasive species has not been assessed, the majority of the new and emerging invasive species in the region are weed species. There are seven emerging freshwater pests (fish), one emerging marine pest, and two emerging pest animal species (feral horses and feral deer). Invasive species that are widely distributed in NSW and present in the region include foxes, freshwater pests and wild dogs; and bitou bush along the coast. The proportion of non-native fish species to native species is 37 per cent averaged over all sites.

Water

- **Riverine ecosystems** – an overall rating for riverine ecosystem condition was not determined. There were many water quality monitoring sites in the Hawkesbury–Nepean catchment relative to other regions. The percentage of samples that exceeded the total phosphorus guidelines was generally low to very low across the region with the exception of six sites. These sites were located either in the urban areas of western Sydney or relatively high in the upper catchments. A third of the sites had a slightly rising or rising trend for turbidity. Just over another third of the sites had stable turbidity trends, while one site had a decreasing trend and five sites had an unclear result. All sites except one had a stable, slightly rising or rising trend for water temperature. The majority of stable water temperature trends was at sites in the lower portion of the catchment. The majority of sites had a slightly rising or rising electrical conductivity trend, while a couple of sites had a stable, decreasing or unclear trend. The overall macroinvertebrate condition was rated moderate. Overall fish condition was poor; the coastal plain was in good condition, slopes and uplands zones were in poor condition, lowlands were in very poor condition and the highlands were in extremely poor condition. Data was insufficient to rate hydrologic condition.
- **Groundwater** – the condition of groundwater dependent ecosystems (GDEs) is not monitored directly as they have yet to be fully identified and mapped. The ability of groundwater systems to support GDEs has therefore been determined by assessing the condition of groundwater

management areas (GWMAs) against seven indicators. Overall condition has not been rated. The sandstone GWMAs have been assessed as being in fair to very poor condition, while the condition of the non-sandstone GWMAs in the region is good to fair. The main potential impact on the condition of the GWMAs is groundwater quality. This is assumed based on the high level of development as there is currently no water quality monitoring occurring within the region. The aquifers in the region are generally experiencing moderate to high pressures. These pressures are associated with the level of the development in the region and levels of extraction.

- **Marine waters and ecosystems** – overall condition was not determined. Protection of marine waters rated poor, as less than one per cent of the region's marine waters are protected. Algal blooms, Beachwatch bacterial indicators and eastern rock lobster all rated good. Key pressures include urbanisation, tourism, sediment and sewage discharge, fishing and climate change.
- **Wetlands** – overall, wetlands in the Hawkesbury–Nepean region are in very poor condition. The confidence in the assessment is low due to the limited data available. The greatest pressure on wetlands in this region is from habitat disturbance caused by feral animals, grazing and roads crossing or adjoining wetlands.
- **Estuaries and coastal lakes** – the overall condition of estuaries and coastal lakes is fair (nine of the 16 estuaries were rated with the remaining seven having limited or no data). Overall ratings for individual indicators were: chlorophyll a – good; macroalgae – not rated; turbidity – poor; seagrass – fair (but with significant variability from very good to very poor); mangroves – not rated; saltmarsh – good; and fish – good. Overall pressure was rated moderate. The main pressures occur along the more highly developed Sydney Metropolitan area coastline.

Land

- **Soil condition** – the overall soil condition in the 10 SMUs across the Hawkesbury–Nepean region, which cover about nine percent of the region, was rated good. Individual SMUs were rated as being in either fair or good condition but with large variation between monitoring sites within SMUs. The lowest scoring indicators within individual SMUs were rated poor and included sheet erosion, acidity, organic carbon and soil salinity.

Expected trend for SMUs, based on the degree to which land management is within capability, is steady except for the 'Mid Wollondilly Lands' SMU which is predicted to show a decline and the 'Wingecaribee Hills' and 'Robertson Basalts' SMUs which are predicted to improve. The expected trend across indicators is stable except for wind erosion which is predicted to improve.

Pressures on soil condition depend on land-use and management practices and are reported in 'land management within capability'.

- **Land management within capability** – the overall rating for land management within capability was fair. The ratings for individual SMUs were poor to good but, as for soil condition, with large variation between sites. Land in the region was managed beyond its capability in at least one SMU for each of the hazards except for wind erosion and structure decline. The degree of land management within capability is tending to be stable across indicators except for organic carbon decline and salinity/waterlogging which are declining.

Community

- **Economic sustainability and social well-being (ESSW)** – overall condition was not assessed, although trends are improving; individual indicators to assess the likely benefit of NRM on

maintaining ESSW rated either good or fair. The impact of business, employment, skills, networking and participation in NRM on ESSW rated fair, while the impact of the effectiveness of NRM decision-making was rated good. ESSW across the catchment is variable. The economy of the region is extensively tied to Sydney's economic circumstances. Key pressures include population change, market forces and drought/climate change

- **Capacity to manage natural resources** – overall adaptive capacity of land managers in the region was rated poor. The five capitals (*human, financial, physical, natural* and *social*) were assessed by groups at Tarago (large-scale landholders) and Windsor (peri-urban and private NRM). The Windsor group had low levels of all capitals, except *physical* capital, which was moderate. The Tarago participants had moderate to high levels of *social, financial* and *physical* capitals, with lower levels of *natural* and *human* capitals. In Windsor, key constraints to NRM action related to a lack of enthusiasm for NRM among the general community, which was linked to suggested actions to develop *human* and *social* capitals. In Tarago the primary constraints to NRM were the low profitability of farming, which was related to the tendency for farmers' children not to return to the land, the aging farming population and the lack of time and labour, for instance, to manage weeds. In both Tarago and Windsor, weeds were an indicator of *natural* capital that was rated very low. Also, in both areas, *social* capital was limited by forms of regulation and incentives, and responses to them, which may currently constrain NRM in diverse ways.

Key pressures

Effective catchment management relies on monitoring not just the status or condition of the resource, but also the underlying causal factors or pressures (occasionally natural forces but largely human activities) that have the potential to degrade the resource. The monitoring programs for a number of themes involve sampling at locations in catchments that are relatively undisturbed and in reference condition, as well as in moderately to highly disturbed systems. By doing this, the sampling is designed to test the effect of different disturbances or pressures on condition, so that effective management responses can be selected.

Examples of high-level pressures on the environment that the reports have identified as applying to the Hawkesbury–Nepean region include:

- rapid development in coastal urban and peri-urban areas
- mining impacts
- ongoing land-use and land management
- invasive species
- water extraction
- climate change
- social and economic pressures.

The links between high-level pressures and condition are often complex; the high-level pressures ultimately translate into direct system stresses (stressors such as high nutrient levels), which consequently manifest as symptoms of degradation. Land-use and land management are common

pressures across nearly all themes. There are also links between themes, where a condition indicator for one theme can be a pressure on an indicator in another theme.

Data sources

In general, only baseline information is available for this report. Data gathered during 2007–08 by NSW agencies has been the primary source of information, supplemented with existing data where available and of suitable quality. This also applies to the management activities included in each theme report. Data collected subsequent to 2007–08 will be included in future reporting and is available from the respective custodians.

Assessments made about the trends in resource condition refer to time scales in the various natural resource themes. In many cases no trend information could be obtained because long-term datasets are not available. Assessments of current condition have been made against a defined reference. In many cases this reference condition is defined as 'pre-European' but in some themes a shorter-term reference has been used and that is indicated in each of the themes.

There is an ongoing need to improve the data collection and analysis systems that are necessary to support the compilation and reporting process. Information about pressures and trends is also lacking across a significant number of themes for various reasons, including lack of existing quantitative data and the time-consuming nature of data collection, quality assurance and analysis. As the intention of the MER strategy is to trial indicators for long-term monitoring, the agencies are in the process of confirming indicator selection. The process of developing the pilot SOC reports involves providing agencies and CMAs with information on which to base that selection.

While the primary data source has been NSW agencies, searches were conducted for data from other potential custodians including CMAs, local councils, water authorities and universities. After checking sampling methods and quality assurance procedures, some of this data has been used to complement the state-wide data.

CMAs are required to monitor the effectiveness of management actions implemented under catchment action plans (CAPS). However, methods for incorporating this performance data, without biasing the representative nature of condition reporting at regional and state-wide scales, remain to be developed. Some limited case study data has been incorporated in the pressure or management activity sections of the theme reports to demonstrate the effectiveness of a specific management action at a local scale.

Data limitations

The state-wide monitoring programs have been designed to report at state and regional scales. Because of the extent and complexity of natural resource assets in NSW and the variability between them, monitoring programs by necessity often sample at a number of discrete points. If sufficient points are sampled at appropriate locations and frequency, assessments can be confidently made of condition and trend. However, not all natural resource systems will be sampled for SOC reporting and there will be a need to develop models with the capacity to predict condition in those systems for which funding is not available. These models can then assist CMAs, state agencies, local councils and other natural resource managers to conduct risk assessments and assign priorities for investment accordingly.

Data gaps affect the ability to score some indicators and an index may score higher or lower depending on which component indicator data is available. If insufficient indicator data is available

to rate the index, the index has been left unscored. There are opportunities for standard monitoring designs and sampling protocols to be developed for a number of indicators. Data collected by natural resource managers wishing to understand the condition of a particular system can then be of an appropriate standard and can complement the state-wide monitoring program.

Gaps in data coverage are evident in this report and these will need to be addressed through a forward development program of new data collection. As with all monitoring, the cost of resourcing data collection will need to be balanced against the inferential strength required from the program.

Management responses

Determining priorities for action often involves a risk assessment where tradeoffs are made between the condition of a natural resource, the severity of the pressure being exerted by human activity, the inherent capacity of the resource to sustain that pressure without adverse effect, the values ascribed to the resource by the community and the benefits and costs of action. Responses can be designed to target either the socio-economic drivers of landholder and manager decision-making, the human activity causing the pressure, a reduction in environmental stressors affecting the condition or else the degraded condition of the resource itself.

State and local government, CMAs, industry and the community respond to the pressures and threats posed to environmental health at a range of levels, from state-wide regulatory action to conserve natural resources, policy and strategy initiatives, public opinion and consumer preference campaigns, research and environmental information programs, land-use planning and economic instruments, through regional planning and investment, to local planning, education, capacity building, best management practice and on-ground protection and rehabilitation works.

The State Plan NRM targets are being addressed through state, regional and local partnerships. The CAPs and the published investment strategies that support them are the key documents that coordinate and drive the effort to improve natural resources across NSW. The CAPs describe the whole-of-Government approach to address each of the state-wide targets at the regional scale. The Hawkesbury–Nepean Catchment Action Plan can be found at: www.hn.cma.nsw.gov.au/topics/2181.html.

Management responses of the Hawkesbury–Nepean CMA for the Hawkesbury–Nepean region are captured in 31 management targets comprising:

- soil and land (seven targets)
- rivers and groundwater (seven targets)
- biodiversity (10 targets)
- community (seven targets).

Implementation costs are included in the CMA investment strategy.

NSW Government agencies' theme specific management actions to support the achievement of the state-wide and CAP targets, along with specific regional actions by the CMA and various local activities, are described in the 'management activity' section of the relevant SOC report. The actions listed will be amended and refined as part of the adaptive management process.

Statutory planning

Statutory planning often addresses multiple aspects of natural resource condition and environmental pressures, on a range of scales. The planning process creates a strategic framework to identify, assess and prioritise land-uses and to assist in strategic investment for the revitalisation/management of natural resource values.

Land-use planning in the region is primarily conducted through local environmental plans (LEPs). All LEPs in NSW are currently being reviewed by local government in consultation with NSW Government agencies and the local community. The plans aim to ensure that appropriate development occurs in the landscape with consideration of future population demands, economic issues and the protection of natural resources and environmental assets in the area. LEPs are statutory controls against which development proposals are assessed.

A number of state environmental planning policies (SEPPs) provide further protection for specific areas (eg koala habitat, rural lands). In addition, the Department of Planning has prepared a series of regional strategies to guide sustainable growth while strongly protecting valuable natural and cultural assets.

Further reading

DNR 2006, *NSW Natural Resources monitoring, evaluation and reporting strategy*, NSW Natural Resources and Environment CEO Cluster Group, Department of Natural Resources, Sydney.

NRC 2005, *Recommendations – State-wide standard and targets*, Natural Resources Commission, NSW Government, Sydney.

Published by: Department of Environment, Climate Change and Water NSW, 59–61 Goulburn Street, PO Box A290, Sydney South 1232.

Ph: (02) 9995 5000 (switchboard). Ph: 131 555 (environment information and publications requests).

Ph: 1300 361 967 (national parks, climate change and energy efficiency information and publications requests).

Fax: (02) 9995 5999. TTY: (02) 9211 4723.

Email: info@environment.nsw.gov.au Website: www.environment.nsw.gov.au

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