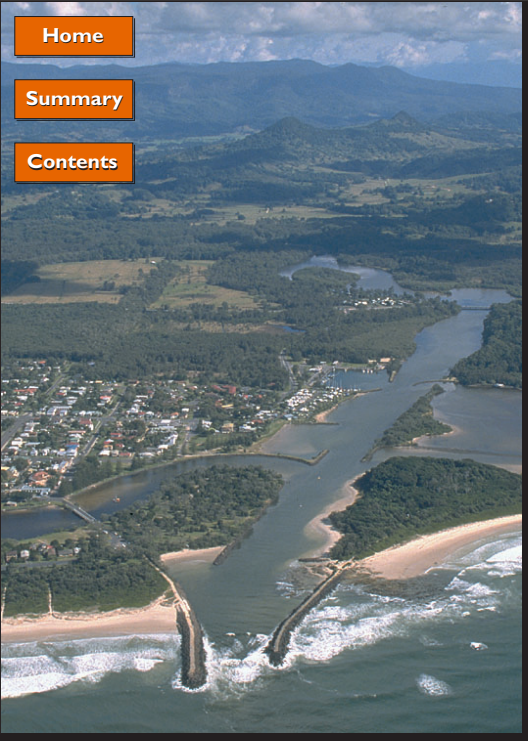

Natural Heritage Trust

Helping Communities Helping Australia

A Commonwealth Government Initiative

AUSTRALIAN CATCHMENT, RIVER AND ESTUARY ASSESSMENT 2002

National Land & Water Resources Audit

A program of the Natural Heritage Trust

VOLUME 2

NATIONAL LAND AND WATER RESOURCES AUDIT

Providing Australia-wide assessments

The National Land and Water Resources Audit (Audit) is facilitating improved natural resource management decision making by:

Providing a clear understanding of the status of, and changes in, the nation's land, vegetation and water resources and implications for their sustainable use.

Providing an interpretation of the costs and benefits (economic, environmental and social) of land and water resource change and any remedial actions.

Developing a national information system of compatible and readily accessible land and water data.

Producing national land and water (surface and groundwater) **assessments** as integrated components of the Audit.

Ensuring integration with, and **collaboration between**, other relevant initiatives.

Providing a framework for monitoring Australia's land and water resources in an ongoing and structured way.

In partnership with Commonwealth, and State and Territory agencies, and through its theme activities—Water Availability; Dryland Salinity; Native Vegetation; Rangeland Monitoring; Agricultural Productivity and Sustainability; Australians and Natural Resource Management; Catchments, Rivers and Estuaries Condition; and Information Management—the Audit has prepared:

Assessments of the status of and, where possible, recent changes in the condition of Australia's land, vegetation and water resources to assist decision makers achieve ecological sustainability. These assessments set a baseline or benchmark for monitoring change.

Integrated reports on the economic, environmental and social dimensions of land and water resource management, including recommendations for management activities.

Australian Natural Resources Atlas to provide internet-based access to integrated national, State and regional data and information on key natural resource issues.

Guidelines and protocols for assessing and monitoring the condition and management of Australia's land, vegetation and water resources.

Australian Catchment, River and Estuary Assessment 2002 presents the key findings for the Audit's Ecosystem Health theme by:

- reporting on the condition of catchments, rivers and estuaries within Australia's more intensively used river basins
- presenting assessment methods based on an understanding of the key biophysical processes affecting catchment, river and estuary condition
- serving as an input towards improved assessment and management.

Australian Catchment, River and Estuary Assessment 2002 was prepared in partnership with State, Territory and Commonwealth agencies; the Fisheries Research and Development Corporation; the Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management; the Cooperative Research Centre for Freshwater Ecology; Geoscience Australia; CSIRO Land and Water; and CSIRO Marine.

AUSTRALIAN CATCHMENT, RIVER AND ESTUARY ASSESSMENT 2002

Assessing the aggregate impact of resource use on key natural ecosystems

Volume 2

National Land & Water Resources Audit
A program of the Natural Heritage Trust

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Disclaimer

We invite all interested people, both within and outside Government, to make use of the Audit's reports, information, its Atlas and products in whatever way meets their needs. We encourage you to discuss the Audit findings with the various partners and contributors that have prepared this information. Partners and contributors are referenced in this report.

The Commonwealth accepts no responsibility for the accuracy or completeness of any material contained in this report and recommends that users exercise their own skill and care with respect to its use.

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March 2002

National Land & Water Resources Audit
A program of the Natural Heritage Trust

Minister for Agriculture Fisheries and Forestry
Parliament House
Canberra, ACT 2600

Minister for Environment and Heritage
Parliament House
Canberra, ACT 2600

Dear Ministers,

I have pleasure in presenting to you *Australian Catchment, River and Estuary Assessment 2002*—a report of the National Land and Water Resources Audit (Audit).

The report recognises and reinforces the role of integrated catchment management, tracing the impacts of land use activity within our catchments on important common property resources, rivers and estuaries. This assessment has been made in the context of a decision support tool that integrates biophysical data sets at the catchment scale and allows for comparisons between catchments.

As Australia's first comprehensive assessment of our catchments, rivers and estuaries, this report clearly identifies the need to:

- manage impact at the source;
- focus on improved practice in all land uses; and
- base targets for improvement in natural resource condition on practice.

The focus on practice provides frameworks for community action to translate a widespread environmental commitment of land users into actions that will deliver significant environmental benefits. Monitoring systems that track natural resource condition in response to changes in practice can then inform us of progress towards meeting these targets and provide a sound basis for program improvement.

By assessing the comparative condition of our catchments, rivers and estuaries, the report raises issues of how best to invest in management to deliver a quality Australian environment. A key role for natural resource programs is investment in protective management from regional to national scales. Catchment-based protective management that seeks to maintain natural resource condition is broadly acknowledged as much more cost-effective than remedial works. Catchments, rivers and estuaries in comparatively good condition are identified in the report. The challenge now lies with policy makers to determine the most appropriate mix of strategies to deliver protective management.

Many of Australia's rivers and estuaries require remedial works. The Audit's emphasis on key causes of decline in condition gives an insight into where best to invest to improve their condition. Activities such as reducing nutrient and sediment loads, rehabilitating riparian vegetation, re-establishing fish passage and tidal flows, and re-creating wetlands and in-stream habitats are all important.

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The Audit's work in catchments, rivers and estuaries results from high levels of commitment and partnerships to improve natural resource management across Australia. The estuary initiative exemplifies this cooperation:

- Estuaries provide Australia's highest value biophysical resources in ecosystem services. The Audit's estuary initiative involved all States and the Northern Territory, Environment Australia, the Fisheries Research and Development Corporation, and the Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management and its partners. It builds on a high level of community interest in improved estuary management.

The estuary initiative has already spawned further investment by the Fisheries Research and Development Corporation, and through the Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management with the formation of an Australia-wide group of estuary managers.

I am pleased to present this report to the Natural Heritage Ministerial Board. It will inform the setting of priorities and targets and the development of strategies as the National Action Plan for Salinity and Water Quality and the National Heritage Trust Extension are implemented.

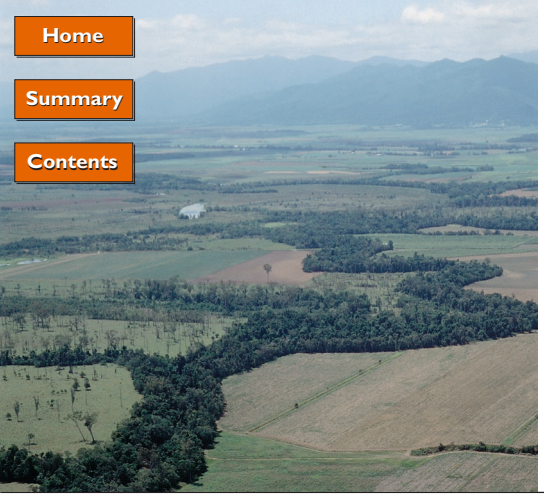
Yours sincerely,

Roy Green

Chair

National Land and Water Resources Audit Advisory Council

March 2002



SUMMARY

Australian Catchment, River and Estuary Assessment 2002

Assessing the status of Australia's natural resources and the health of its ecosystems is of paramount importance for their wise use, development and management. The National Land and Water Resources Audit (Audit) Australian Catchment, River and Estuary Assessment 2002 is Australia's first comprehensive assessment of catchments, rivers and estuaries. The assessment uses a systemic approach based on surface water catchments to determine the aggregate impact of patterns of resource use on rivers and estuaries (key common property resources).

Benchmarks for the assessments were based on natural conditions and provide a good basis for assessing aggregate impact and change in condition. Nevertheless for many extensively modified catchments, rivers and estuaries, management targets need to be defined in the context of trade-offs between natural condition and the other values provided by uses.

Australia's catchments

The assessment of catchment condition provides a way to compare the biophysical condition of catchments. Using indicators based on nationally available data to assess condition of land, water and biota of river basins and subcatchments, it produced a composite assessment of relative catchment condition. The assessment provides insight into the magnitude of environmental issues being faced in Australia's more intensively used catchments.

The majority of catchments in the poorest condition classes have also been identified as priorities under the National Action Plan for Salinity and Water Quality (Commonwealth of Australia 2000). Important areas for remedial works outside the National Action Plan include the Hunter and Hawkesbury River basins in central New South Wales, smaller coastal river basins in northern New South Wales, southern and central Queensland, and coastal Victoria.

The biophysical condition of a significant proportion of catchments (between 15 and 25%) is likely to continue to decline because of the long-term nature of environmental processes and degree of change in the catchment. These catchments are in the cleared, agronomically marginal rainfall areas, and have soils of relatively poor fertility and structure. They are prone to soil structure decline, soil erosion and salinisation and have low flexibility in terms of profitable land uses.

The assessment demonstrated that spatial pattern and variation in catchment condition can be described by a few indicators—change in vegetation cover, native vegetation fragmentation, sediment and nutrient inputs into rivers, changes to catchment hydrology (particularly the effects of impoundments) and land use intensity. These indicators enable the relative importance of different catchment condition drivers to be identified allowing for more targeted management planning.

The assessment and reporting methods developed can also be used at State and regional scales to examine management scenarios.

Australia's rivers

Rivers provide water for agriculture, industry and domestic use. They sustain ecosystems that provide economic, recreational, aesthetic, social and cultural benefits. The assessment of Australian rivers found that they have been significantly altered by land use and that without informed and strategic management, the condition of Australia's rivers will continue to deteriorate.

The river assessment collated and interpreted data for about 14 000 reaches across the more intensively used catchments. The assessment uses a range of attributes reflecting key ecological processes at the river reach and basin scales and builds on other river assessment initiatives such as AUSRIVAS. Two indices were used:

- an *aquatic biota index* using macro-invertebrates; and
- an *environment index* with four subindices—catchment disturbance, hydrological disturbance, habitat, and nutrient and suspended sediment load.

Key findings include:

- one third of the assessed river length has *impaired* aquatic biota;
- over 85% of the assessed river reaches are classified as *significantly modified* in terms of environmental features;
- over 80% of the reaches are affected by catchment disturbance;
- with limited data on change of hydrology from natural flows, hydrologic change could be assessed in only 25% of reaches;
- over half of the river reaches have *modified* habitat, mainly linked to changes in sediment loads that can also alter channel shape; and
- nutrients (mainly phosphorus) and suspended sediment loads are higher than natural loads in over 90% of reaches, with 33% classified as *substantially modified.*

Management challenges

Protective management. River reaches that were classified *largely unmodified* in all aspects (habitat, catchment disturbance and nutrient and suspended sediment loads) are scattered throughout the assessed area, especially in far north Queensland, eastern Victoria and Tasmania. They require investment in protective management to ensure their condition is maintained.

Rehabilitation and strategic management. Rivers with the most degraded reaches are located in the Murray–Darling Basin, the Western Australian wheatbelt, western Victoria, and South Australian agricultural basins. These river reaches generally:

- have highly modified catchments;
- are subject to high nutrient and suspended sediment loads;
- have lost much of their riparian vegetation; and
- have dams and levees that disrupt the movement of biota and material into and from the river.

Control of nutrient and suspended sediment loads. Some river reaches have *largely unmodified* habitat (bed condition, riparian vegetation, connectivity) but very high nutrient and suspended sediment loads. These include the majority of river reaches in Queensland, northern coastal New South Wales, western Victoria and south-west Western Australia. Erosion from hill slopes and stream banks is high and control of nutrient and suspended sediment loads is essential for rehabilitation of these streams.

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Murchison River, Western Australia

Environmental flows and longitudinal connectivity. A small group of river reaches in central Tasmania, central Victoria and New South Wales have *severely modified* habitat following construction of dams. They are otherwise in good condition. These reaches need restoration of environmental flows and longitudinal connectivity (e.g. fish ladders).

Improving management. A key management challenge that follows from this assessment is to implement clearer delineation of institutional and lead agency responsibilities for river management at regional, State and Commonwealth levels.

Building better river assessments

Several areas for improvement were identified, including:

- collection of finer-scale management-relevant data on riparian vegetation—a key component of river condition and rehabilitation works;
- collecting and then using more representative and responsive biotic information, especially fish populations;
- gaining Australia-wide agreement on river reaches, assessment methods and reporting so that changes in condition can be tracked and management activities evaluated; and
- information on changes in river hydrology, especially comparing natural and current flow regimes.

Australia's estuaries

Australia has 36 700 km of coastline and over 1000 estuaries. Estuaries provide highly productive and diverse habitats for fauna and flora. They support fisheries, aquaculture, ports and recreational activities, and are dynamic systems that link catchments, rivers and inshore marine waters. Eighty-three percent of Australia's 19.4 million people live in coastal Australia. The assessment of estuaries has identified that land use impacts are compromising the ecological, economic and social values of Australian estuaries.

The assessment compiled readily available data and used qualitative and quantitative methods within a 'pressure, state, response' assessment framework. The assessment provides detail on the condition of Australian estuaries including:

- amount of modification from the pristine state;
- drivers of change;
- susceptibility to further change; and
- key management needs.

Estuarine geomorphic data were mapped and compiled to classify estuaries in terms of the dominant processes governing their form and function. Detailed site-specific data were collected from a selection of estuaries around Australia and used to develop the Simple Estuarine Response Model. This internet-based decision support tool models the behaviour of estuaries identifying likely consequences of particular management activities.

Of the 979 estuaries and coastal waterways assessed:

- 50% are in *near-pristine* condition;
- 22% are in *largely unmodified* condition;
- 19% are in *modified* condition; and
- 9% are in *extensively modified* condition.

Most of Australia's near-pristine estuaries are located away from population centres. Some are found around the developed areas of Australia, often within or adjacent to managed public lands such as national parks. The majority of estuaries in near-pristine condition have relatively small catchments (< 15 km^2). Protective management of the fisheries and nature conservation values of the near-pristine estuary resource is essential.

Estuaries that have experienced significant change in their condition are those with extensive floodplains that support agriculture, of sufficient size to support industrial ports or with recreational assets surrounded by urban development.

Some of the common challenges facing Australia's modified estuaries are:

- excess nutrients and sedimentation;
- habitat loss;
- changes to natural flows and tidal flushing;
- pathogens and toxicants;
- introduced pests; and
- change to ocean entrances.

Understanding the dominant natural processes in estuaries will assist in developing cost-effective management strategies. Australia's estuaries were classified into six subclasses according to relative influence of the wave, tide and river energies that shape them:

- 17% of estuaries were classified as wave-dominated 'true' estuaries;
- 11% were classified as tide-dominated 'true' estuaries;
- 10% were classified as wave-dominated deltas;
- 9% were classified as tide-dominated deltas;
- 5% were classified as strand plains, coastal lakes and lagoons; and
- 35% were classified as tidal creeks and flats.

Tide-dominated systems are mainly located in northern tropical Australia. Wave-dominated systems are mainly located in southern temperate regions. Their management needs and ecological processes vary.

Sharing information and management approaches

The estuary assessment engaged agencies and groups from around Australia with an interest in estuarine management and has catalysed a number of estuarine specific initiatives including the establishment of a national estuary management network. The groundwork is set for partnerships across Australia to ensure efficiencies in applying research findings, a common level of understanding of management imperatives, publicly accessible information on estuaries and provide for effective involvement of community groups in estuarine monitoring.

Lower Hastings River estuary, New South Wales: extensively modified by urban development

Management challenges

The key challenges facing estuarine managers include:

- establishing and maintaining protective management for near-pristine estuaries;
- working to achieve estuarine management targets within catchment management planning processes;
- implementing a clearer delineation of institutional and lead agency responsibilities for estuarine management at a State and national level;
- developing an Australia-wide, estuarine-specific policy and management initiative that builds on the strong industry and community commitment for improved estuarine management; and
- continuing to provide information, training and support to assist local government planning and estuarine management staff.

Natural resource condition in Australia's drainage divisions

Natural resource management strategies need to identify interactions between different resource management issues and deal with development opportunities and degradation issues systemically. Use of an integrated catchment management framework for tackling natural resource issues has been promoted for many years, most recently by the Commonwealth as part of its National Action Plan for Salinity and Water Quality.

Natural resource assessments compiled by the Audit provide an unprecedented opportunity to examine the regional patterns of geographic and resource use drivers of ecosystem condition. Audit findings within Australia's drainage divisions:

- identify climatic, geographic and resource use drivers of catchment, river and estuary condition;
- define the relative importance of these drivers;
- examine relationships between patterns of resource use and the condition of catchments, rivers and estuaries; and
- suggest regionally specific, integrated natural resource management challenges.

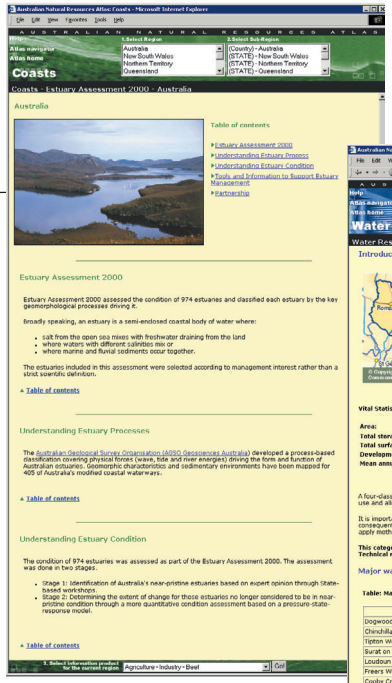
Ways forward

The Audit assessment of Australia's catchments, rivers and estuaries reveals that much remains to be done to; understand impacts; improve management practice and fully assess benefits, costs, opportunities and trade-offs.

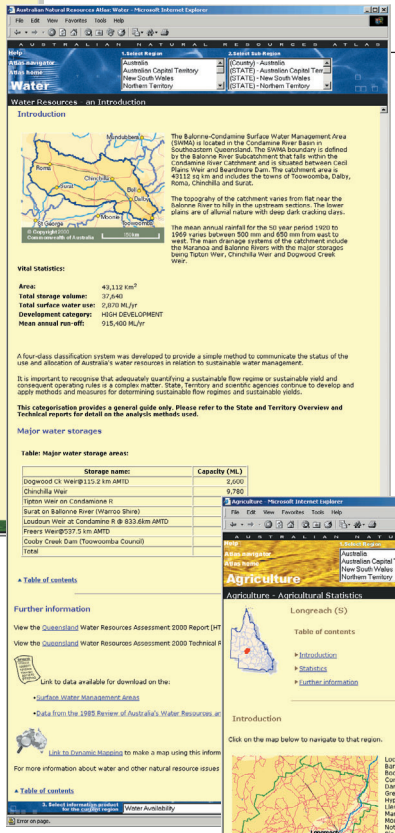
Key challenges

- **Land use**. We need to continually re-assess and improve land use patterns and practices, with attention to issues of soil erosion, landscape, nutrient balance, dryland salinity, vegetation and pasture management, water resource sustainability, and water use efficiency.
- **Institutional and policy needs**. We need to seek a balance between public and private benefits and costs, especially for key public resources—rivers and estuaries—and develop integrated approaches to natural resource management.
- **Information provision**. We need to ensure monitoring and assessment are cost-effective and provide information to support management decisions and track progress from regional to Australia-wide scales.

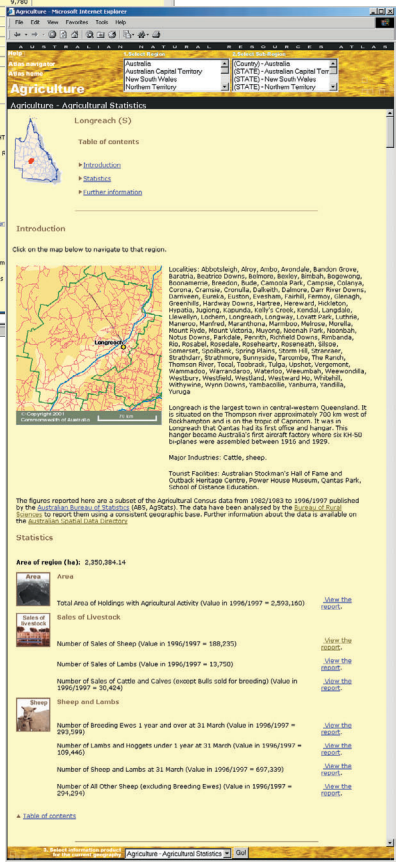
Australia has many programs in place and there is widespread community and government commitment to improved natural resource management. Audit findings and information sets are available in the Australian Natural Resources Atlas (Atlas) <www.environment.gov.au/atlas>. The Atlas provides insight into key issues and the differences in resource condition across Australia's regions, as well as an information base to assist in setting management priorities. With continued commitment to sustainability, Australia's productive and ecologically diverse landscapes will continue to provide the goods and services the community demands.



Australia-wide and regional information



Link to monitoring data



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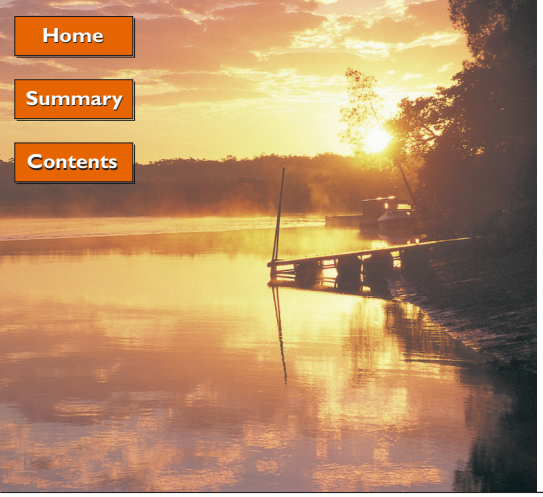

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INTEGRATED FINDINGS: natural resource condition in Australia's drainage divisions

Underpinning the need for integrated and region specific natural resource management

Recognition that natural resource management strategies need to deal with issues from a total system perspective has led to integrated catchment management initiatives. Understanding of the links between physical and ecological processes in both natural- and production-dominated ecosystems allows the causes of natural resource degradation to be more readily identified and strategically managed.

Limited availability of information on the status of natural resources within river basins has constrained the capacity to implement integrated catchment management strategies. Australia-wide natural resource assessments compiled by the Audit provide an unprecedented opportunity to examine patterns of resource condition and change within river basins.

Geographic patterns

Key ecosystem condition drivers have been identified by catchment, river, estuary condition and other Audit assessments. They include climate, landscape and topography, land use intensity, erosion rate, sediment and nutrient loading, native vegetation cover, soil degradation, water quality, water resource use, altered flow hydrology, and exotic biota.

Maps of contextual information from other Audit assessments can be found in Appendix 4, in the appropriate report or on the Australian Natural Resources Atlas at www.environment.gov.au/atlas.

These summaries for each of Australia's 12 drainage divisions are general. They recognise the broad diversity of landscapes and natural resource management issues across Australia and attempt to draw out the key salient points for each division. The intent is to provide an overview of ecological condition and management challenges.

Within each drainage division condition varies immensely. The variation in condition and management needs cannot be detailed in this overview. The reader should refer to catchment management plans, regional strategies and resource appraisals for more detailed information where these are available.

Catchment, river and estuary condition—are they linked?

Using a total catchment management approach, natural resource managers seek to understand how various parts of a catchment interrelate to the overall system and how activities in one part of a catchment may affect the condition of downstream resources. Recognising the biophysical links between component systems within a catchment, it is generally assumed that river condition reflects catchment condition and further downstream, estuary condition reflects both river and catchment condition.

But within estuaries and rivers, there are both internal and external interactions that influence their condition. For example, within the bed and water column of a river, interactions between biota and habitat can alter the relationship between catchment and river condition. Likewise, use patterns within an estuary or external interactions with marine waters affect their relationship to catchment and river conditions.

The Audit's assessment of catchment, river and estuary condition within river basins across Australia enables the assumption that catchment, river and estuary condition are linked and the concept that estuaries are 'the report card of the catchment' to be tested.

A simple correlation technique was used to assess statistical relationships across catchment, river and estuary condition indices at a river basin scale. Although correlation does not demonstrate causality it does serve to highlight expected relationships, similarities and differences between the assessments. Some of the stronger correlations result from shared input variables (i.e. the national land use data). In other instances stronger relationships between independent input variables highlight underlying biophysical linkages between catchment, river and estuary systems. These relationships could be expected to vary regionally.

The relatively high correlation observed between assessed river and catchment condition underlines the need for river management to include catchment management activities.

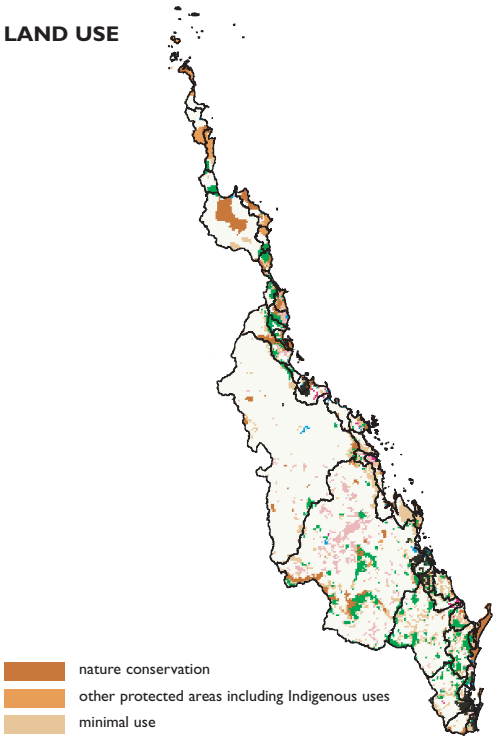
Correlation of catchment and estuary condition is generally good except between the catchment biota subindex and estuary condition This may be expected as the catchment biota subindex is based on terrestrial biota. The correlation between catchment and estuary condition confirms that estuaries are a useful 'report card of the catchment'. Total catchment management approaches can use these linkages by using the condition of the estuary as an indicator of their effectiveness in improving catchment condition.

Correlation values between river and estuary condition are lower than between catchment and river, and catchment and estuary condition, but still indicative of a positive relationship. The lower correlation between river nutrient and suspended sediment load subindex and estuary condition reflects the differing assimilative capacity of estuary types for sediment and nutrient loads. Further analysis would likely indicate a much higher correlation between wave-dominated estuaries and sediment and nutrient loads, given that such loads stay largely within these estuaries. This is compared to tide dominated estuaries (> 50% of all estuaries) where much of the sediment and nutrient load moves through the estuary to the near shore marine environment.

Correlation between catchment and river condition	
Catchment condition land subindex versus river environment index	0.63
Catchment condition land subindex versus river catchment disturbance subindex	0.65
Catchment condition land subindex versus river nutrient and suspended sediment load subindex	0.46
Catchment condition land subindex versus river physical habitat subindex	0.33
Catchment condition land subindex versus river riparian vegetation subindex	0.41
Correlation between catchment and estuary condition	
Catchment condition index versus average estuary condition	0.54
Catchment condition land subindex versus average estuary condition	0.5
Catchment condition biota subindex versus average estuary condition	0.06
Catchment condition water subindex versus average estuary condition	0.54
Correlation between river and estuary condition	
River condition environment index versus average estuary condition	0.48
River nutrient and suspended sediment load subindex versus average estuary condition	0.19
River catchment disturbance subindex versus average estuary condition	0.47

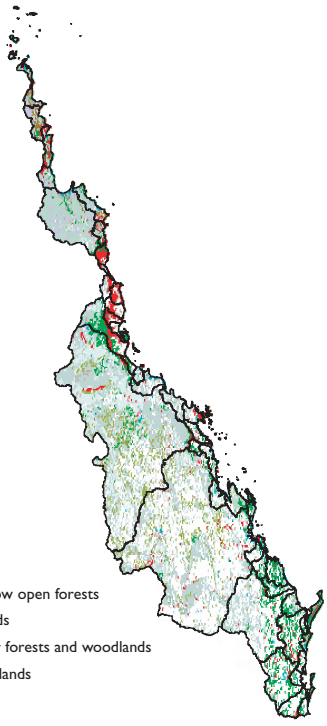
INTEGRATED FINDINGS: North East Coast Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Tropical eucalypt woodlands/grasslands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

NORTH EAST COAST DRAINAGE DIVISION

Total area	451 220 km^2
Number of basins	46
Basin areas	257 – 142 680 km^2
Estuary types	wave-dominated estuaries, tide-dominated estuaries, wave-dominated deltas, tidal-flat creeks
Rainfall	600 – 3200 mm/yr
Evaporation	550 – 1360 mm/yr
Run-off	30 – 1860 mm/yr
Net primary productivity	2 – 9 t C/ha/yr
Climate types	equatorial savanna (far north Cape York) persistently wet and seasonally dry tropics (northern areas) seasonally dry (winter) and no-dry subtropical (central and southern areas)

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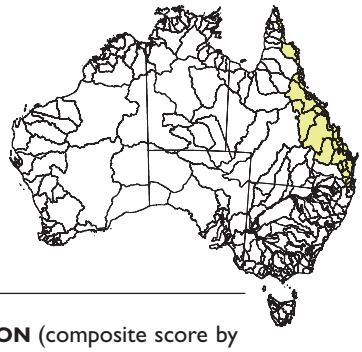
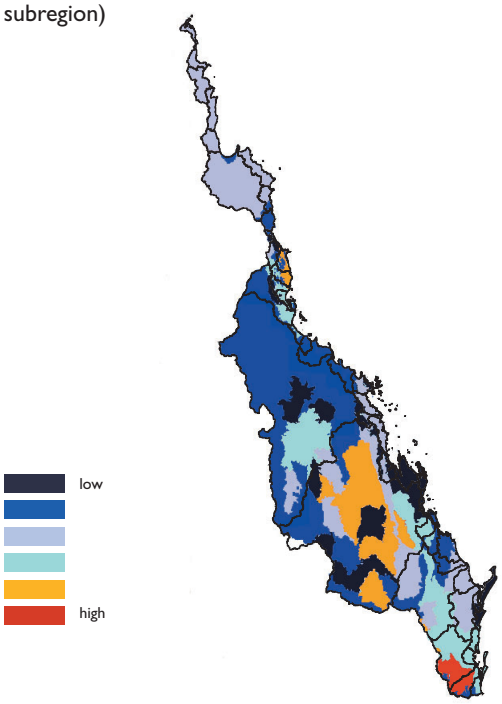
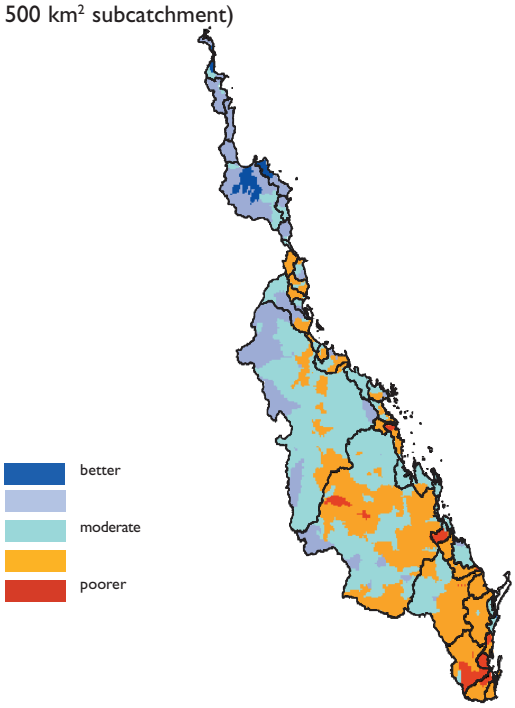


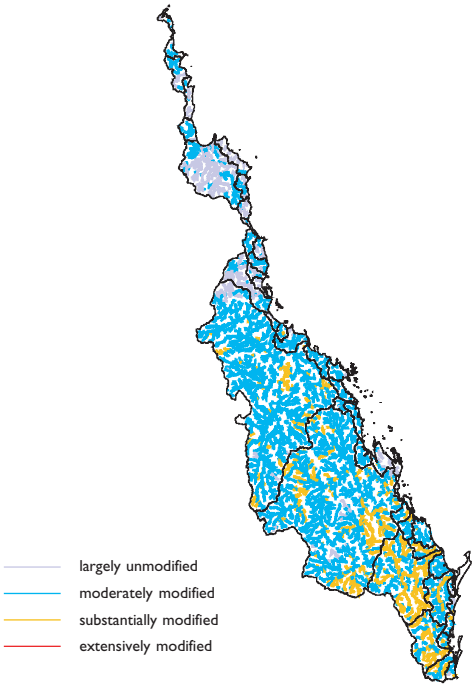
LANDSCAPE STRESS (composite index by subregion)



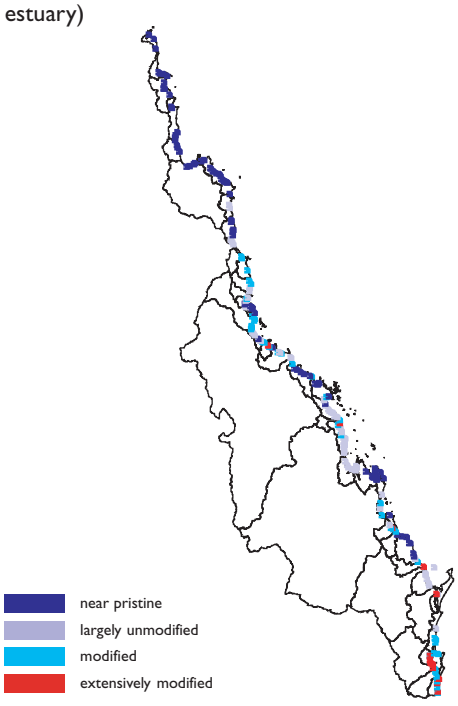
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)



ESTUARY CONDITION (condition for each estuary)



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Patterns of ecosystem condition

The generally observed pattern of ecosystem condition reflects the pattern of land use and settlement intensity.

- Good ecosystem condition in the north east (Cape York)
- Poorer condition in south-eastern basins
- A range of condition in central basins

The poorer condition landscapes, catchments and substantially modified river reaches are mainly in the south east principally within the Fitzroy, Burnett, Brisbane and Logan – Albert river basins. Elsewhere, smaller basins with more intensively used lowlands, such as the Ross, Haughton, Pioneer and Calliope, show poorer catchment condition while those with less intensive uses are in better condition.

Exceptions to the general pattern include the agriculture-dominated lowlands of north Queensland's Wet Tropics which have poorer condition landscapes and catchments and areas of better condition within the south east, principally reflecting areas of lower intensity land use including protected areas. Landscapes in better condition identified within central and south-eastern river basins correlate with assessments of better catchment condition and less modified river and estuary condition. These include the Marlborough Plains, Byfield, Burnett – Curtis Hills and Ranges, Burnett – Curtis Lowlands, Gympie Block, and Great Sandy subregions that include the Shoalwater Creek, Water Park Creek, Baffle Creek, Fraser Island and Noosa River basins.

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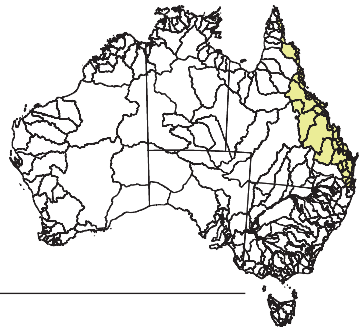

Key ecosystem condition drivers

Climate

Temperature

- High summer temperatures through much of the division affects water quality (low dissolved oxygen) and biochemical activity (decomposition of organic matter). Many organisms experience thermal stress and this can be exacerbated by ecosystem condition.

Rainfall

- Low and seasonal rainfall results in large areas of seasonally arid landscapes. This leads to reduced vegetation cover, increasing susceptibility to land use impacts. Water-borne soil erosion can be high where the dry is followed by very intense summer rainfall.
- Intense summer rainfall generates peaked river flows that have a large sediment and nutrient load transport capacity.
- Areas of persistently high intensity rainfall have high soil erosion potential. Special attention is needed to ensure soil cover and soil management practices minimise erosion.

Rainfall patterns also result in:

- Highly seasonal and variable (intermittent to perennial) flow patterns in many of the rivers leading to a wide range of water quality conditions and susceptibility to water quality impacts during low flow.

Landscape, topography, soils

Topography

- Much of the division has coastal ranges with short, steep catchments and high run-off gradients. High or intense rainfall results in sediment being transported to the near-shore marine zone.
- Most of the division drains to the Great Barrier Reef Lagoon where low wave energy has resulted in the formation of tide-dominated estuaries and deltas. Their low sediment-trapping efficiency means that sediment and nutrient loads are delivered to the lagoon, impacting on seagrass beds and inshore coral reefs.

Soils

- Many of the soil types (Tenosols, Vertosols, Sodosols, and Chromosols) are susceptible to degradation. They have low reserves of organic matter, low fertility and low water retention capacity; and are prone to compaction, dispersion, hard setting, crusting and acidification.

Land use intensity

Land use intensity varies with the most intensive land use occurring throughout the larger southern river basins and along the coastal plains and floodplains of central and northern Queensland. This contrasts to the low intensity land use of Cape York.

	Area (km^2)	% Area
Nature conservation	26 160	6
Other protected areas and Indigenous land	5 850	1
Minimal use	49 870	11
Grazing	295 980	66
Forestry	31 470	7
Dryland agriculture	27 980	6
Irrigated agriculture	2 780	< 1
Built environment	7 570	2
Water bodies	2 570	< 1

- Most of the drainage division (including up to 90% of northern basins e.g. Burdekin River) is used for *grazing*. Grazing in the north occurs on native rangelands with less management inputs and pasture improvement than in southern river basins.
- *Dryland agriculture* accounts for approximately 6% of the division area. The greatest extent (1.8 million hectares) occurs in the Fitzroy River basin. River basins dominated by dryland agriculture occur in central and northern Queensland (e.g.. Plane Creek, Pioneer, Russell Mulgrave and Johnstone).
- *Irrigated agriculture* occupies less than 1%. Major irrigation areas are located in the south east (Brisbane, Mary, Burnett, Burrum, Kolan), central (Fitzroy, Plane Creek, Pioneer) and northern (Haughton, Burdekin) river basins.
- The major areas of *built environment* are in the south east (e.g. South Coast, Logan–Albert, Pine and Maroochy river basins are > 15% built environment) and in larger population areas in the north (occupies 4–7% of northern river basins e.g. Ross, Barron, Russell Mulgrave). Urban environments in south-east Queensland contribute a high percentage of basin phosphorus loads from point sources.
- *Nature conservation* is relatively low in extent compared with other eastern divisions (only 6% of total area). River basins with a larger proportion (> 10%) of nature conservation land use are concentrated in the Wet Tropics, Cape York, continental islands and Great Sandy Region coast and island basins. Large basins with extensive agriculture land use (Brisbane, Mary, Burnett, Fitzroy and Burdekin) typically have less than 4% nature conservation area.
- *Forestry* (7% of total area) generally occurs in upper catchment areas and is evenly distributed across all higher rainfall river basins. The largest extents occur in southern basins (e.g. Fitzroy, Burnett and Mary River).
- *Minimal use crown lands* occupy 11% of the division. *Other protected areas*—including those for Indigenous use—occupy 1% of the division area and are a significant land use in Cape York.

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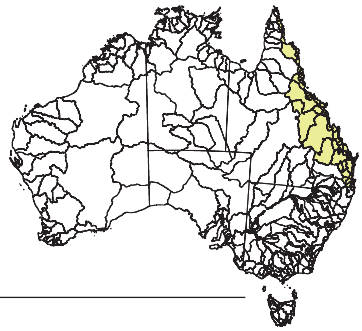

Native vegetation

Approximately a third (38%) of native vegetation has been cleared. Vegetation types most affected occur on land more suitable for agricultural, forestry and coastal development, particularly areas with reliable rainfall and suitable soils.

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	45 122 200	27 969 728	17 152 472	38
Rainforest and vine thickets	2 758 004	1 744 744	1 013 260	37
Eucalypt tall open forests	389 904	40 036	349 868	90
Eucalypt open forests	5 914 212	3 287 888	2 626 324	44
Eucalypt low open forests	10 884	10 884	0	0
Eucalypt woodlands	18 626 940	13 100 676	5 526 264	30
Acacia forests and woodlands	6 857 408	1 918 964	4 938 444	72
Callitris forests and woodlands	177 124	124 448	52 676	30
Casuarina forests and woodlands	218 972	75 568	143 404	65
Melaleuca forests and woodlands	1 108 868	899 720	209 148	19
Other forests and woodlands	209 996	198 320	11 676	6
Eucalypt open woodlands	5 651 460	4 094 092	1 557 368	28
Tropical eucalypt woodlands/grasslands	641 856	639 468	2 388	< 1
Acacia open woodlands	54 608	14 952	39 656	73
Low closed forests and closed shrublands	43 932	43 624	308	< 1
Acacia shrublands	1 736	1 272	464	27
Other shrublands	217 864	205 112	12 752	6
Heath	46 384	31 400	14 984	32
Tussock grasslands	1 378 916	804 692	574 224	42
Hummock grasslands	3 184	1 960	1 224	38
Other grasslands, herblands, sedgelands and rushlands	85 572	72 200	13 372	16
Chenopod shrubs, samphire shrubs and forblands	116 492	113 248	3 244	3
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	522 868	501 056	21 812	4

- Vegetation types with the largest areas cleared include eucalypt woodlands, acacia forests and woodlands, eucalypt open forests, eucalypt open woodlands, and rainforest and vine thickets.
- Vegetation types that have undergone the greatest proportional reduction include eucalypt tall open forests, acacia open woodlands, acacia forests and woodlands, casuarina forests and woodlands, and eucalypt open forests.
- Larger central to southern river basins (i.e. southern Burdekin to Logan–Albert) and coastal lowlands, particularly floodplains of most basins north to the Barron River, are extensively cleared.
- Loss of riparian vegetation is restricted to isolated groups of river reaches in larger southern basins and central and northern coastal floodplains.

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Erosion rate and sediment load

Audit soil erosion data indicate an average 22-fold increase from natural sediment supply rates with increases of more than 90 times recorded for some basins (e.g. Burnett). Natural rates of erosion compared to other divisions are high.

	Minimum basin value	Maximum basin value	Average basin value	Total
Current to pre-settlement sediment supply	2	96	22	
Sediment supply (t/ha/yr)	0.2	3.1	1.3	
Total sediment supplied to streams (t/yr)	11 823	18 446 498	n/a	54 290 351
% supplied by hillslope erosion	10	97	64	
% supplied by gully erosion	0.3	38	14	
% supplied by bank erosion	2	77	22	
Total sediment exported to coast (t/yr)	7 288	2 635 482	n/a	14 146 279
Erosion per hectare exported to the coast (t/ha/yr)	~0	2.5	0.7	
Delivery ratio	0.1	0.8	0.5	
Percentage of stream length > 30 cm sediment deposition	0	0.2	0.1	

Source of sediment

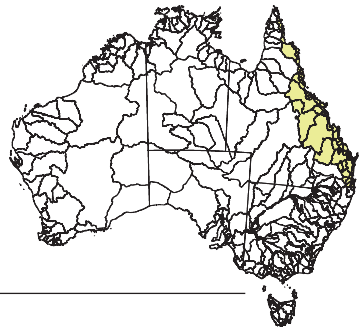
- Hillslope erosion is the greatest sediment load contributor indicating the importance of pasture management in the extensive areas of grazing use.
- Bank erosion on average is the second most important source of sediment particularly in less seasonal higher rainfall basins, indicating the importance of riparian zone management.
- Gully formation is relatively recent and still active, particularly in the Burdekin and Fitzroy River Basins where it is the second most important source of eroded sediment.

Sediment delivery

The amount of total sediment load delivered to estuaries is determined by stream gradient, flow patterns, presence of reservoirs and extent of floodplain.

- Steeper gradient, high rainfall river basins without reservoirs or significant floodplains are the most effective at delivering their sediment load to estuaries (i.e. Daintree with 84% of load delivered).
- Low gradient, low rainfall river basins with significant reservoirs and floodplains are the least efficient (i.e. Burdekin with 13% of load delivered).

Ecosystem condition impacts related to soil erosion are demonstrated by the water quality and physical habitat (bed load) index results in the river assessment and water quality and ecological integrity indicators in the estuary condition assessment. These are confirmed by the water quality exceedances for turbidity, and nutrients.



Nutrient loading

	Range	(Total) and division average		Range	(Total) and division average
Total nitrogen			**Total phosphorus**		
Total export (t/yr)	57 – 10 314	(59 051)	Total export (t/yr)	6 – 2 538	(12 111)
Export rate (kg/ha/yr)	0.3 – 10.5	2.7	Export rate (kg/ha/yr)	0 – 2.4	0.5
Load current to pre-European ratio	1.1 – 5.5	2.5	Load current to pre-European ratio	1.1 – 14.4	4.4
Load – dissolved to total ratio	8 – 86	38	Load – dissolved to total ratio	2 – 66	23
Nitrogen sources and sinks (%)			**Phosphorus sources and sinks (%)**		
From sediments	15 – 95	71	From fine sediments	20 – 99	85
From point sources	0 – 48	2	From point sources	0 – 75	6
Dissolved from diffuse sources	5 – 85	27	Dissolved from diffuse sources	1 – 53	9
Deposited on floodplains	4 – 66	24	Deposited on floodplains	4 – 74	29
Deposited in reservoirs	0 – 39	5	Deposited in reservoirs	0 – 46	6
Denitrified	0 – 6	2	Delivered to estuary	18 – 96	66
Delivered to estuary	22 – 96	69			

Nutrient source and transport

Basins fall within three broad categories with differing nutrient sources and loads.

- *Low and seasonal rainfall, erodible soils, turbid water*. Phosphorus and nitrogen load is typically derived and transported bound to fine sediments (e.g. Burdekin, 99% phosphorus and 91% nitrogen). Extensive land uses such as grazing are major contributors to increased fine sediment supply and associated nutrient loads.
- *High rainfall, permeable soils, low turbidity*. Phosphorus and nitrogen load is typically derived and transported in dissolved forms (e.g. Noosa 53% phosphorus and 85% nitrogen). Fertilisers and animal waste contribute to these dissolved loads.
- *Large populations and intensive animal production*. Phosphorus and nitrogen loads are typically from point sources such as sewerage treatment plants (e.g. South Coast basin, 75% phosphorus and 48% nitrogen).

Nutrient balance

Landscape phosphorus balance across the division is largely negative (-10 times for areas of the Fitzroy, Burnett and Brisbane River basins) indicating a potential decline in the status of soil nutrients in agricultural areas. Areas of positive balances of 5 to 10 times include Wet Tropics (Murray, Tully, Russell–Mulgrave, Barron) and south-east Queensland (Maroochy and Logan–Albert) river basins indicating a potential source of increased nutrient loads.

Positive landscape nitrogen balances of 10 to 50 times dominate lowland areas within south east (Logan–Albert, Maroochy, Mary), central (Pioneer, O'Connell, Proserpine) and northern (Tully Johnstone) river basins. Areas of positive nitrogen balances of 100 to 250 times occur for upper north Queensland basins (Herbert and Barron) and upper south-eastern (Brisbane, Burnett) river basins.

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Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			62	Number of groundwater management areas			61
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%	Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	34	54	1.	< 30	13	21
2.	30 – 70	11	18	2.	30 – 70	12	20
3.	70 – 100	17	27	3.	70 – 100	25	41
4.	> 100	0	0	4.	> 100	11	18

Surface water

Approximately a quarter of surface water management areas have diversion levels of between 70% and 100% of sustainable yield. These occur in the south east (Brisbane, Burnett, Kolan, Fitzroy basins) and northern (Proserpine, Burdekin, Haughton, Ross and Barron) river basins.

Most basins from southern to northern Queensland have impoundments including the Logan–Albert, Brisbane, Pine, Maroochy, Burrum, Burnett, Kolan, Fitzroy, Pioneer, Proserpine, Burdekin, Ross, Tully and Barron basins.

The river assessment found that the Fitzroy and Burdekin River basins have substantially modified hydrology. An assessment of the impacts of altered river hydrology on estuaries was limited to where tidal barrages have direct and significant impacts on tidal regime (e.g. Burnett and Fitzroy river basins). A significant proportion of freshwater fish species within the division are dependent on estuaries for breeding. Functional fish passage structures have been established on barriers in the Logan–Albert, Mary, Burnett, Kolan, Fitzroy and Pioneer rivers (DPI 2002).

Groundwater

Almost 20% of groundwater management units within the division have abstraction rates beyond 100% of sustainable yield. These include Great Artesian Basin groundwater management units that extend into the division from the west and other small units within the Brisbane, Water Park Creek and Black River basins.

Approximately 40% of groundwater management units within the division have abstraction commitment levels between 70% and 100% of sustainable yield including units within the Logan–Albert, Brisbane, Burrum, Burnett, Don, Burdekin and Barron river basins.

Groundwater is important for base flows of rivers, hydrology of floodplain wetlands, and thermal springs.

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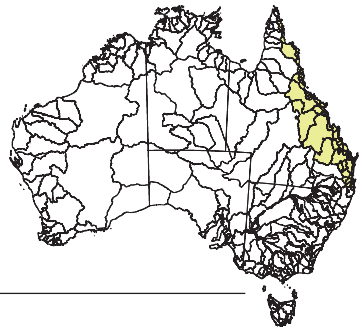

Weeds and feral animals

- Number and density of feral vertebrates are most significant in the larger inland extending and southern basins including western areas of the Burdekin and Fitzroy River basins and the more densely populated Burnett, Mary and Brisbane River basins.
- Number and density of exotic weeds is highest in the central Burdekin and Fitzroy River basins. Weeds are extending into undeveloped areas of Cape York basins including the Normanby and Jacky Jacky.
- Coastal lowland areas of river basins in the south east (logan–Albert, Brisbane, Pine), central (Water Park Creek, lower Fitzroy, Shoalwater, O'Connell, Pioneer, Plane Creek) and north (Ross, Johnstone, Russell–Mulgrave, Barron, Daintree and Endeavour) also have significant weed issues.

Feral vertebrates impacting on ecosystem condition include species that:

- add to grazing pressures (i.e. goats, rabbits, pigs);
- are predators of native wildlife (i.e. foxes, cats, pigs, toads);
- disturb or destroy habitat (pigs impact on riparian and wetland habitats and biota); and
- cause mortality in native predators (cane toad infestations have led to reductions in abundance of native frog-eating predators).

Weed and exotic plant species also act as major ecosystem condition drivers by:

- invading wetlands and contributing to wetland biodiversity loss (e.g. ponded pasture species para grass, hymenachne, the floating fern salvinia and pond apple, a wetland tree species);
- altering grassland fire ecology and dominating savanna ground and shrub layers (e.g. buffel grass, parthenium and prickly acacia); and
- degrading riparian environments and leading to increased bank erosion (rubber vine is a major weed of riparian vegetation in northern dry tropics).

Both lantana and parthenium have the potential for significant range expansion.

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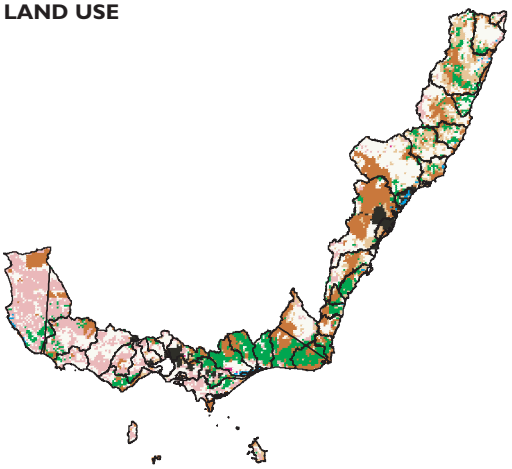
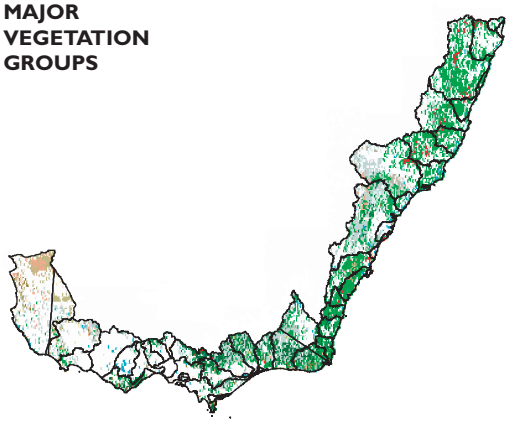
INTEGRATED FINDINGS: South East Coast Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

SOUTH EAST COAST DRAINAGE DIVISION

Total area	264 000 km^2
Number of basins	39
Basin areas	508 – 34 346 km^2
Estuary types	wave-dominated estuaries and deltas
Rainfall	533 – 1 879 mm/yr
Evaporation	352 – 1 131 mm/yr
Run-off	186 – 752 mm/yr
Net primary productivity	2.8 – 8.8 tC/ha/yr
Climate types	subtropical in the north east temperate in most of the remainder Mediterranean in the south west

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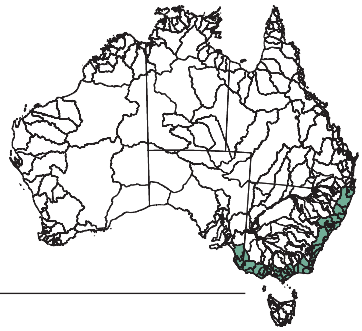
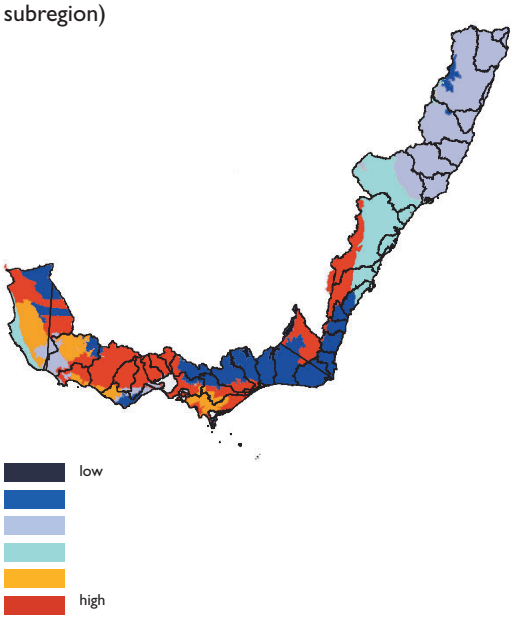
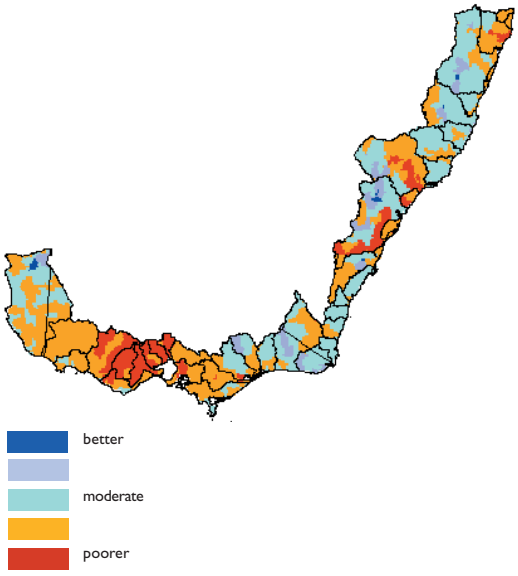


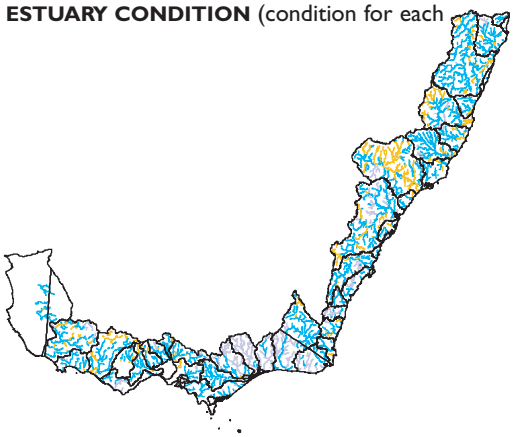
LANDSCAPE STRESS (composite index by subregion)



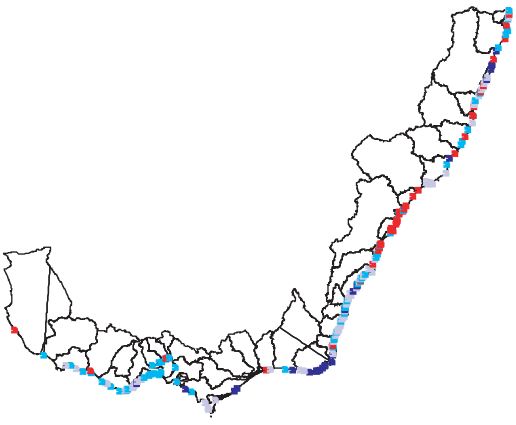
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)



ESTUARY CONDITION (condition for each estuary)



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Patterns of ecosystem condition

- The largest group of river basins in good condition is located from north-east Victoria to south-east New South Wales including the Mitchell, Tambo, lower Snowy, East Gippsland, Towamba, Tuross, Moruya and Clyde river basins.
- River basins in good condition are also found in central northern New South Wales including the mid- to upper-basin of the Hastings, Macleay, Bellinger and Clarence rivers.
- Smaller, less extensive areas of good ecosystem condition include uplands within coastal southern Victorian river basins (Otway Coast and upper Glenelg).
- Limited areas of upper river basins in good condition occur in central New South Wales rivers (Hawkesbury and Hunter River basins).

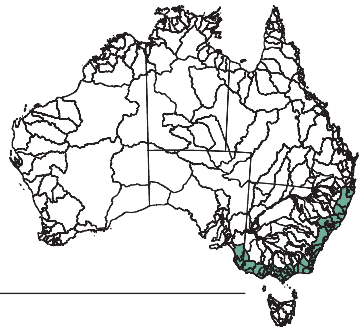
Poorer ecosystem condition occurs in:

- the southern coastal basins of Victoria stretching from the South Gippsland basin west to the Millicent Coast in eastern South Australia;
- central New South Wales including the Wollongong Coast, Hawkesbury (upper and lower basin), Georges, Macquarie Tuggerah Lakes and Hunter river basins; and
- the lower basins, coastal floodplains and estuaries of north eastern New South Wales rivers including the Manning, Macleay, Clarence and Richmond, the latter having poor condition throughout much of the basin.

Isolated areas of poor condition are also found in the upper catchment of both the Snowy River in southern New South Wales and the Macleay River in northern New South Wales.

Estuary condition largely reflects catchment and river condition.

- Most of the near pristine estuaries occur in river basins with good condition (e.g. the smaller estuaries in the East Gippsland River basin in north-east Victoria and the Bellinger River Basin in central northern New South Wales).
- The greatest concentration of extensively modified estuaries occur in areas of poor catchment and river condition including central New South Wales (Wollongong Coast to Hunter River basins) and in larger river basins particularly in northern New South Wales, across southern Victoria and eastern South Australia.



Key ecosystem condition drivers

Climate

Rainfall

- Moderately high and evenly distributed rainfall helps ensure soil cover remains relatively high throughout the year, limiting bare ground exposure and therefore erosion from hill slopes.
- Relatively high rainfall ensures that river systems generally maintain base flows for all or most of the year helping to maintain water quality and implying a need for good riparian vegetation to minimise bank erosion.
- Intense subtropical rainfall events in the northern river basins create peaked flow events and high erosion potential so that riparian vegetation is essential.
- Predominantly winter rainfall for many of the central and southern river basins tilts landscape water balance toward greater infiltration than evaporation. When combined with the reduced water use of crops and pastures, this can lead to dryland salinity.

Landscape, topography and soils

- Steep and short river basins combined with medium to high rainfall creates significant soil erosion potential and gives stream flow sufficient energy to transport sediment to the estuary. High flow velocities also help maintain water quality (e.g. dissolved oxygen).
- Wave-dominated estuaries and delta systems at the mouths of coastal catchments often have sand bars across ocean openings. Their extended closure can result in limited tidal exchange between estuary and open ocean so that these systems are particularly vulnerable to increased sediment and nutrient loading affecting water quality.

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Land use intensity

	Area (km²)	% Area
Nature conservation	49 996	19
Other protected areas and Indigenous	Minimal	–
Minimal use	33 082	13
Grazing	79 803	30
Forestry	38 936	15
Dryland agriculture	48 902	19
Irrigated agriculture	2 008	< 1
Built environment	8 488	3
Water bodies	1 558	< 1

- *Stock grazing on native pasture* in the most dominant land use in extent.
- Low intensity land uses including *forestry* and *nature conservation* dominate many upper catchment areas particularly in the east.

  These land uses combined with the climatic regime mean that much of the native vegetation cover and many of the biophysical processes required to maintain ecosystem condition are still present.
- Proportion of *dryland agriculture* is the third largest for any division in Australia and is concentrated in the west from southern Victoria to eastern South Australia. In the east, agriculture is limited in extent. The most agriculturally developed areas (agriculture occupying between 5 and 15% of total basin area) in the east include the Hunter River in central New South Wales, upper basin areas of the Macleay, Hawkesbury and Snowy Rivers and lower basin and floodplain areas of northern New South Wales rivers (Clarence, Richmond, Brunswick and Tweed).
- The largest proportion of *built environment* in Australia occurs in this drainage division.

Population density

- Includes Australia's two largest cities (Sydney and Melbourne).
- Population is distributed along much of the coast, often adjacent to major rivers, floodplains and estuaries.
- Resource impacts resulting from dense human populations and built environments are a significant driver of ecosystem condition. All areas of major population density are associated with a 'footprint' of poor condition in riverine and estuarine ecosystems.

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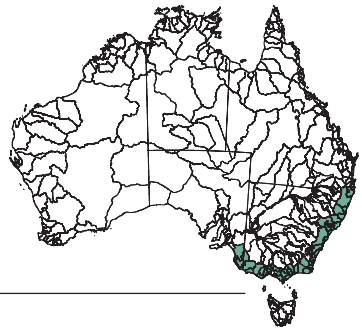

Vegetation cover

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	26 400 000	13 313 408	13 086 592	45
Rainforest and vine thickets	519 296	253 748	265 548	51
Eucalypt tall open forests	2 100 744	1 360 820	739 924	35
Eucalypt open forests	9 553 316	6 453 584	3 099 732	32
Eucalypt low open forests	73 448	61 724	11 724	16
Eucalypt woodlands	7 935 272	2 756 632	5 178 640	65
Acacia forests and woodlands	56 500	29 016	27 484	49
Callitris forests and woodlands	17 860	17 852	8	< 1
Casuarina forests and woodlands	34 332	10 000	24 332	71
Melaleuca forests and woodlands	31 252	6 412	24 840	79
Other forests and woodlands	112 024	82 456	29 568	26
Eucalypt open woodlands	1 172 816	603 344	569 472	49
Mallee woodlands and shrublands	1 271 728	450 344	821 384	65
Low closed forests and closed shrublands	292 640	80 052	212 588	73
Acacia shrublands	306 568	21 048	285 520	93
Other shrublands	264 576	114 296	150 280	57
Heath	313 508	299 736	13 772	4
Tussock grasslands	1 512 216	130 288	1 381 928	91
Other grasslands, herblands, sedgelands and rushlands	231 144	95 852	135 292	59
Chenopod shrubs, samphire shrubs and forblands	198 100	153 308	44 792	22
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	301 156	286 524	14 632	5

- Approximately half of the native vegetation has been cleared mainly in southern and western Victoria, eastern South Australia and the more developed eastern basins in central and far northern New South Wales.
- Vegetation types most affected by clearing occur on land suitable for agriculture, plantation forestry and coastal development. They include eucalypt woodlands, eucalypt open forests, tussock grasslands, mallee woodlands and shrublands, and eucalypt tall open forests.
- Vegetation types that have undergone the greatest proportional reduction include acacia shrublands, tussock grasslands, melaleuca forests and woodlands, low closed forests and shrublands, and casuarina forests and woodlands.
- Patterns of landscape stress, catchment condition and river and estuary modification broadly reflect the extent of native vegetation cover.

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Erosion rate and sediment load

Audit soil erosion data indicates an average 100-fold increased supply of sediment. The greatest rate increases have been in southern Victoria where sediment supply is predicted to have increased by up to 1000 times in basins that historically had very low rates (e.g. Bunyip, Portland Coast). River basins in central (Sydney, Hawkesbury, Hunter and Hastings) and northern (Clarence) New South Wales have also experienced increases in supply of sediment of several hundred times.

	Minimum basin value	Maximum basin value	Average basin value	Total
Current to pre-settlement sediment supply	3	> 1 000	97	
Sediment supply (t/ha/yr)	0.1	1.4	0.4	
Total sediment supplied to streams (t/yr)	3 162	2 950 924	n/a	12 677 228
% supplied by hillslope erosion	2	53	14	
% supplied by gully erosion	0	72	37	
% supplied by bank erosion	19	92	49	
Total sediment exported to coast (t/yr)	0	743 606	n/a	3 926 398
Erosion per hectare exported to the coast (t/ha/yr)	0	0.6	0.2	
Delivery ratio	0	0.7	0.3	
Percentage of stream length > 30 cm sediment deposition	0	0.4	0.1	

Source of sediment

- Bank erosion contributes the greatest proportion of sediment particularly in the south west where the percentage of degraded stream bank is the greatest. This highlights the importance of good riparian zone management.
- Gully erosion is the second most important source of eroded sediment particularly in southern New South Wales river basins where there is a high density of gullies due to topography, soil type and land use. Hillslope erosion is the most significant source of sediment supply in northern New South Wales river basins that experience intense subtropical rainfall events.

Sediment delivery

Many of the areas experiencing large increases in soil erosion rates are located in upper catchments. Ecosystem condition impacts are reflected in poor riverine water quality, physical habitat and estuary condition throughout receiving river basins. Turbidity and total phosphorus are key causes of poor river condition.

Water quality data for turbidity and total phosphorus confirm the Audit's assessment of basin sediment loads except in northern New South Wales and the Snowy River Basin. Measured water quality does not always capture high intensity events, that have been incorporated in modelled outputs (e.g. the huge loads of sediment transported by the Clarence and Richmond systems during the 2001 floods is not reflected by patterns of water quality defined by preceeding years of monitoring).

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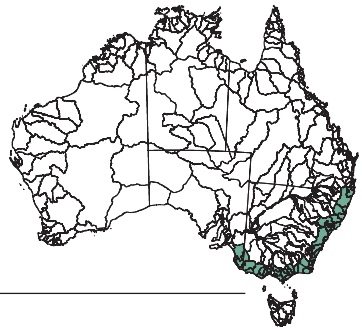

Nutrient loading

	Range	(Total) and division average
Total nitrogen		
Total export (t/yr)	35 – 4 799	(34 360)
Export rate (kg/ha/yr)	0.1 – 5.9	1.4
Load current to pre-European ratio	1 – 3.1	1.6
Load – dissolved to total ratio	31 – 90	68
Nitrogen sources and sinks (%)		
From sediments	14 – 83	40
From point sources	0 – 38	2
Dissolved from diffuse sources	17 – 86	58
Deposited on floodplains	3 – 41	15
Deposited in reservoirs	0 – 20	2
Denitrified	1 – 23	6
Delivered to estuary	50 – 96	77

	Range	(Total) and division average
Total phosphorus		
Total export (t/yr)	3 – 891	(3 898)
Export rate (kg/ha/yr)	0 – 0.4	0.13
Load: current to pre-European ratio	1 – 48	2.2
Load: dissolved to total ratio	9 – 63	32
Phosphorus sources and sinks (%)		
From fine sediments	40 – 97	71
From point sources	0 – 11	1
Dissolved from diffuse sources	3 – 60	29
Deposited on floodplains	4 – 81	31
Deposited in reservoirs	0 – 35	3
Delivered to estuary	16 – 96	66

Nutrient source and transport

Point source discharges are a significant source of nutrient load in river basins and estuaries close to major population centres. Effluent sourced from septic tank fields for many of the smaller coastal villages can be added to the known point sources.

- A significant proportion of the total nutrient load and on average the greatest proportion of the nitrogen load is contributed in dissolved forms.
- Fine sediment on average carries the greatest proportion of the phosphorus load and a substantial proportion of the nitrogen load highlighting the importance of soil erosion as a nutrient source and transport mechanism.

Increased nutrient loads reduce river and estuary water quality and result in surface water quality exceedances for total nitrogen and/or phosphorus and algal blooms.

Nutrient balance

Several areas have a positive landscape phosphorus balance (South Gippsland and coastal western Victoria). On average river basin phosphorus loads have increased by greater than 2 times.

Areas with positive landscape balances for nitrogen include the major agricultural floodplains of coastal New South Wales, Gippsland and dryland agriculture areas in western Victoria. On average river basin nitrogen loads have increased by 1.6 times.

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Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			50	Number of groundwater management areas			85
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%	Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	22	44	1.	< 30	40	47
2.	30 – 70	17	34	2.	30 – 70	18	21
3.	70 – 100	8	16	3.	70 – 100	18	21
4.	> 100	3	6	4.	> 100	9	11

Surface water

Compared to Murray–Darling Drainage Division to the west, the level of river regulation and surface water extraction is limited.

- Most (78%) surface water management areas have development categories of less than 70% of sustainable yield.
- 16% of surface water management areas have a more developed status of 70 – 100% of sustainable yield (including those adjacent to major irrigated agriculture and population areas such as Hunter, Latrobe, Yarra, Werribee, Lake Corangamite and Glenelg).
- Three surface water management areas are developed beyond sustainable yield (regulated area in Hunter, Sydney Coasts – Georges and the regulated area in Bega).

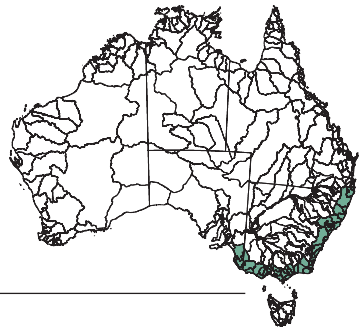
The main concentrations of impoundments occur in central to southern New South Wales (Hunter, Hawkesbury, Georges, Wollongong Coast, Shoalhaven, Bega and Snowy River Basins) and southern Victoria (Latrobe, Bunyip, Yarra, Werribee, and Moorabool, Barwon and Otway Coast).

Impacts of surface water use and altered hydrology on river condition were assessed where flow data was available and were identified in the south (Snowy, Thomson, Latrobe, Bunyip, Werribee, Moorabool and Glenelg). Loss of habitat connectivity due to impoundment construction is also recognised to be a significant issue for estuarine-dependent freshwater fish in the south east (Morns et al. 2001).

Groundwater

Groundwater use is relatively high.

- 32% of groundwater management units have extraction rates greater than 70% of sustainable yield including groundwater management units in the Millicent Coast, Bunyip and Hunter river basins.
- 11% of groundwater management units have extraction levels beyond 100% of sustainable yield including units in the Gippsland, Western Port, Port Phillip and Otways groundwater provinces in the south.



Water balance/salinity

Loss of native vegetation cover is a significant factor contributing to change in landscape water balance. Extensive vegetation loss is associated with areas of intensive agriculture and urban development, including southern to western Victoria, and southern (upper Snowy), central (Hawkesbury and Hunter) and northern New South Wales river basins. Within the temperate climatic zone, these areas have a significant and increasing dryland salinity risk due to rising groundwater tables .

Exceedances of surface water salinity guidelines are recorded for most river basins in southern to western Victoria and the Hawkesbury. At least five biogeographic subregions in the west of the drainage division have greater than 10% of remnant vegetation predicted to be in high risk salinity areas by 2050.

Weeds and feral animals

The greatest number of weed species occurs in the south (e.g. South Gippsland) and in the east extending from central to northern New South Wales. Key weed species include significant invaders of:

- wetlands (alligator weed, cabomba, salvinia);
- riparian zones (willows, blackberry);
- bushland (bridal creeper, boxthorn, radiata pine, lantana); and
- coastal zones (bitou bush).

Key feral animals include:

- predators of native wildlife (cats, foxes);
- grazers of native vegetation (rabbits, goats, pigs);
- general habitat disturbers (pigs disturb wetland and riparian habitats); and
- toxic prey (cane toads, currently restricted to the very north but continuing to expand south).

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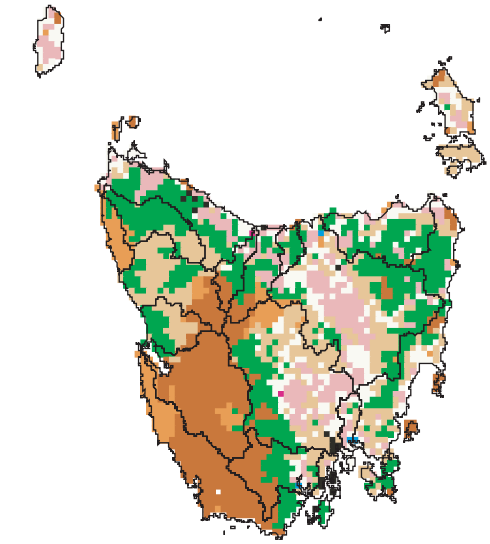
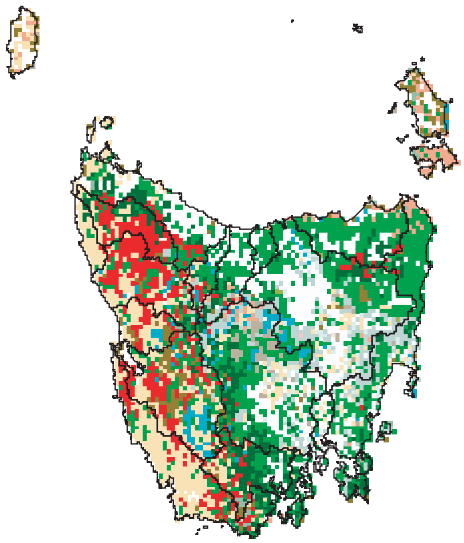
LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

TASMANIAN DRAINAGE DIVISION

Total area	68 363 km^2
Number of basins	19
Basin areas	678 – 11 344 km^2
Estuary types	wave-dominated estuaries and delta systems
Rainfall	560 – 2 509 mm/yr
Evaporation	406 – 688 mm/yr
Run-off	154 – 1 821 mm/yr
Net primary productivity	3.5 – 6.4 tC/ha/yr
Climate types	wet temperate in the west and north east (central highlands) with a mainly mild to cool summer low rainfall in the central midlands

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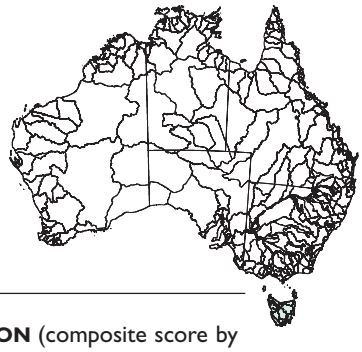
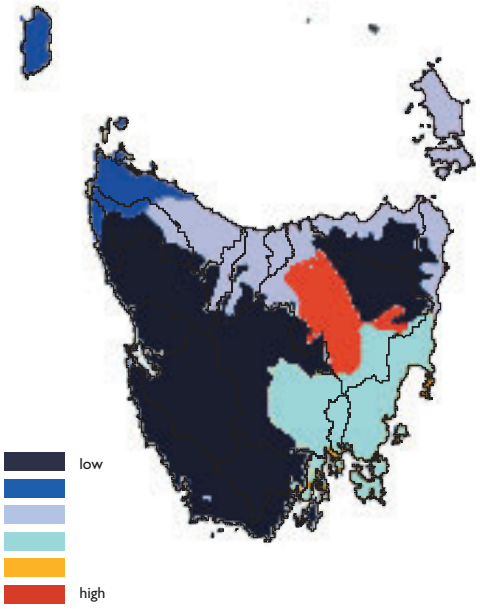
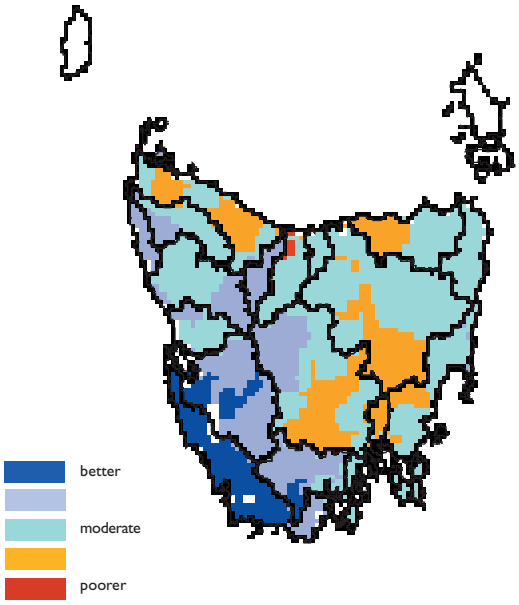


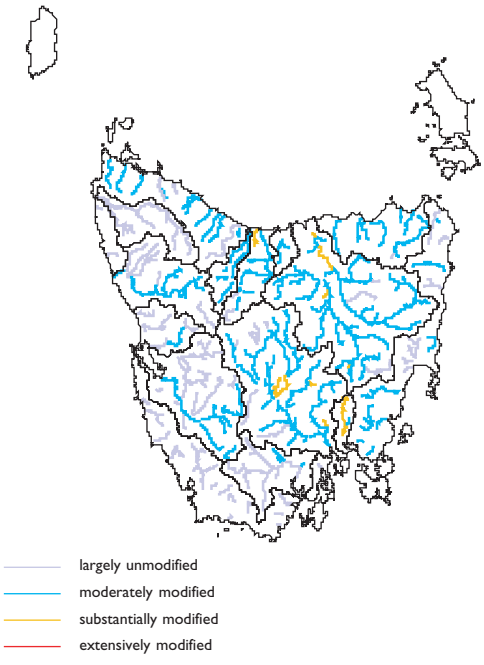
LANDSCAPE STRESS (composite index by subregion)



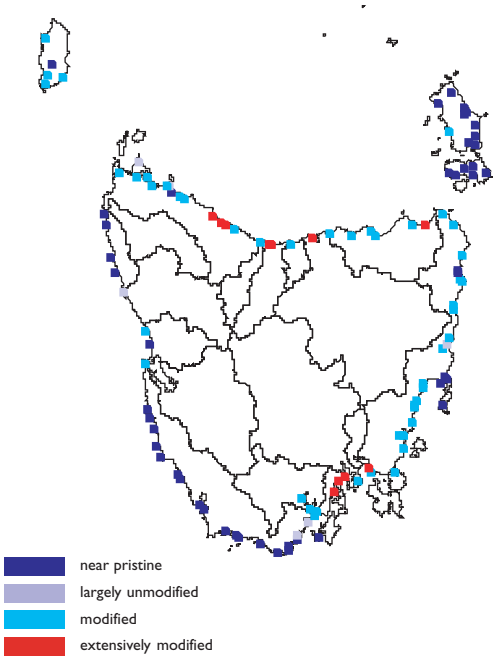
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)



ESTUARY CONDITION (condition for each estuary)



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Patterns of ecosystem condition

- The best landscape, catchment, river and estuarine system conditions are observed in the relatively undeveloped western and south-western river basins. The north-east section of the East Coast Basin also has good to moderate landscape, catchment, river and estuary condition.
- Areas of poorest ecosystem condition occur mainly in the two most intensively developed river basins in the Tasmanian midlands, the Derwent and Tamar.
- Other basins draining to the north or south-east coasts of the drainage division have moderately modified and moderate river and catchment conditions with modified to extensively modified estuary condition.

Key ecosystem condition drivers

Climate

- Where rainfall is high and evenly distributed, ground cover remains relatively high throughout the year, limiting bare ground and erosion potential.
- Relatively high rainfall ensures that river systems generally maintain base flows for all or most of year helping to maintain water quality.
- Areas of low rainfall with a greater potential for seasonal aridity/variability can experience seasonally reduced vegetation cover and are susceptible to water-borne soil erosion.
- Winter-dominated rainfall can tilt landscape water balance toward greater infiltration than evaporation, leading to increased groundwater recharge where vegetation cover or plant vigour is low. Salinity hazard can result.

Topography, landscape and soils

Topography

- Relatively steep and short river basins and medium to high rainfall create significant soil erosion potential and ensure that stream flow has sufficient energy to transport sediment to the estuary.
- High flow velocities also help maintain water quality (e.g. dissolved oxygen).

Soils

- Dominant soil types (Sodosols, Chromosols and Tenosols) in the intensive agricultural midlands are susceptible to degradation, including erosion and salinity.
- Soil acidification is relatively extensive throughout the more intensive agricultural areas. Decline in soil structure and fertility associated with acidification can provide conditions to change rainfall infiltration rates and landscape water balance.

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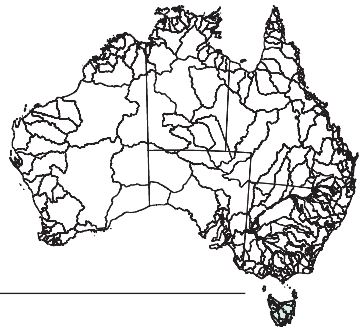

Land use intensity

	Area (km²)	% Area
Nature conservation	14 260	21
Other protected areas and Indigenous	4 470	7
Minimal use	14 010	21
Grazing	8 830	13
Forestry	16 540	24
Dryland agriculture	8 110	12
Irrigated agriculture	610	1
Built environment	710	1
Water bodies	minimal	–

- Highest percentage area of *nature conservation* and *forestry* land uses for any drainage division.
- Other protected areas including *Indigenous uses* and *minimal use crown lands* occupy 28% of the drainage division.

  Other than some more intensive forestry operations, these land uses retain much of the native vegetation cover and many of the biophysical processes required to maintain ecosystem condition. Nature conservation land uses are concentrated in the south-west quarter of the island. *Forestry* land use occurs mainly in the western half of the island and in the north-east quarter.
- Lowest percentage of area used for *livestock grazing on native pastures* for any drainage division.
- *Dryland agriculture* (12% of total area) is distributed across northern river basins and extends south to the south-east coast through the midlands.

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Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	6 836 300	5 782 212	1 054 088	15
Rainforest and vine thickets	715 712	705 188	10 524	1
Eucalypt tall open forests	850 292	619 076	231 216	27
Eucalypt open forests	2 353 084	1 916 084	437 000	19
Eucalypt low open forests	21 300	10 568	10 732	50
Eucalypt woodlands	716 360	460 360	256 000	36
Acacia forests and woodlands	19 140	2 564	16 576	87
Callitris forests and woodlands	132	116	16	12
Casuarina forests and woodlands	15 840	14 808	1 032	7
Other forests and woodlands	35 784	35 780	4	< 1
Eucalypt open woodlands	125 000	110 732	14 268	11
Low closed forests and closed shrublands	282 648	215 644	67 004	24
Acacia shrublands	1 364	1 336	28	2
Other shrublands	75 620	73 552	2 068	3
Heath	190 592	190 516	76	< 1
Tussock grasslands	109 728	108 080	1 648	2
Other grasslands, herblands, sedgelands and rushlands	1 065 572	1 064 856	716	< 1
Chenopod shrubs, samphire shrubs and forblands	2 616	2 616		0
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	187 184	187 172	12	< 1

- In areas of more intensive land use (e.g. northern slopes, northern midlands and south east) native vegetation cover is low and highly fragmented. These areas also have increased soil erosion rates and changes to landscape water balance.
- Vegetation types with the largest areas cleared include eucalypt open forests, eucalypt woodlands, eucalypt tall open forests, low closed forests and shrublands, and acacia forests and woodlands.
- Vegetation types that have undergone the greatest proportional reduction include acacia forests and woodlands, eucalypt low open forests, eucalypt woodlands, eucalypt tall open forests, and low closed forests and shrublands.

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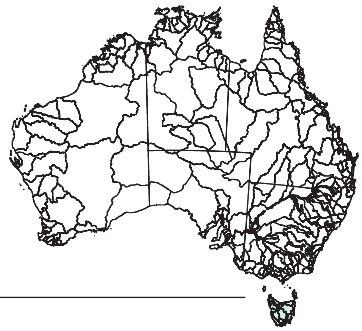

Erosion rate and sediment load

Most agricultural areas have undergone a two to five-fold increase in hillslope soil erosion rate with increased rates up to between 20 and 30 times natural levels for the steeper slopes in the midland agricultural areas and the northern coastal fringe. Including gully and river bank erosion, there is an average increased sediment supply to river basins of 42 times pre-European levels.

	Minimum basin value	Maximum basin value	Average basin value	Total
Current to pre-settlement sediment supply	1	186	42	
Sediment supply (t/ha/yr)	0.05	0.56	0.31	
Total sediment supplied to streams (t/yr)	1 099	463 606	n/a	1 903 716
% supplied by hillslope erosion	0.6	34	12	
% supplied by gully erosion	0	61	22	
% supplied by bank erosion	23	99	67	
Total sediment exported to coast (t/yr)	727	195 373	n/a	872 664
Erosion per hectare exported to the coast (t/ha/yr)	0.03	0.28	0.15	
Delivery ratio	0.37	0.66	0.49	
Percentage of stream length > 30 cm sediment deposition	0	0.09	0.01	

Source of sediment

- Bank erosion is the dominant source of sediment reflecting the relatively natural condition of the mainly forested river basins.
- Gully erosion is the second most dominant sediment source mainly in the more intensively developed basins with low vegetation cover.

Sediment delivery

In the Tasmanian Midlands, large increases in soil erosion rates are occurring in upper catchment areas with impacts being realised throughout receiving river basins (Tamar and Derwent) in terms of poor river water quality (total phosphorus and suspended solids), physical habitat (lowermost reaches only) and estuary condition.

Nutrient loading

	Range	(Total) and division average		Range	(Total) and division average
Total nitrogen			**Total phosphorus**		
Total export (t/yr)	15 – 2 182	(9 815)	Total export (t/yr)	1 – 277	(1 031)
Export rate (kg/ha/yr)	0.36 – 2.34	1.4	Export rate (kg/ha/yr)	0.02 – 0.25	0.14
Load: current to pre-European ratio	0.9 – 2.7	1.3	Load: current to pre-European ratio	0.6 – 4.4	1.6
Load: dissolved to total ratio	27 – 90	75	Load: dissolved to total ratio	10 – 97	64
Nitrogen sources and sinks (%)			**Phosphorus sources and sinks (%)**		
From sediments	15 – 74	29	From fine sediments	41 – 89	59
From point sources	0 – 14	2	From point sources	0 – 31	5
Dissolved from diffuse sources	26 – 83	69	Dissolved from diffuse sources	11 – 59	36
Deposited on floodplains	0 – 20	3	Deposited on floodplains	0 – 26	5
Deposited in reservoirs	0 – 9	2	Deposited in reservoirs	0 – 9	1
Denitrified	0 – 4	1	Delivered to estuary	74 – 100	94
Delivered to estuary	79 – 99	94			

Nutrient source and transport

Average increases in nitrogen load are relatively low at 1.3 times. Up to 14% of nitrogen and 31% of phosphorus load within the Tamar basin was contributed by point sources. This is relatively low by many mainland Australia standards.

Much of the nutrient load is carried in dissolved form contributing to the extremely high nutrient load delivery efficiency (average 94% for both phosphorus and nitrogen loads).

Nutrient balance

Landscape phosphorus balance was found to be positive (10–50 times in the north; 2–5 times in the south-east draining midlands). Average increase in basin phosphorus load is low (1.6 times), indicating the extent of undeveloped river basins. A few developed river basins have undergone relatively large increases in basin phosphorus load (e.g. Coal at 4.4 times).

Landscape nitrogen balance is mainly positive with small localised areas in the south east (Huon) having positive balances of 50 to 100 times.

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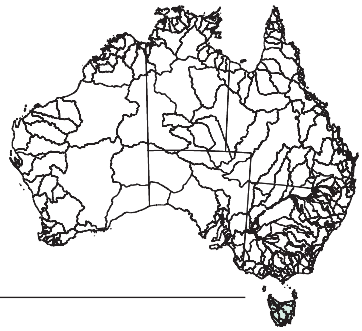

Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			19	Number of groundwater management areas			17
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%	Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	10	53	1.	< 30	15	88
2.	30 – 70	2	11	2.	30 – 70	2	12
3.	70 – 100	7	37	3.	70 – 100		
4.	> 100	0	0	4.	> 100		

Surface water

The level of river regulation and surface water extraction is relatively high. This is primarily associated with the widespread development of water resources for hydro-electric power generation.

- More than a third of the surface water management areas within the division have development categories in the 70 – 100% of sustainable yield category.
- Impoundments are located in all central river basins (including Pieman, King–Henty, Gordon, Derwent, Coal, Forth, Mersey and Tamar).

Loss of aquatic habitat connectivity and changed flow regimes within impounded and regulated river systems are key contributors to river condition.

Water balance/salinity

In midland river basins the high risk of losing landscape water balance due to the extent of native vegetation loss, wet temperate climate, soil structural decline and irrigation water use is reflected by the extent of areas assessed to have a significant and increasing salinity hazard. They include the Derwent, upper Tamar, Coal and southern East Coast basins.

Three biogeographic subregions in the midland and north east have between 1% and 5% of remnant vegetation predicted to be in high hazard salinity areas by 2050. These include subregions where the extent of remnant vegetation is low and fragmentation high.

Weeds and feral animals

Number of species and distribution patterns of weeds and feral animals are limited and have remained primarily confined to more developed areas reflecting both the isolation and relatively good ecological condition of Tasmania.

- Some key mainland pest species (e.g. foxes and pigs) have not established in Tasmania.
- Cats, rabbits and goats are widespread.

Weeds are significant issues in the more developed basins in the midlands and the north.

- Willow and blackberry invade the riparian zone.
- Bridal creeper, boxthorn, and gorse invade bushland.
- Bitou bush invades coastal zones.

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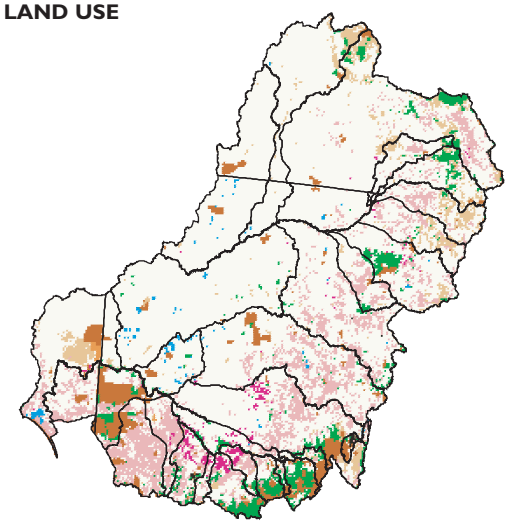
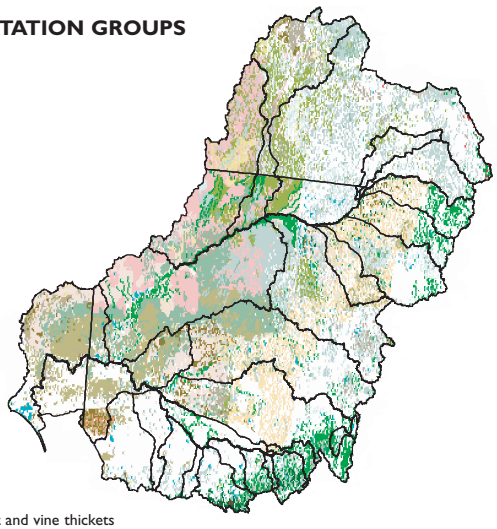
INTEGRATED FINDINGS: Murray–Darling Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

MURRAY–DARLING DRAINAGE DIVISION

Total area	1 058 590 km^2
Number of basins	26
Basin areas	945 – 162 602 km^2
Estuary types	one wave dominated estuary
Rainfall	280 – 1 232 mm/yr
Evaporation	257 – 622 mm/yr
Run-off	26 – 612 mm/yr
Net primary productivity	0.8 – 6.2 tC/ha/yr
Climate types	subtropical in the north east desert in the central west Mediterranean in the south west wet temperate in the south east

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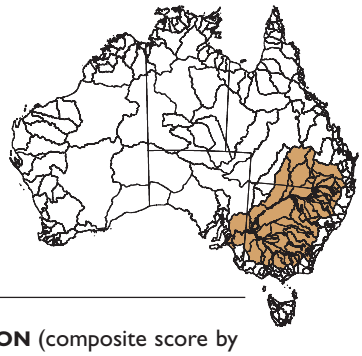
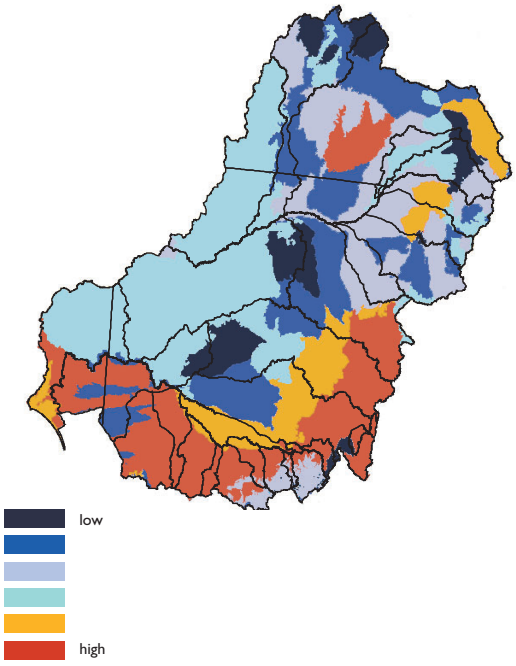
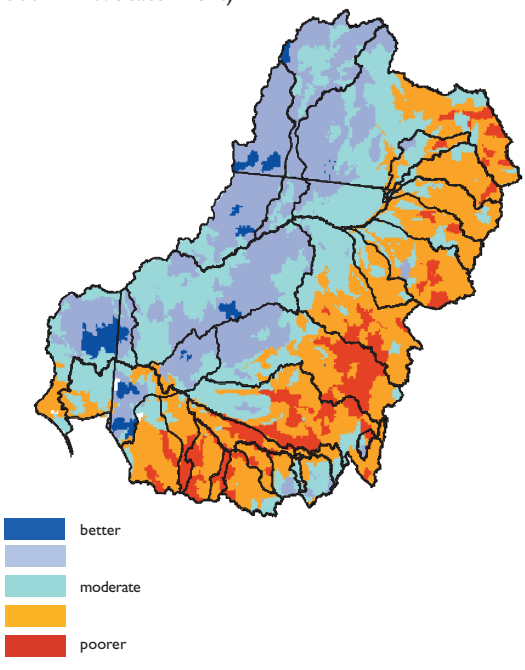


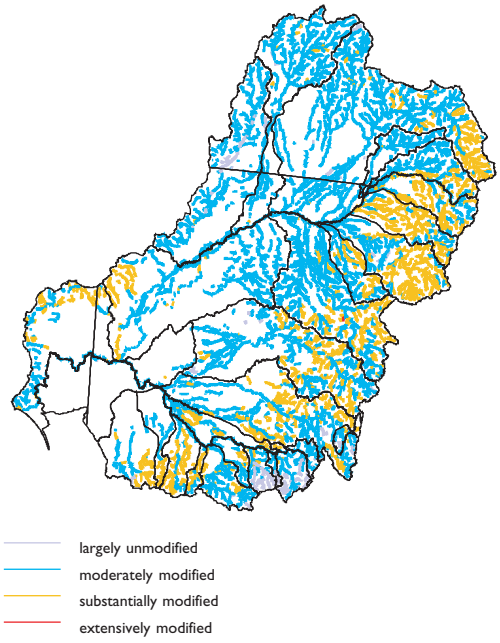
LANDSCAPE STRESS (composite index by subregion)



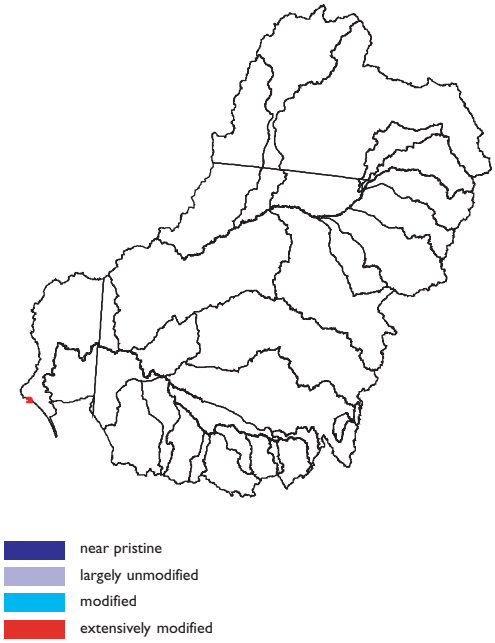
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)



ESTUARY CONDITION (condition for each estuary)



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Patterns of ecosystem condition

The pattern of ecosystem condition follows the pattern of intensive land use, particularly agriculture. A crescent of poorer condition catchments and substantially modified river reaches runs east from the lower Murray River and curves to the north east across the mid to upper catchment areas of the eastern river basins. Most of the remainder of the division is in better condition.

Landscapes of the western part of the drainage division including most of the Paroo, Darling and northern Lower Murray river basins are impacted by rangeland grazing pressure, weeds and feral animals. River and catchment condition assessments of this area identified largely unmodified river reaches within the Paroo basin, moderately modified river reaches elsewhere and generally better condition catchments. This reflects some separation in relationship between terrestrial and aquatic habitat condition and the limitation of the applied catchment condition indicators in rangeland areas. Substantially modified river reaches in the northern Lower Murray and western Darling River basins reflect landscape conditions.

A band of relatively good condition landscapes runs north–south through the centre of the drainage division. These include subregions within the Mitchell Grass Downs, Southern Brigalow Belt, Mulga and Darling Riverine Plains bioregions within the Warrego and northern and southern Condamine – Culgoa river basins, and downs and riverine plains subregions within the lower Macquarie – Bogan, upper Darling, lower Lachlan and lower Murrumbidgee river basins.

Upper catchment areas in south-east basins (Goulburn, Ovens, Upper Murray and Murrumbidgee) were identified as having good ecosystem condition by all assessments.

The drainage division has only one estuary—the Murray River mouth also known as the Coorong. The Coorong is an extensively modified wave-dominated estuary.

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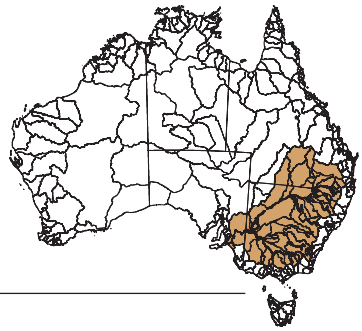

Key ecosystem condition drivers

Climate

The Murray–Darling Drainage Division contains the greatest diversity of climate zones for any Australian drainage division.

- Highly variable precipitation patterns (including snowfall) translates into seasonal and naturally variable flow patterns for many of the river basins.
- Potentially intense subtropical rainfall events in the northern river basins create high erosion potential and peaked flow events.
- Mainly winter rainfall for many of the southern river basins tilt landscape water balance toward greater infiltration than evaporation.
- Large areas of arid and seasonally arid landscapes in which vegetation cover may be seasonally low are susceptible to wind and water-borne soil erosion.

Landscape, topography and soils

Topography

- Relatively steep upper catchments with gentle lower slopes for river basins in the southern, eastern and northern margins combined with loss of vegetation create ideal conditions for both erosion in upper catchments and saline discharge on lower slopes.
- Low flow velocities across the large low gradient inland basin increases the susceptibility for instream water quality to be reduced and results in a low capacity for sediment transport. Very little sediment or nutrient leaves the basin with most remaining in the river or distributed across floodplains at flood times. Weir systems contribute to the accumulation of sediments, nutrients and toxicants in the river.

Soils

- Soil types (Sodosols, Kandosols, Chromosols and Tenosols) are used intensively and are susceptible to a range of degradation issues.

Land use intensity

	Area (km²)	% Area
Nature conservation	45 460	4
Other protected areas and Indigenous	minimal	–
Minimal use	60 980	6
Grazing	726 530	69
Forestry	43 110	4
Dryland agriculture	154 230	15
Irrigated agriculture	15 680	2
Built environment	minimal	–
Water bodies	8 800	< 1

- *Livestock grazing* is the dominant land use in extent, particularly in the more arid central to western basins.
- The greatest extent of *dryland* and *irrigated agriculture* occurs in this division. Land and water resource development have resulted in large-scale changes to vegetation cover and biophysical processes.

  Dryland agriculture is extensive across southern and eastern river basins. south-eastern river basins (Wimmera–Avon, Avoca, Loddon, Campaspe and Broken) have the greatest percentage (between 30 and 50%) of their area used by dryland agriculture. Larger eastern river basins have the largest extent of dryland agriculture comprising up to 20% of their area.

  Irrigated agriculture is concentrated on floodplain alluvial soils. The greatest extent occurs in the lower Murrumbidgee (292 000 ha). The Murray–Riverina, Broken, Goulburn, Loddon and Campaspe river basins have up to 15% of basin area used for irrigated agriculture.
- *Forestry* is concentrated in the upper catchments of the south-east river basins where it occupies up to 32% of basin area. It is increasing in extent in eastern and southern river basins.
- *Nature conservation* represents a relatively small total percentage of the drainage division area—the third lowest for Australia. The main protected areas include the upper catchments of river basins in the south (Wimmera–Avon) and south east (Murrumbidgee, Upper Murray, Kiewa, Ovens, and Goulburn) where nature conservation occupies between 5% and 29% of basin area. Large conservation areas (6–28% basin area) also occur in lowland mallee areas in basins in the south west (Mallee and Lower Murray). Other large nature conservation areas are spread across lowland floodplain areas in the arid central basins (Lachlan 4% basin area) and north west (Paroo 3% basin area).

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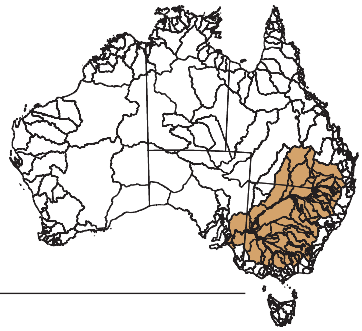

Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	105 859 000	65 276 960	40 582 040	38
Rainforest and vine thickets	67 944	34 552	33 392	49
Eucalypt tall open forests	859 592	758 312	101 280	12
Eucalypt open forests	7 264 768	4 379 020	2 885 748	40
Eucalypt low open forests	663 416	648 996	14 420	2
Eucalypt woodlands	31 059 512	11 469 272	19 590 240	63
Acacia forests and woodlands	8 954 808	5 208 088	3 746 720	42
Callitris forests and woodlands	2 756 308	2 488 560	267 748	10
Casuarina forests and woodlands	5 811 932	4 751 568	1 060 364	18
Melaleuca forests and woodlands	268	40	228	85
Other forests and woodlands	587 324	289 984	297 340	51
Eucalypt open woodlands	7 475 496	4 390 616	3 084 880	41
Acacia open woodlands	753 328	620 260	133 068	18
Mallee woodlands and shrublands	10 683 964	6 019 656	4 664 308	44
Low closed forests and closed shrublands	378 696	373 960	4 736	1
Acacia shrublands	6 500 416	6 284 280	216 136	3
Other shrublands	1 297 828	1 096 068	201 760	16
Heath	187 884	185 884	2 000	1
Tussock grasslands	6 009 476	2 552 252	3 457 224	58
Hummock grasslands	120 408	110 664	9 744	8
Other grasslands, herblands, sedgelands and rushlands	6 440 560	6 422 280	18 280	< 1
Chenopod shrubs, samphire shrubs and forblands	7 302 204	6 546 504	755 700	10
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	673 220	636 496	36 724	5

- Approximately 40% of native vegetation has been cleared mainly in southern and upper eastern river basins. Lower rainfall rangeland areas (central and western half) have retained native vegetation cover.
- Vegetation types that have the greatest extent cleared include eucalypt woodlands, mallee woodlands and shrublands, acacia forests and woodlands, tussock grasslands, and eucalypt open woodlands.
- Vegetation types that have undergone the greatest proportional reduction include melaleuca forests and woodlands, eucalypt woodlands, tussock grasslands, other forests and woodlands, and rainforest and vine thickets.

Erosion rate and sediment load

Most of the east and south has undergone a two- to five-fold increase in rate of hillslope erosion. Some dryland agricultural areas in the upper catchments of southern and eastern river basins and on the lowland sandy soils of cleared mallee areas in the south west are experiencing hillslope erosion rate increases of between 10 and 30 times natural rates. Combined with other sources of erosion, sediment supply to river basins within the division has undergone an average 67-fold increase.

	Minimum basin value	Maximum basin value	Average basin value	Total
Current to pre-settlement sediment supply	3	434	67	
Sediment supply (t/ha/yr)	0.3	1.4	0.8	
Total sediment supplied to streams (t/yr)	25 868	5 551 688	n/a	48 834 373
% supplied by hillslope erosion	1	47	16	
% supplied by gully erosion	~0	80	42	
% supplied by bank erosion	7	99	42	
Total sediment exported to coast (t/yr)	0	564 300	n/a	1 158 905
Erosion per hectare exported to the coast (t/ha/yr)	0	0.3	~0	
Delivery ratio	0	0.2	~0	
Percentage of stream length > 30 cm sediment deposition	0	0.9	0.3	

Source of sediment

- Gully erosion is typically the dominant (> 50%) supply of sediment for basins with steeper slopes or susceptible soils (> 80% for Avoca and Campaspe).
- Bank erosion dominates sediment supply for lower gradient river basins (>80% in the Darling, Murray and Benanee).
- For most river basins, hillslope erosion is a less significant source of sediment supply than gully or bank erosion.

Increased sediment loads also leads to river bed aggradation. River bed aggradation is a driver of poor river condition for reaches at the break in slope for southern and eastern river basins.

- On average a third of river length has greater than 30 cm of accumulated sediment, the greatest proportion for any drainage division.

Sediment delivery

The low velocity of flow in the lower rivers means there is limited capacity for transporting material through the system. Impacts on physical habitat are likely to persist. The storage capacity of river channels, reservoirs and floodplains is indicated by the low ratio of sediment load delivery to the estuary (27%).

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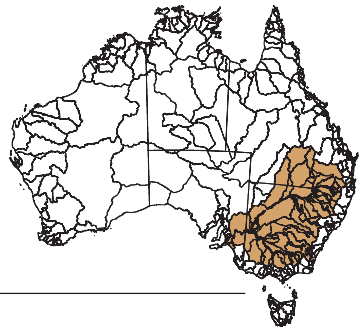

Nutrient loading

	Range	(Total) and division average		Range	(Total) and division average
Total nitrogen			**Total phosphorus**		
Total export (t/yr)	0 – 14 728	(67 689)	Total export (t/yr)	0 – 661	(3 956)
Export rate (kg/ha/yr)	*–1.6 – 2.4	0.5	Export rate (kg/ha/yr)	*-0.1 – 0.2	~0
Load: current to pre-European ratio	1 – 3.8	2.1	Load: current to pre-European ratio	0.7 – 8.5	2.9
Load: dissolved to total ratio	25 – 81	57	Load: dissolved to total ratio	5 – 41	14
Nitrogen sources and sinks (%)			**Phosphorus sources and sinks (%)**		
From sediments	0 – 87	52	From fine sediments	0 – 99	77
From point sources	0 – 6	1	From point sources	0 – 15	1
Dissolved from diffuse sources	0 – 55	29	Dissolved from diffuse sources	0 – 22	8
Deposited on floodplains	0 – *171	43	Deposited on floodplains	0 – *262	66
Deposited in reservoirs	0 – 42	10	Deposited in reservoirs	0 – 71	15
Denitrified	0 – *403	27	Delivered to estuary	0 – 531	53
Delivered to estuary	0 – *5243	287			

* The effectiveness of some river basins as sinks for loads derived from upstream basins results in negative load export values and large (> 100%) load deposition values.

Nutrient source and transport

- River basin nitrogen loads are estimated to have doubled on average compared to pre-European levels.
- River basin phosphorus loads are estimated to have on average tripled, due to an increased percentage of the phosphorus load (77%) being transported in association with fine sediment.
- Approximately half (52%) of the nitrogen load is transported in association with fine sediment, highlighting the role of fine sediment as a key transport mechanism for nutrient loads.

Low river gradients, numerous reservoirs, extensive floodplains and internal confluencing of streams means that some river basins are important nutrient sinks.

- On average 43% of river basin nitrogen load and 66% of phosphorus is deposited on floodplains while 10% of river basin nitrogen load and 15% of phosphorus is deposited in reservoirs.

Point source nutrient loads from inland population areas and industry are an additional nutrient load source.

- Up to 15% of phosphorus load in the Kiewa River Basin and 6% of nitrogen load in the Murrumbidgee River Basin is derived from point sources.

Nutrient balance

Landscape nutrient balance assessments indicate that surpluses are a significant feature for some areas of agricultural land use.

Positive nitrogen balances of up to 200 times occur in areas of intensive irrigated agriculture within the Riverina, while 10 to 20 times increases occur in more extensive areas in the east and south.

Landscape phosphorus balance is generally negative but with two to five times positive balances recorded in upper south-eastern and north-eastern basins.

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Water balance/salinity

Native vegetation loss, the wet temperate climate, soil structural decline and use of irrigation water, creates a high risk of losing landscape water balance in many river basins of the drainage division.

Key areas at high risk of dryland salinity hazard include the lower slopes of the southern and central eastern basins and riverine plains in the lower Murray and Murray – Riverina Basins.

Ecosystem impacts due to dryland salinity include:

- salinisation of surface waters; and
- increased salinity risks for remnant habitat.

Seven subregions have greater than 5% of remnant vegetation within dryland salinity high risk areas.

Water quality

Impacts on water quality resulting from increased nutrient, sediment and salt loads have been recorded through much of the drainage division.

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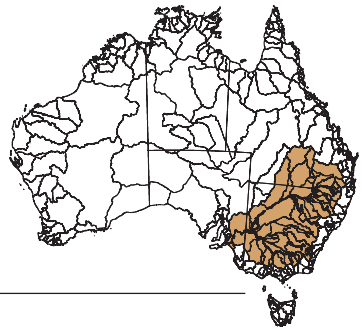

Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			54	Number of groundwater management areas			97
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%	Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	8	15	1.	< 30	43	44
2.	30 – 70	2	4	2.	30 – 70	22	23
3.	70 – 100	18	33	3.	70 – 100	12	12
4.	> 100	26	48	4.	> 100	17	18
					n/a	3	3

Surface water

- Approximately half the surface water management areas are assessed as being developed beyond 100% of sustainable yield.

Impoundments, surface water abstraction and river regulation associated with water resource development are significant drivers of riverine ecosystem condition. These are important drivers of aquatic biota condition affecting the freshwater fish community many of which are known to be migratory and need hydrological cues for breeding (MDBC in prep.).

Groundwater

- Approximately half of the groundwater management units have extraction levels less than 30% of sustainable yield.
- 18% of groundwater management units have been developed to abstraction rates of greater than 100% of sustainable yield. These include several units in the Great Artesian Basin in the north of the division.

Weeds and feral animals

Weeds and feral animal density and diversity are greatest in the south and south east extending from northern Victoria to the western slopes of New South Wales and into the arid north west (Warrego, Condamine-Culgoa and Darling river basins).

Weed species include bushland, grassland and riparian invaders (e.g. Chilean needle grass, serrated tussock, bridal creeper, willows, blackberry, boxthorn and olives).

Exotic fish are a major concern with at least ten species of exotic freshwater fish. European carp is the highest profile invader.

Other feral animals include:

- major predators of native wildlife (cats, foxes);
- grazers and disturbers of native vegetation (rabbits, goats, pigs); and
- toxic prey (cane toads—currently restricted to the far north, extent of continuing expansion to the south is not known).

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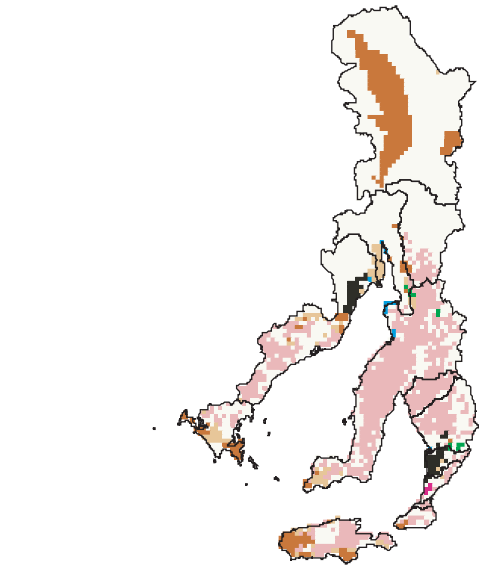
LAND USE



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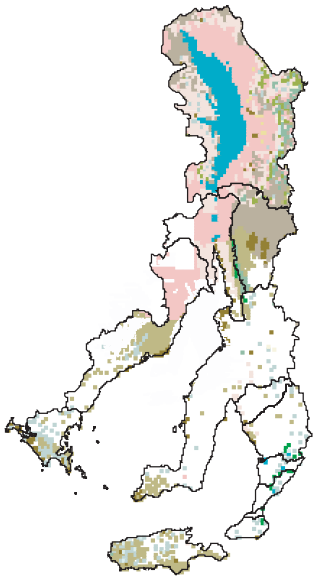
MAJOR VEGETATION GROUPS



- Cleared
- Eucalypt open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

SOUTH AUSTRALIAN GULF DRAINAGE DIVISION

Total area	83 366 km^2
Number of basins	13
Basin areas	155 – 26 259 km^2
Rainfall	193 – 742 mm/yr
Evaporation	154 – 1 120 mm/yr
Run-off	39 – 332 mm/yr
Net primary productivity	0.3 – 3.5 t C/ha/yr
Climate types	persistently dry to hot desert in the north west Mediterranean climate in the south east and south west

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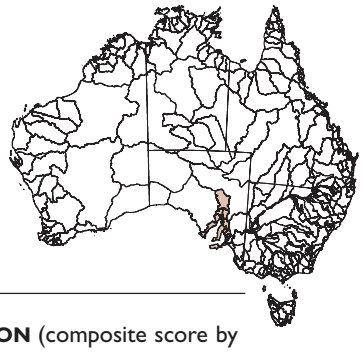
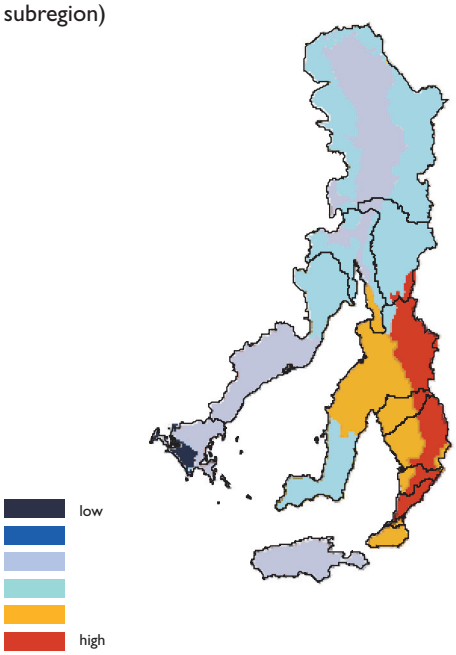
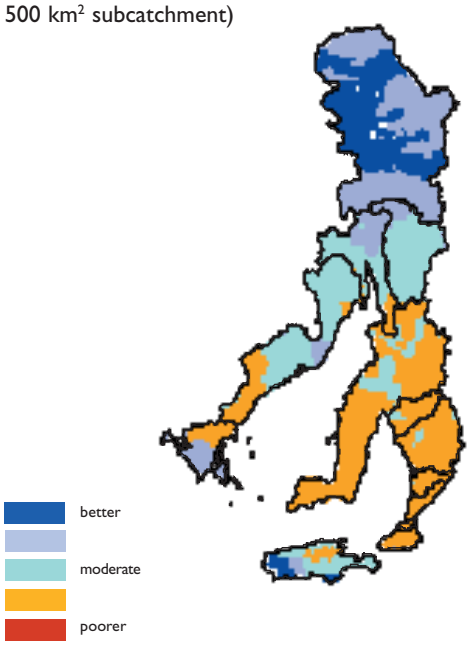


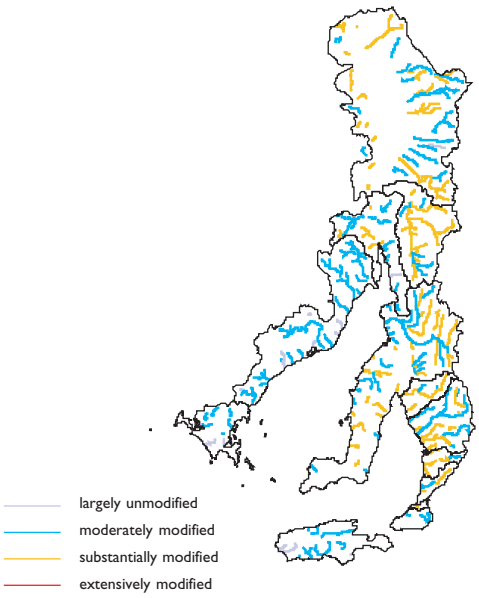
LANDSCAPE STRESS (composite index by subregion)



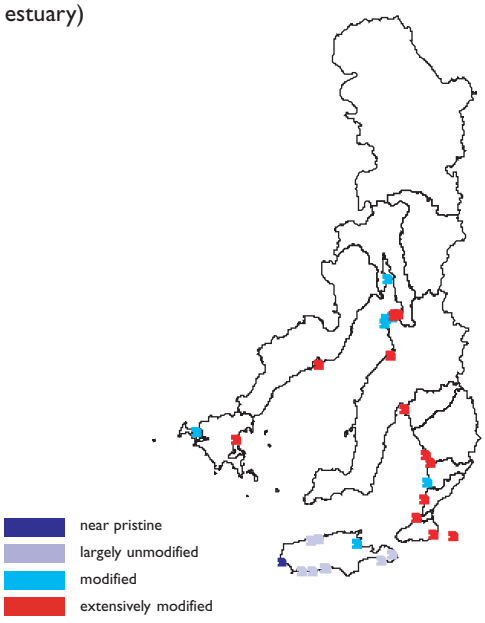
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)



ESTUARY CONDITION (condition for each estuary)



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Patterns of ecosystem condition

Areas of poorest ecosystem condition coincide with the most intensive development. These are in the south-east corner of the drainage division and include the Fleurieu Peninsula, Myponga, Onkaparinga, Torrens, Gawler, Wakefield and Broughton basins. Some of these basins are managed as part of Adelaide's water supply.

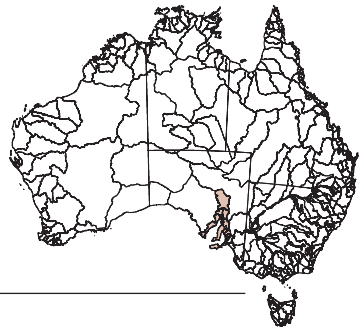
Better landscape, catchment, and river conditions are observed in basins in arid rangeland grazing areas in the north (Lake Torrens and Mambray Coast), the northern Spencer Gulf, the southern Eyre Peninsula and Kangaroo Island.

The drainage division has a small number of estuaries as a consequence of its low rainfall and limited fluvial discharge.

- All mainland estuaries are modified to extensively modified.

The occurrence of the less modified estuaries coincides with better condition catchments.

- Less developed Kangaroo Island estuaries are in better condition including several that are largely unmodified and one classed as near pristine.



Key ecosystem condition drivers

Climate

The climate of the South Australian Gulf is temperate Mediterranean to arid grassland.

- Seasonal or persistent aridity results in low vegetation cover and susceptibility to wind- or water-borne soil erosion.
- Low and seasonal rainfall results in intermittent flowing river systems with a limited capacity to transport sediments (except during storm events) and greater susceptibility to water quality impacts. Low rainfall also limits the capacity for soil erosion. Very arid areas lack defined drainage channels or rivers though intermittent surface and groundwater flows can maintain pools for extended periods.
- Winter rainfall can tilt landscape water balance towards greater infiltration than evaporation, particularly where vegetation cover has been lost.

Landscape, topography and soils

Topography

- Areas of generally flat land (central and western basins) allow high infiltration of rainfall and in low rainfall areas allow formation of undifferentiated and low gradient drainages with intermittent flows. Evapoconcentration can lead to high salinity in surface waters.
- High relief areas include the Mt Lofty Ranges. In the higher rainfall areas of the Mt Lofty Ranges, cover reduces susceptibility to hillslope erosion. Further to the east in the rain shadow-affected parts of the ranges, there is a much less vegetated landscape.

Soils

- The mainly sandy and sandy-loam textured soils (Calcarosols, Chromosols, Sodosols and Tenosols) have one or more characteristics conducive to degradation including low water retention, dispersiveness, low fertility and proneness to wind and water erosion. Rainfall infiltration is generally greater on sandy textured soils.

Land use intensity

	Area (km²)	% Area
Nature conservation	9 220	11
Other protected areas and Indigenous	0	–
Minimal use	3 430	4
Grazing	47 000	57
Forestry	minimal	–
Dryland agriculture	20 750	25
Irrigated agriculture	minimal	–
Built environment	1 563	2
Water bodies	minimal	–

The South Australian Gulf Drainage Division is one of Australia's most intensively developed.

- The area occupied by *dryland agriculture* is second only to the South-West Coast drainage division in Western Australia. Several river basins (Wakefield, Gawler and Broughton) have 50% or more of their area occupied by dryland agriculture.

  Close to Adelaide, agricultural activity is intense, catering for local and well as national and international markets.
- *Irrigated agriculture* is mostly for vines and wine production.
- *Grazing* is concentrated in the more arid northern river basins including Lake Torrens, Willochra Creek, Mambray Coast, northern Broughton and northern Spencer Gulf river basins.
- More than half of the *nature conservation* land area is a single reserve covering the Lake Torrens salt lake. Other major areas of nature conservation include the southern Eyre Peninsula, southern Broughton and south-eastern Kangaroo Island basins.

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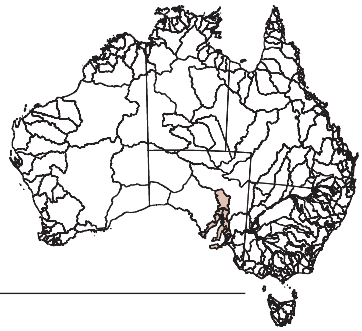

Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	8 336 600	4 899 960	3 436 640	41
Eucalypt open forests	101 452	24 916	76 536	75
Eucalypt woodlands	1 030 764	278 900	751 864	73
Acacia forests and woodlands	90 916	90 916		0
Callitris forests and woodlands	65 500	65 500		0
Casuarina forests and woodlands	25 612	25 612		0
Melaleuca forests and woodlands	516	64	452	88
Other forests and woodlands	52 800	31 392	21 408	41
Eucalypt open woodlands	32 096	32 096		0
Acacia open woodlands	15 376	15 376		0
Mallee woodlands and shrublands	2 542 312	691 400	1 850 912	73
Low closed forests and closed shrublands	304	304		0
Acacia shrublands	1 508 220	1 271 488	236 732	16
Other shrublands	314 060	186 248	127 812	41
Heath	192	192		0
Tussock grasslands	1 079 564	725 280	354 284	33
Hummock grasslands	22 160	22 160		0
Other grasslands, herblands, sedgelands and rushlands	604	604		0
Chenopod shrubs, samphire shrubs and forblands	857 348	845 332	12 016	1
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	550 744	550 740	4	0

- Intensive land use has resulted in a low extent of native vegetation (59%) remaining. Clearing includes riparian areas as well as the general landscape. Native vegetation is restricted to the arid grazing areas in the north (Lake Torrens, Mambray, Willochra and northern Spencer Gulf river basins) and protected areas (southern Eyre Peninsula, southern Broughton and Kangaroo Island basins). Uplands of the Torrens and adjacent Gawler River basin (the Adelaide Hills area) also retain a relatively significant area of native vegetation cover. These include forest reserves and the vegetated margins of the reservoir network (e.g. upper Torrens, Gawler, parts of the middle Onkaparinga, southern Broughton).
- Vegetation types that have been most cleared include mallee woodlands and shrublands, eucalypt woodlands, tussock grasslands, acacia shrublands, and other shrublands.
- Vegetation types that have undergone the greatest proportional reduction include melaleuca forests and woodlands, eucalypt open forests, eucalypt woodlands, mallee woodlands and shrublands, and other shrublands.
- Fire management is a key issue in the management of vegetation cover and structure.

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Erosion rate and sediment load

There is a five- to ten-fold increase in hillslope erosion rate across much of the division, with localised areas of higher rates (e.g. 10 to 20 times increases in part of the northern Broughton and Willochra Creek Basins). Overall, including bank and gully erosion, there is a 16-fold increase in supply of sediment.

	Minimum basin value	Maximum basin value	Average basin value	Total
Current to pre-settlement sediment supply	63	1	16	
Sediment supply (t/ha/yr)	0.9	0.1	0.28	
Total sediment supplied to streams (t/yr)	582 864	1 482	n/a	1 654 877
% supplied by hillslope erosion	49	3	23	
% supplied by gully erosion	90	18	45	
% supplied by bank erosion	70	7	32	
Total sediment exported to coast (t/yr)	56 140	0	n/a	180 479
Erosion per hectare exported to the coast (t/ha/yr)	0.3	0	0.2	
Delivery ratio	0.4	0	0.2	
Percentage of stream length > 30 cm sediment deposition	0.5	0	0.1	

Source of sediment

- Up to 90% of eroded sediment is derived from gully erosion in areas with susceptible soils and steeper topography (e.g. areas within Fleurieu Peninsula).
- 90% of stream bank is degraded.

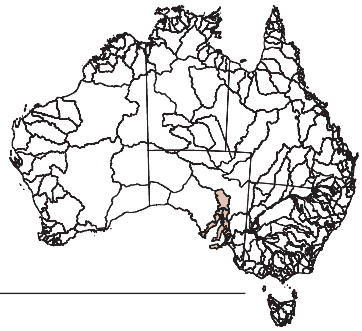
The poor state of riparian vegetation throughout much of the division exposes instream habitats to increased catchment erosion rates and contributes to it.

- Stream bank erosion was identified as the second most important source of sediment supply particularly in flatter topography areas.

Low rainfall other than intense storm events limits the transport of eroded material down river channels.

Sediment delivery

Soil erosion and increased sediment loading impact on physical habitats with increased river bed loads in more arid northern areas including parts of the Willochra Creek, northern Broughton and Wakefield river basins. Water-borne soil erosion is also a primary driver underpinning increased turbidity and nutrient loads.



Nutrient load

	Range	(Total) and division average
Total nitrogen		
Total export (t/yr)	18 – 1 236	(3 332)
Export rate (kg/ha/yr)	0.1 – 1.2	0.58
Load: current to pre-European ratio	1.2 – 4.5	2.4
Load: dissolved to total ratio	18 – 89	65
Nitrogen sources and sinks (%)		
From sediments	9 – 80	32
From point sources	0 – 28	2
Dissolved from diffuse sources	20 – 91	65
Deposited on floodplains	1 – 48	17
Deposited in reservoirs	0 – 13	2
Denitrified	5 – 36	18
Delivered to estuary	30 – 94	63

	Range	(Total) and division average
Total phosphorus		
Total export (t/yr)	1 – 75	(262)
Export rate (kg/ha/yr)	0 – 0.1	0.1
Load: current to pre-European ratio	0.5 – 4.5	2.4
Load: dissolved to total ratio	1 – 60	21
Phosphorus sources and sinks (%)		
From fine sediments	24 – 95	64
From point sources	0 – 61	5
Dissolved from diffuse sources	5 – 65	32
Deposited on floodplains	5 – 75	40
Deposited in reservoirs	0 – 37	5
Delivered to estuary	25 – 95	55

Nutrient source and transport

Increased soil erosion rates provide an important nutrient transport mechanism.

- On average 32% of river basin nitrogen load and 64% of phosphorus load are transported by fine sediment.
- Low and intermittent flow characteristics of surface waters create nutrient load susceptibilities for both riverine and estuarine ecosystems. There is a high average delivery rate to estuaries of nutrient loads (63% for nitrogen and 55% for phosphorus).

Both river and estuary condition assessments identify nutrient loading as a key ecosystem condition driver.

Nutrient balance

Overall, nutrient application across much of the agricultural land is relatively balanced with some significant areas of deficit for nitrogen balance.

Areas of positive landscape phosphorus balance include northern Broughton, Gawler and Onkaparinga basins.

Areas of positive landscape nitrogen balance include eastern Lake Torrens, southern Broughton, eastern Kangaroo Island, Gawler, Torrens, Onkaparinga, Myponga and Fleurieu Peninsula basins.

Nitrogen and phosphorus loads are estimated to have increased on average 2.4 times.

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Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			16	Number of groundwater management areas			18
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%	Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	5	31	1.	< 30	5	28
2.	30 – 70	6	38	2.	30 – 70	4	22
3.	70 – 100	0	0	3.	70 – 100	7	39
4.	> 100	5	31	4.	> 100	2	11

Low rainfall means that significant demands are made on surface and groundwater resources, particularly in areas of larger population and irrigated agriculture land use.

Surface water

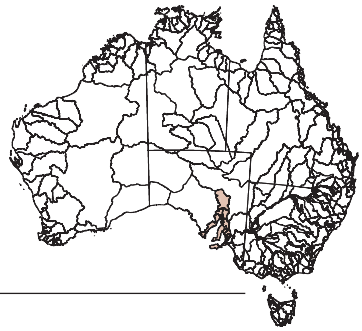
- Approximately 30% of surface water management areas including those north from Fleurieu Peninsula to the Gawler River Basin are developed beyond 100% of their sustainable yield. These five systems are all managed and subject to water transfers from the Murray as part of the metropolitan water supply scheme.

Surface water commitment from farm dams can be as significant as that stored in large reservoirs. Areas of intensive surface water use are concentrated in the south east and are reflected in riverine ecosystem modification associated with loss of habitat connectivity and modified hydrology.

Groundwater

- Half of the groundwater management units have extraction levels greater than 70% of sustainable yield.
- 11% of units including the North Adelaide Plains, have extraction levels considered to be beyond 100% of sustainable yield.

The extent to which the level of groundwater resource development is impacting upon ecosystem condition was not assessed. Groundwater-dependent ecosystems are recognised within the division.



Water balance/salinity

Loss of native vegetation cover, winter-dominated rainfall and sandy textured soils have resulted in widespread changes to landscape water balance and the development of high risk dryland salinity areas.

Ecosystem impacts from dryland salinity include:

- increased salinisation of surface waters; and
- increased salinity risks for remnant habitat.

Up to 5% of remnant vegetation in the Spencer Gulf, Broughton and Wakefield river basins are in dryland salinity high risk areas.

Weeds and feral animals

Areas identified as most stressed by weeds included the Mt Lofty and Broughton subregions. The greatest number of feral animal species occur in the northern and southern Flinders Ranges subregions.

Weed species include wards weed, bridal creeper, gorse, bitou bush, boxthorn, broom, olives and radiata pine.

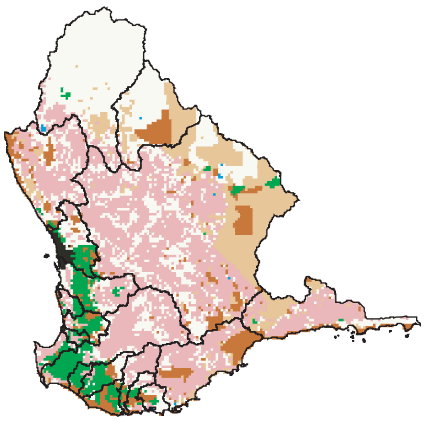
Feral animals include

- predators of native wildlife (cats, foxes); and
- grazers and disturbers of native vegetation (rabbits, goats).

Goats are a particular problem in the northern Flinders where control programs are under way to curb their numbers. Rabbits have been reduced in numbers by the calicivirus but are still present across the entire landscape.

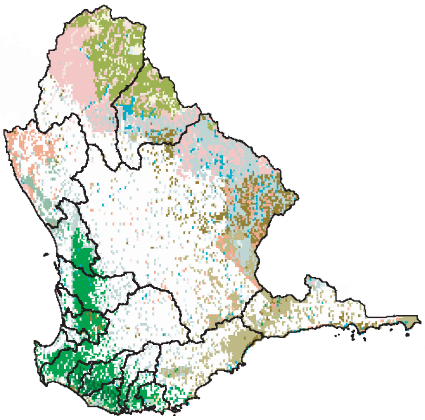
INTEGRATED FINDINGS: South West Coast Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

SOUTH WEST COAST DRAINAGE DIVISION

Total area	314 614 km^2
Number of basins	19
Basin area	1 134 – 117 721 km^2
Estuary types	wave-dominated estuaries
Rainfall	284 – 1 051 mm/yr
Evaporation	265 – 487 mm/yr
Run-off	19 – 565 mm/yr
Net primary productivity	0.8 – 5.6 tC/ha/yr
Climate types	Mediterranean in the south west arid grassland in the north east subtropical in the north-western margin

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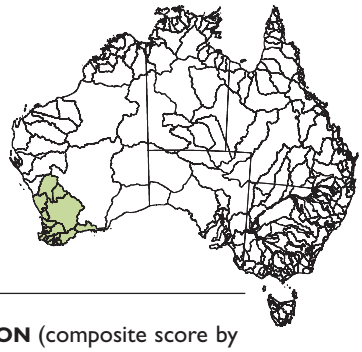
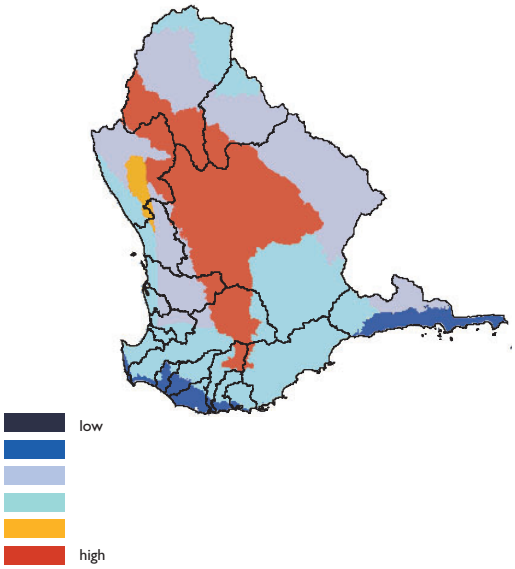
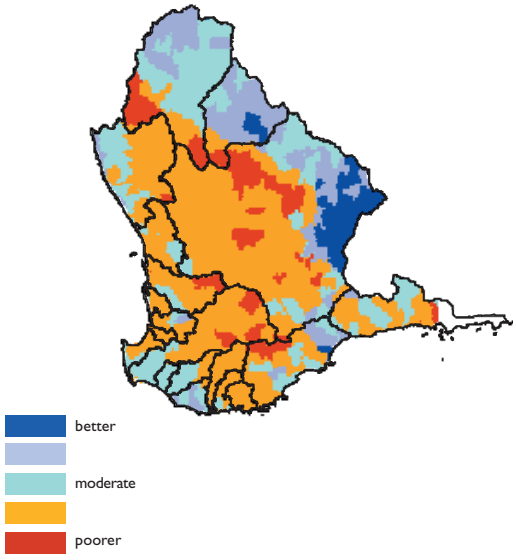


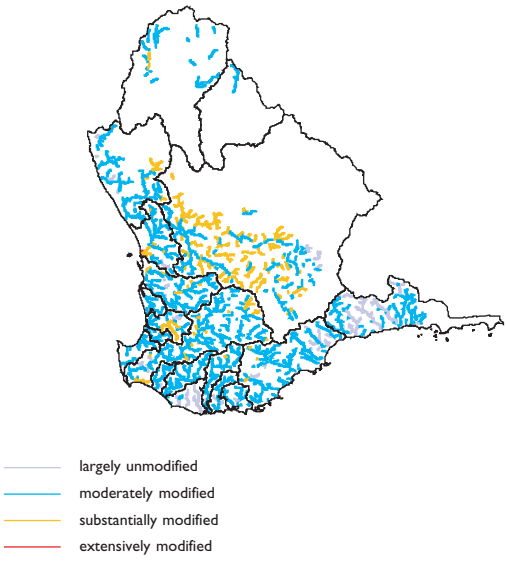
LANDSCAPE STRESS (composite index by subregion)



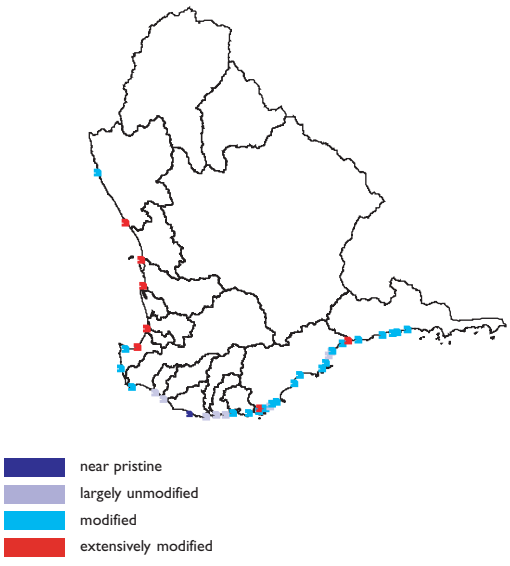
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)



ESTUARY CONDITION (condition for each estuary)



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Patterns of ecosystem condition

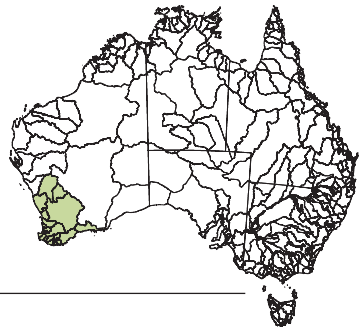
The areas of poorest ecosystem condition include a broad band of poor landscape and catchment condition that extends north west from the upper Blackwood and central Avon river basins. It runs through the more intensively cleared areas of the wheat belt including the western half of the Avon Basin, the upper Moore–Hills and southern Ningham basins to the central western Yarra Yarra Lakes Basin. There is a lack of defined river drainages across much of this arid landscape. Where river reaches are defined (i.e. in the upper Blackwood, western Avon and northern Yarra Yarra Lakes basins), most have a substantially modified condition.

Good ecosystem condition occurs in the south-west coastal basins including the Donnelly, Warren and Shannon river basins. The relatively unstressed landscape and good catchment and river condition of this area is matched by largely unmodified estuaries. The entire Shannon River basin has largely unmodified river reaches and better catchment condition throughout the entire basin and a near pristine estuary.

South-east river basins (i.e. Frankland to Esperance Coast), have predominantly poorer condition catchments. This is reflected in substantially modified river reaches and modified estuaries. Areas of lower intensity land use (i.e. nature conservation and minimal use) are reflected in better condition catchments and more largely unmodified river reaches and estuaries. Coastal areas within the Esperance Coast Basin are used for nature conservation and this is reflected in the low landscape stress of the Recherche subregion on the Esperance Coast.

The west coast has a similar pattern of mixed catchment and river condition though tending more toward greater modification and poorer condition. Both upper catchment wheat belt and coastal sandplain areas have poor ecosystem condition. The upper Collie, upper Murray and upper Moore–Hill river basins have poorer catchment condition reflected by substantially modified river reaches. Better catchment condition in the northernmost and southern-most areas of the west coast is reflected by some largely unmodified river reaches. West coast estuary condition follows this broad pattern with the northern-most and southern-most modified and those centrally distributed extensively modified. A band of less stressed landscapes including the Northern Jarrah Forest and Leseur Sandplain subregions run inland and parallel to the coast, lying across the mid to upper catchments of west coast river basins.

Most of the north-east margin of the drainage division is arid rangeland that has retained native vegetation and is assessed to have landscapes of lower stress and better condition catchments, particularly the southern half which includes significant areas of minimal (crown land) and nature conservation land use. Landscapes within the northern-most margin have greater stress reflecting the susceptibility of the desert climatic zone environment to less intense but extensive land use pressures.



Key ecosystem condition drivers

Climate

The climate of this division is temperate Mediterranean, subtropical and arid grassland.

The south-west of the drainage division experiences a Mediterranean climate with a dry, warm (southern coast), to hot (inland) summer and winter rainfall. Rainfall is relatively high (> 1000 mm) in the southern and western coastal areas and decreases markedly away from the coast to less than 400 mm. The north-east of the division has lower rainfall experiencing an arid climate with hot (north west) to warm (south east) summer drought. The north-western margin of the division has a subtropical climate with a distinctly dry summer. Implications of these climatic regimes for ecosystem condition drivers include:

Rainfall

- Seasonal or persistent aridity results in low vegetation cover and susceptibility to wind- or water-borne soil erosion.
- Low and seasonal rainfall results in seasonal and intermittent flowing river systems with a limited capacity to transport sediments and greater susceptibility to localised water quality impacts. Very arid areas lack defined drainage channels or rivers.

Temperature

- Lower temperatures mean that winter rainfall can tilt landscape water balance toward greater infiltration than evaporation, particularly where vegetation cover has been lost. Generally higher vegetation cover during the moister winter season also reduces the erosivity of winter rainfall.

Landscape, topography and soils

Landscape

- Wave-dominated estuaries result in the formation of sand bars across ocean openings. These can close for extended periods. The resulting limited tidal exchange between estuary and open ocean means that these systems are vulnerable to water quality impacts associated with increased sediment and nutrient loads.

Topography

- Large areas of flat to gently undulating land allow high rainfall infiltration and in low rainfall areas lead to the formation of undifferentiated and low gradient drainages.

Soils

- Soils are mainly sandy textured (Chromosols, Sodosols and Tenosols) with one or more characteristics that mean they are susceptible to degradation (e.g. low water retention, dispersiveness, soil acidity, low fertility and proneness to wind and water erosion). Rainfall infiltration is high on deep sandy textured soils increasing the potential for water balance problems and leaching of nutrients to groundwater.
- Naturally high landscape stores of soil salts combined with low rainfall mean that high salt levels occur in the non-saturated zone of the soil profile. Saline lakes and brackish watercourses are part of the natural landscape. Rising watertables results in dryland salinity.

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Land use intensity

	Area (km²)	% Area
Nature conservation	29 520	9
Other protected areas and Indigenous	minimal	–
Minimal use	43 970	14
Grazing	110 400	35
Forestry	18 450	6
Dryland agriculture	108 210	34
Irrigated agriculture	minimal	–
Built environment	2 070	< 1
Water bodies	minimal	–

The South West Coast Drainage Division is one of Australia's most intensively developed.

- The percentage area occupied by *dryland agriculture* is the greatest for any drainage division in Australia. Several river basins (Albany Coast, Blackwood and Frankland) have 50% or greater of their area occupied by dryland agriculture.
- Major areas of *grazing* (35% of the total area) are located in the more arid rangelands of the northern (Moore – Hill, Ninghan and Yarra Yarra Lakes), eastern and south-eastern (eastern Avon and Esperance) river basins.
- *Nature conservation* (9% of the total area) occurs mainly in the southern (Donnelly, Warren, Shannon, Kent, Denmark), eastern coastal (Albany and Esperance Coasts), arid north-eastern (Avon, Ninghan) and coastal north-western (Moore – Hill Rivers) river basins.
- *Forestry* is a significant land use and occurs mainly in the south-west coastal river basins with greater than 20% of basin area used for forestry within the Shannon, Warren, Donnelly, Busselton Coast, Preston, Collie, Harvey, Murray, and Swan Coast river basins.
- *Minimal use crown land* occupies approximately 14% of the total area.
- More than half a percent of the drainage division is occupied by *built environment*. This is includes the city of Perth situated in the Swan Coast basin and other coastal regional population centres distributed along the south-west coast.

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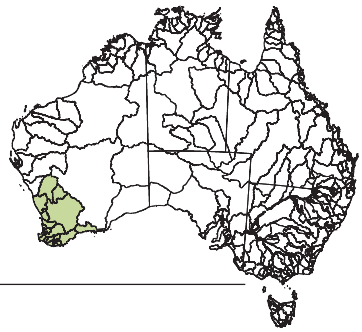

Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	31 461 400	15 557 320	15 904 080	51
Eucalypt tall open forests	275 644	234 304	41 340	15
Eucalypt open forests	2 853 364	2 032 132	821 232	29
Eucalypt low open forests	326 176	150 456	175 720	54
Eucalypt woodlands	3 211 604	3 195 968	15 636	< 1
Acacia forests and woodlands	1 750 604	1 750 452	152	< 1
Callitris forests and woodlands	2 028	0	2 028	100
Casuarina forests and woodlands	25 560	7 136	18 424	72
Melaleuca forests and woodlands	158 588	118 892	39 696	25
Other forests and woodlands	517 676	297 680	219 996	43
Eucalypt open woodlands	7 560 536	163 828	7 396 708	98
Mallee woodlands and shrublands	5 514 720	1 861 880	3 652 840	66
Low closed forests and closed shrublands	440 216	88 500	351 716	80
Acacia shrublands	2 931 624	2 525 792	405 832	14
Other shrublands	1 865 728	1 018 220	847 508	45
Heath	2 140 396	858 684	1 281 712	60
Tussock grasslands	392	132	260	66
Hummock grasslands	341 200	341 200		0
Other grasslands, herblands, sedgelands and rushlands	67 448	41 936	25 512	38
Chenopod shrubs, samphire shrubs and forblands	676 228	413 632	262 596	39
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	753 724	411 492	342 232	45

- Extensive clearing of native vegetation has occurred to allow development of large areas of dryland agriculture (highest percentage of cleared vegetation for any drainage division). Vegetation loss has occurred across the less defined riparian areas of the inland wheat belt as well as the general landscape.
- Broad vegetation types that have experienced the largest areas of clearing include eucalypt open woodlands, mallee woodlands and shrublands, heath, other shrublands, and eucalypt open forests.
- Vegetation types that have undergone the greatest proportional reduction include callitris forests and woodlands, eucalypt open woodlands, low closed forests and closed shrublands, casuarina forests and woodlands, and tussock grasslands.

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Erosion rate and sediment load

Combined sources of eroded sediment have resulted in average increases in sediment supply of more than 200 times across the division. These increases in soil erosion rates need to be considered in the context of very low natural/pre-settlement erosion rates. Predicted suspended sediment yields within river basins are between 50 and 100 times background levels.

	Minimum basin value	Maximum basin value	Average basin value	Total
Current to pre-settlement sediment supply	29	> 1 000	253	
Sediment supply (t/ha/yr)	0.1	0.6	0.3	
Total sediment supplied to streams (t/yr)	12 817	1 631 866	n/a	5 446 860
% supplied by hillslope erosion	0.7	21	4	
% supplied by gully erosion	52	83	70	
% supplied by bank erosion	14	45	26	
Total sediment exported to coast (t/yr)	0	97 576	n/a	717 877
Erosion per hectare exported to the coast (t/ha/yr)	0	0.2	0.1	
Delivery ratio	0	0.4	0.2	
Percentage of stream length > 30 cm sediment deposition	0	0.6	0.2	

Source of sediment

- Gully erosion is the dominant source of sediment contributing on average 70% of sediment supplied to river basins. Gully erosion, largely a consequence of dispersible subsoils and loss of cover, is still forming in some areas 50 years after development for agriculture and grazing.
- Hillslope erosion is a relatively minor contributor of eroded sediment due to relatively flat topography. The increase in hillslope erosion rate has been between two and five times. Bands of higher hillslope erosion increase ratios—between 10 and 20 times increases occur in eastern south coast (Albany and Esperance Coasts) and south-west coast (Murray – Busselton Coast) river basins.
- Riverbank erosion is the second most dominant source of eroded sediment and is related to the relatively large proportion of degraded riverbank.

Sediment delivery

Low rainfall provides a limited capacity to transport sediment.

- Physical habitat impacts assessed with a substantially modified river bed load occur in river basins in the wheat belt (upper Frankland, Blackwood, Murray Avon and Moore – Hill).
- Extensively modified bed load condition occurs in some coastal lowland reaches of river basins at the break in slope where flow energy decreases (lower Blackwood, Swan Coastal and Moore – Hill).

Water-borne soil erosion has increased turbidity and nutrient loads. Sedimentation of estuaries is a major issue.

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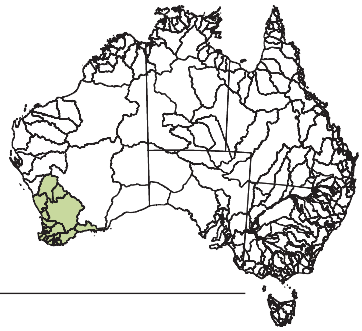

Nutrient load

	Range	(Total) and division average		Range	(Total) and division average
Total nitrogen			**Total phosphorus**		
Total export (t/yr)	185 – 2 332	(12 406)	Total export (t/yr)	14 – 200	(883)
Export rate (kg/ha/yr)	0 – 1.6	0.6	Export rate (kg/ha/yr)	0 – 0.3	0.1
Load: current to pre-European ratio	1.4 – 3.6	2.2	Load: current to pre-European ratio	1.6 – 7.7	2.8
Load: dissolved to total ratio	75 – 98	82	Load: dissolved to total ratio	7 – 71	24
Nitrogen sources and sinks (%)			**Phosphorus sources and sinks (%)**		
From sediments	18 – 64	29	From fine sediments	36 – 90	64
From point sources	0 – 43	2	From point sources	0 – 56	3
Dissolved from diffuse sources	39 – 96	69	Dissolved from diffuse sources	13 – 82	34
Deposited on floodplains	7 – 41	16	Deposited on floodplains	19 – 86	43
Deposited in reservoirs	0 – 8	1	Deposited in reservoirs	0 – 27	2
Denitrified	6 – 33	16	Delivered to estuary	37 – 93	57
Delivered to estuary	43 – 93	67			

Nutrient source and transport

Assessments estimate an average 2.2 times increase in river basin nitrogen load and 2.8 times increase in phosphorus.

In the sandy soil landscapes movement of nutrients to lower catchment rivers and estuaries involves nutrient leaching to groundwater and discharge to surface waters.

- Up to 69% of basin nitrogen load and 34% of basin phosphorus load is derived and transported in dissolved forms.

Water-borne soil erosion is an important way that diffuse nutrient sources are transported—carrying on average 64% of river basin phosphorus load. With a high fraction of river basin nutrient load being carried in dissolved form, a large proportion is delivered to estuaries, 67% of nitrogen load and 57% of phosphorus load.

Measured surface water quality exceedances for phosphorus and nitrogen are observed for most river basins where monitoring coverage is available.

Nutrient balance

Positive landscape phosphorus and nitrogen balances are extensive across areas of agricultural land use.

Positive landscape nitrogen balances of up to 250 times occur in agricultural areas along the south-west coast (Murray, Harvey, Busselton Coast, lower Blackwood and lower Kent). Larger areas with increases of 50 to 100 times occur on the Albany Coast, Swan Coast and Moore – Hill river basins. The most extensive areas have 10 to 50 times increases and occur throughout the wheat belt and Esperance coast agricultural areas.

Extensive though more moderate 2–5 fold positive landscape phosphorus balances occur throughout much of the wheat belt, Albany and Esperance Coast basins. Larger (5 to 20 times) positive landscape phosphorus balances occur in lower south-west coastal basins where more intensive land uses, including irrigated agriculture, occur.

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Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			19	Number of groundwater management areas			97
	Development category: diversion as a percentage of sustainable flow regime (%)	Number	%		Development category: abstraction as a percentage of sustainable yield (%)	Number	%
1.	< 30	14	74	1.	< 30	49	51
2.	30 – 70	5	26	2.	30 – 70	16	16
3.	70 – 100	0	0	3.	70 – 100	30	31
4.	> 100	0	0	4.	> 100	2	2

Surface water

Surface water management areas are well managed and are not highly committed. All have development commitment levels of less than 70% of sustainable yield.

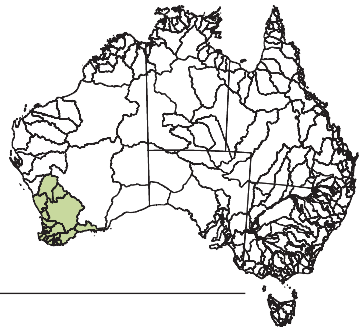
- West Coast river basins from the Swan Coast south to the Collie have between 30 and 70% of their sustainable yield committed.
- Most other basins in the division have less than 30% committed.

Groundwater

Groundwater commitment levels are relatively high.

- A third (33%) of groundwater management units have been developed to abstraction levels greater than 70% of sustainable yield, particularly along the west coast (Perth Groundwater Province). Within this area the development status for most groundwater management units is between 70 – 100% of their sustainable yield with two in the Collie and Murray River basins committed beyond a 100% of their sustainable yield.

In the sedimentary aquifers of the division stream base flows and wetland hydrology (including estuaries) are often driven by groundwater.



Water balance/dryland salinity

The division contains the greatest extent of dryland salinity in Australia and has the greatest risk of increasing salinity over the next 50 years.

- High dryland salinity risk areas are extensive across the wheat belt.
- Areas affected also include the coastal lowlands of the Esperance Coast Basin and from Albany to beyond Perth.

Increasing dryland salinity is a major driver of ecosystem condition decline and is causing degradation of remnant terrestrial and wetland habitats and surface water quality.

- Between 10% and 30% of remnant native vegetation throughout most of the division is predicted to be within areas of high salinity risk by 2050.

Given the already highly fragmented nature of native habitat this is likely to lead to regional extinctions of endemic biota.

Shallow watertables associated with the formation of dryland salinity are also having indirect effects on water quality through changed catchment hydrology associated with soil waterlogging. Western Australian Water and Rivers Commission investigations (Ruprecht & Schofield 1991) have determined that the more rapid hydrological response of rainfall run-off from catchments with shallow water tables results in a greater capacity to transport sediments and nutrient. This contributes to the water quality impacts observed for riverine and estuarine ecosystems within the division.

Weeds and feral animals

Areas identified as most stressed by weeds included the Perth, Southern Jarrah Forests and Warren subregions, while incidence and density of feral animals are most significant in the Perth, Esperance Plains and Avon Wheat Belt subregions.

Weed species include bridal creeper and blackberry. Several (e.g. willows, gorse, olives and lantana) have substantial potential to expand their distribution.

Abundant feral animals include:

- major predators of native wildlife (cats, foxes); and
- grazers and disturbers of native vegetation (rabbits, goats, pigs).

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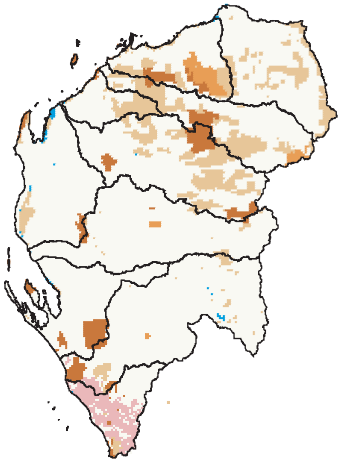
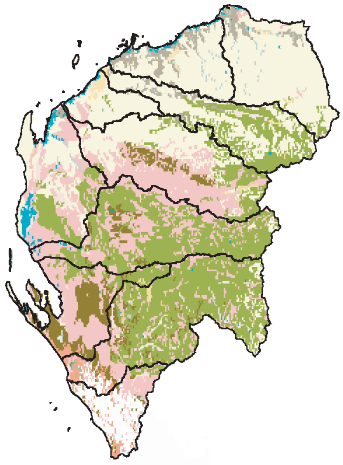
INTEGRATED FINDINGS: Indian Ocean Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Acacia forests and woodlands
- Casuarina forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

INDIAN OCEAN DRAINAGE DIVISION

Total area	522 086 km^2
Number of basins	10
Basin areas	17 805 – 91 229 km^2
Estuary types	wave-dominated estuaries and deltas south of the Onslow Coast basin tide-dominated creeks, deltas and estuaries north of the Onslow Coast basin
Rainfall	224 – 369 mm/yr
Evaporation	213 – 307 mm/yr
Run-off	11 – 61 mm/yr
Net primary productivity	0.2 – 1.6 tC/ha/yr
Climate types	subtropical in the south west hot arid in the south east and the north hot desert in the centre

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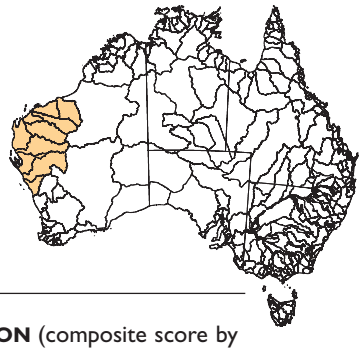
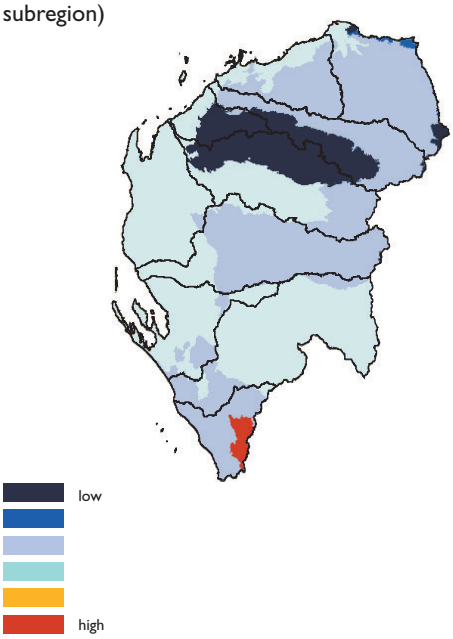
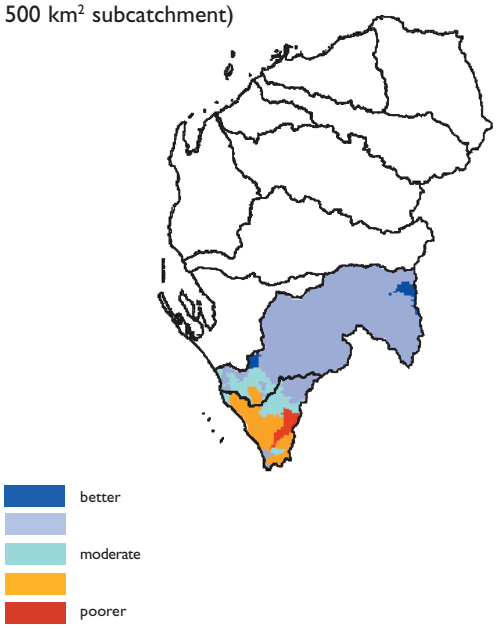


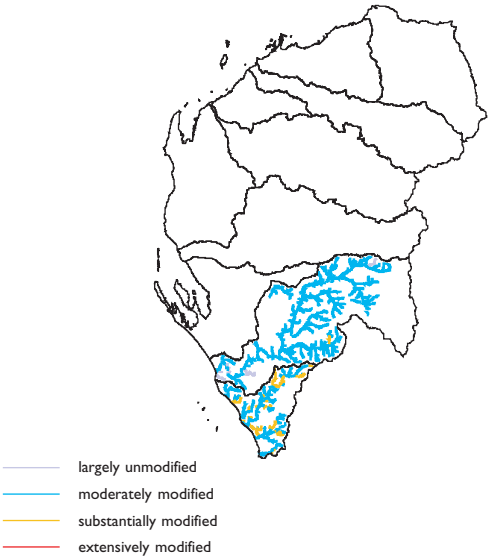
LANDSCAPE STRESS (composite index by subregion)



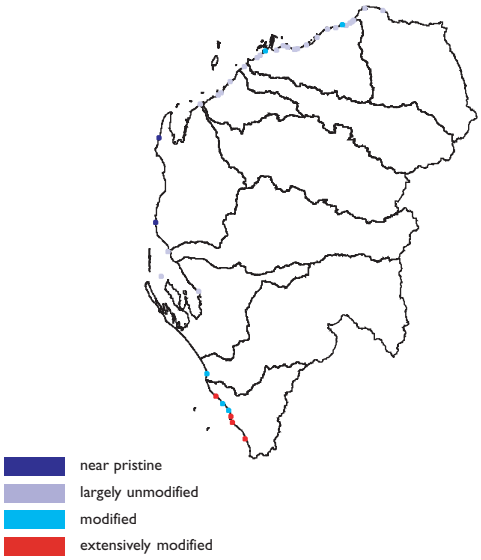
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)



ESTUARY CONDITION (condition for each estuary)



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Patterns of ecosystem condition

- The poorest ecosystem condition occurs in the south within the central Greenough River Basin. This basin has more intensive land use and higher landscape stress, poorer catchment condition, modified river reaches and extensively modified estuaries.
- Medium landscape stress also occurs in more extensive use areas within coastal subregions of the Carnarvon and Pilbara Bioregions and more inland subregions within the Murchison Bioregion. These include the upper Murchison, Wooramel, lower Gascoyne, Lyndon – Minilya, and lower Onslow Coast, Port headland coast and De Grey River basins.
- The Hamersley subregion has low landscape stress. This subregion covers the upper Ashburton, Onslow Coast and Fortescue River basins.

There are few estuaries due to the arid nature of the division and limited freshwater run-off. Estuaries are concentrated in the south (wave-dominated) and north west (tidal creeks).

- Estuary condition in the southern basins is extensively modified to modified reflecting the more intensive use and poorer condition of adjoining catchments.
- Most estuaries in the north-west are largely unmodified, some with more intensive uses (e.g. ports, salt farms) are modified.

Key ecosystem condition drivers

Climate

- Seasonal or persistent aridity results in low vegetation cover and greater potential for impacts on natural ecosystems from inappropriate fire regimes and wind- or water-borne soil erosion.
- Many aquatic and terrestrial biota depend on refuge areas for survival during seasonally arid periods.
- Low rainfall results in seasonal and low net primary productivity. Native vegetation has a limited growing season tightly coupled to availability of moisture. These ecosystems are susceptible to grazing pressure and inappropriate burning that can lead to long-term downward trends in vegetation productivity and soil organic carbon content.
- Low and seasonal rainfall results in intermittent river systems with limited capacity to transport sediments and nutrients.

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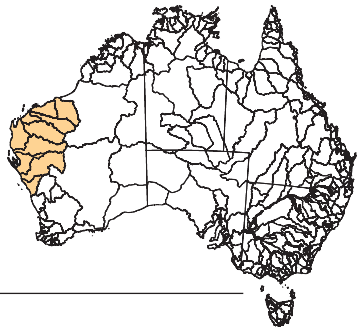

Landscape, topography and soils

Topography

- Dissected plateaus (Pilbara and Gascoyne in the north and central east), aeolian landforms including coastal and inland dunes (western margin and plains) and depositional floodplains (south and surrounding dissected areas), low relief coastal hills and plateaus (Greenough River Basin in the south west).
- Generally flat landscapes ensure high infiltration of rainfall, particularly on the sandy and sandy-loam textured soils.
- Surface waters are naturally turbid.

Soils

- Soils (Tenosols) are mainly shallow, formed over igneous bedrock and ancient sedimentary rock including ironstone layers.
- Areas of deeper soils (Sodosols, Kandosols, Hydrosols and Chromosols) have formed on floodplains in the Murchison, lower Wooramel, Gascoyne, Lyndon – Minilya, Onslow Coast and Fortescue river basins.
- Aeolian landforms form areas with no surface drainage (Wooramel River Basin) and areas where drainage is impeded by barriers of sand (Lyndon – Minilya River basins).
- Degradation issues include compaction, hard setting, dispersion, poor water retention, low fertility and proneness to wind and water-borne erosion.
- Soils have a high potential for erosion but rivers have limited sediment transport capacity.

Land use intensity

	Area (km²)	% Area
Nature conservation	24 603	5
Other protected areas and Indigenous	6 777	1
Minimal use	70 489	14
Grazing	404 095	78
Forestry	minimal	–
Dryland agriculture	12 168	2
Irrigated agriculture	minimal	–
Built environment	minimal	–
Water bodies	minimal	–

- *Grazing* (approximately 78% of total area) occurs on native pasture rangelands. Pasture improvement via the sowing and promotion of buffel grass has been extensively practised.
- *Minimal use crown land* (approximately 13.5% of total area), *other conservative uses* including Indigenous (1%) and *nature conservation* (approximately 4.7%) make up approximately 19.2% of total area.
- *Dryland agriculture* (2.3% of total area) is concentrated in the south (lower Murchison and Greenough River basins) and forms the northern limits to the Western Australian wheat belt.
- More intensive and localised land uses including mining, *irrigated agriculture*, salt farming and port development affect very local ecosystem conditions. These uses have not been mapped.

Grazing pressure

- Grazing pressure across the west of the division increased between the 1950s and 1980s. Grazing pressure peaked in the 1980s (2000 – 4000 dse/km²) (western Lyndon – Minilya, Gascoyne and Wooramel). Pressure has since declined with maximum values now of between 1000 and 2000 dse/km².

  Key subregions exposed to grazing pressure impact include Carnegie, Cape Rouge, Hamersley and Yalgoo.

Weeds and feral animals

- Mesquite and parkinsonia are both weeds of savanna woodlands associated with high grazing pressure.
- Goats and rabbits contribute to the already substantial grazing pressure of domestic and native animals.
- Cats and foxes are common and abundant, placing predation pressure on small vertebrates that are also subject to habitat pressures associated with grazing.

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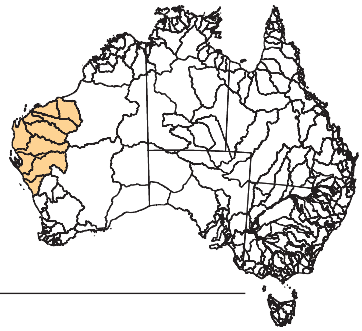

Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	52 208 600	50 402 788	1 805 812	3
Eucalypt woodlands	187 368	187 368		0
Acacia forests and woodlands	15 342 776	15 313 300	29 476	< 1
Casuarina forests and woodlands	34 576	32 088	2 488	7
Eucalypt open woodlands	57 824	19 856	37 968	66
Acacia open woodlands	181 408	181 408		0
Mallee woodlands and shrublands	108 908	14 088	94 820	87
Low closed forests and closed shrublands	118 896	44 572	74 324	63
Acacia shrublands	12 077 312	11 603 616	473 696	4
Other shrublands	2 893 168	2 645 484	247 684	9
Heath	1 450 324	647 860	802 464	55
Tussock grasslands	1 345 788	1 345 220	568	< 1
Hummock grasslands	16 586 220	16 575 112	11 108	< 1
Other grasslands, herblands, sedgelands and rushlands	299 276	299 224	52	< 1
Chenopod shrubs, samphire shrubs and forblands	773 488	762 808	10 680	1
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	629 796	615 136	14 660	2

- Only 3% of the division has been cleared of its native vegetation.
- Significant proportions of some vegetation types have been cleared including eucalypt open woodlands, mallee woodlands and shrublands, low closed forests and shrublands and heath. Broad scale clearing ceased during the 1990s.
- The most significant drivers operating on vegetation cover and condition are grazing pressure, weeds and fire regime. They interact with each other—sustained high total grazing pressure is associated with reduced ground vegetation cover; reduced ground cover can result in lower fire fuel loads, reduced fire frequency and increased woody vegetation can then lead to further impacts on ground vegetation cover.
- Fire regime is particularly important. Burning to remove senescent grass and promote new pasture growth can also result in reduced recruitment of woody vegetation and a subsequent decrease in density of woodland trees. This occurs when burns are conducted during hot, dry conditions or too often for woody plant species to regenerate. Buffel grass can accelerate this process by producing high fuel loads increasing fire intensity so that the extent and condition of fire-sensitive vegetation communities including native grass species and associated biota are impacted.

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Nutrient and sediment loading (Greenough and Murchison river basins)

Only two river basins within the southern Indian Ocean Drainage Division (Murchison and Greenough) were included in the Audit's assessment of sediment and nutrient loads. Although these basins are not typical of the division as a whole due to climatic, geographic and land use distinctions, they provide useful insight to sediment and nutrient load drivers within the division's basins can be found.

Water-borne soil erosion	Greenough basin value	Murchison basin value
Current to pre-settlement sediment supply	91	9
Sediment supply (t/ha/yr)	0.4	0.3
Total sediment supplied to streams (t/yr)	724 210	1 502 684
% supplied by hillslope erosion	6	25
% supplied by gully erosion	76	54
% supplied by bank erosion	18	21
Total sediment exported to coast (t/yr)	116 012	21 096
Erosion per hectare exported to the coast (t/ha/yr)	0.06	0.004
Delivery ratio	0.16	0.01
Percentage of stream length > 30 cm sediment deposition	0.45	0.14

Nutrient loading

Total nitrogen	Greenough	Murchison	Total phosphorus	Greenough	Murchison
Total export (t/yr)	1 132	169	Total export (t/yr)	96	19
Export rate (kg/ha/yr)	0.44	0.02	Export rate (kg/ha/yr)	0.04	0.002
Load: current to pre-European ratio	3.1	2.7	Load: current to pre-European ratio	5.3	7.2
Load: dissolved to total ratio	69	51	Load: dissolved to total ratio	4	4
Nitrogen sources and sinks (%)			**Phosphorus sources and sinks (%)**		
From sediments	36	70	From fine sediments	77	92
From point sources	0	0	From point sources	0	0
Dissolved from diffuse sources	64	30	Dissolved from diffuse sources	23	8
Deposited on floodplains	26	68	Deposited on floodplains	58	95
Deposited in reservoirs	0	0	Deposited in reservoirs	0	0
Denitrified	23	24	Delivered to estuary	42	5
Delivered to estuary	51	8			

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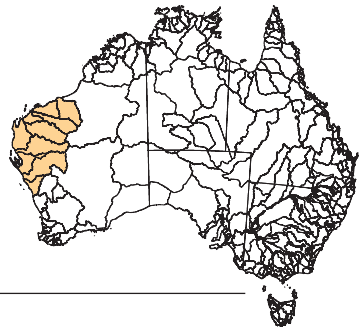

Greenough Basin

- dominated by grazing (50%) and dryland agriculture (43%).
- dryland agriculture on susceptible soils and topography has resulted in two orders of magnitude increases in low background soil erosion rates.
- gully erosion is the dominant source of sediment supply.
- greater proportion of dissolved nitrogen load is sourced from diffuse sources.
- fine sediment is the most significant source of phosphorus.
- higher gradient stream with less developed floodplain that delivers more of its sediment and nutrient load to the estuary than the Murchison.

Murchison Basin

- dominated by grazing (89%) with limited dryland agriculture (1.6%).
- grazing on susceptible soils in semi-arid climate has resulted in an order of magnitude increase in medium background soil erosion rates.
- lower gradient stream with developed floodplain that delivers little of its sediment and nutrient load to the estuary.
- hill and bank erosion in addition to gully erosion are significant sources of sediment.
- fine sediment most significant source of phosphorus and nitrogen.

Water use and hydrology

Surface water

Number of surface water management areas			10
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%
1.	< 30	9	90
2.	30 – 70	1	10
3.	70 – 100	0	0
4.	> 100	0	0

Groundwater

Number of groundwater management areas			32
Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	21	65
2.	30 – 70	5	16
3.	70 – 100	6	19
4.	> 100	0	

Surface water

Surface water use is low.

- Only one surface water management area has a development category beyond 30% of sustainable yield.

Groundwater

Groundwater resources within the division are substantially developed.

- 19% of groundwater management areas have 70 – 100% of sustainable yield developed.

Groundwater resources have been developed to supply settlements, mining, agriculture and pastoral development.

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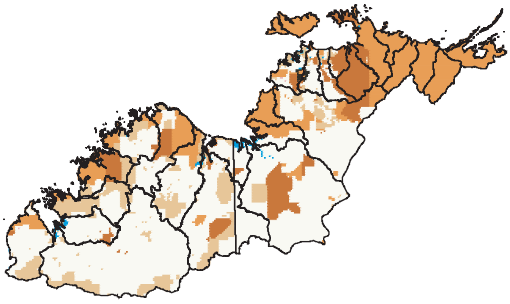
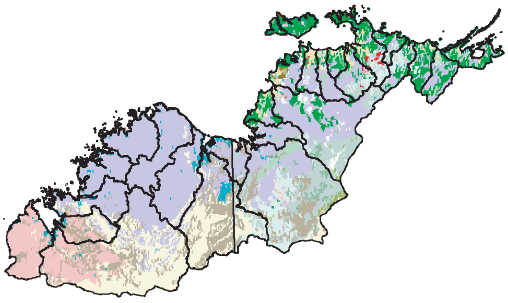
INTEGRATED FINDINGS: Timor Sea Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Rainforest and vine thickets
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Tropical eucalypt woodlands/grasslands
- Other shrublands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

TIMOR SEA DRAINAGE DIVISION

Total area	564 647 km^2
Number of basins	26
Basin area	4 814 – 93 829 km^2
Estuary types	tide dominated estuaries and deltas
Rainfall	606 – 1 705 mm/yr
Evaporation	507 – 856 mm/yr
Run-off	99 – 850 mm/yr
Net primary productivity	0.5 – 1.4 tC/ha/yr
Climate types	equatorial savanna across the Tiwi Islands, Coburg Peninsula and the Darwin hinterland tropical savanna across the eastern river basins and inland to mid basin for central and north western basins hot grassland with winter drought covers south-western and inland central basin areas

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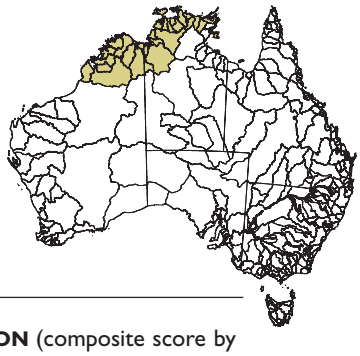
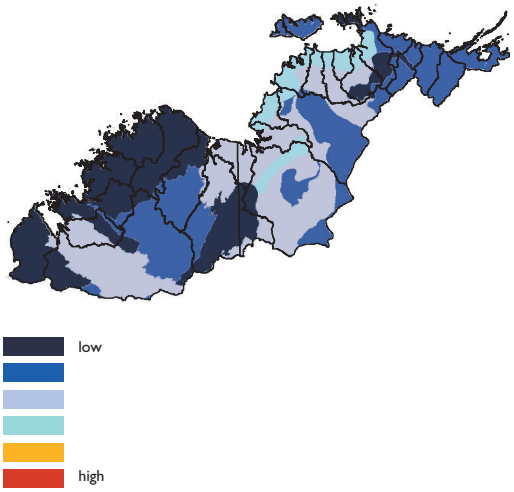
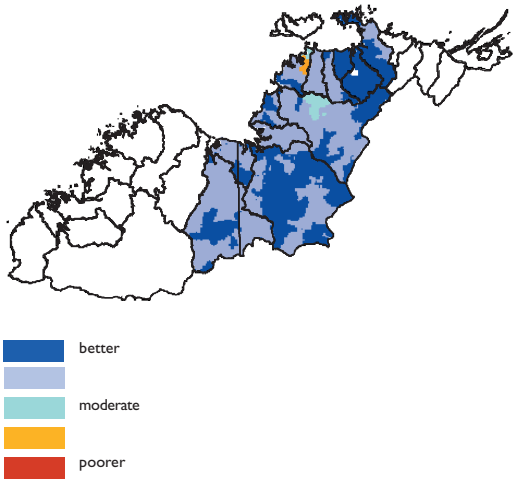


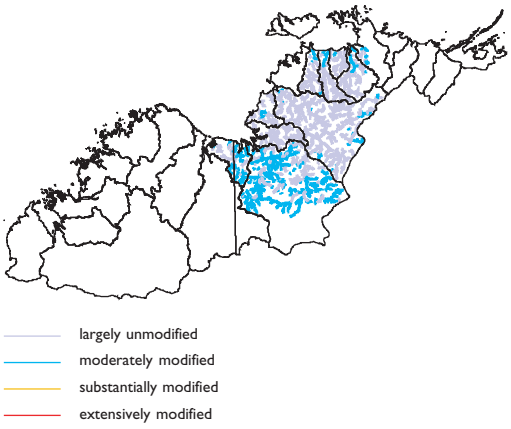
LANDSCAPE STRESS (composite index by subregion)



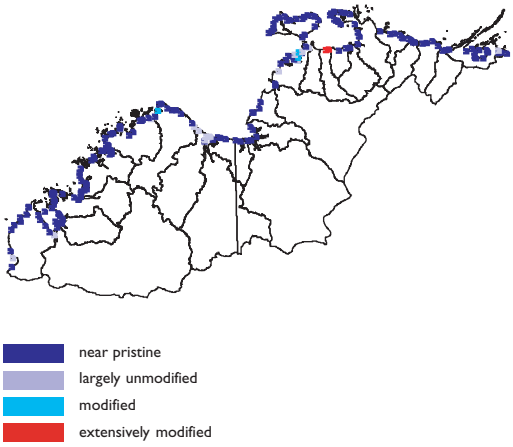
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)



ESTUARY CONDITION (condition for each estuary)



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Patterns of ecosystem condition

River and catchment assessments included river basins that contain areas of intensive land use—the East Alligator River west to the Ord River basin. Landscape health and estuary condition assessments covered all river basins.

- Subregional landscapes showing higher landscape stress include the Darwin Coastal subregion (extending across the coastal plain between the East Alligator and Victoria river basins) and the Victoria Bonaparte-3 Subregion (spanning the lower Victoria river basin).
- The least stressed subregions occur in the east (Arnhem Plateau, Arnhem Coast, Tiwi–Coburg and Daly) and west (Ord, Hart, Pentecost, Berkeley, Mitchell and Pindenland subregions), covering most western river basins except for the lower Fitzroy.
- Only two localised areas (built environments and cleared areas associated with more intensive land uses) have catchments of intermediate to poorer relative condition. These include the coastal area of the Finniss River basin associated with Darwin and its relatively developed hinterland and areas of cleared grazing land in the central northern Daly river basin.

The majority of river reaches are largely unmodified.

- Areas of moderately modified river reach condition include lower near-coastal reaches of the East Alligator, South Alligator, Wildman, Mary, Adelaide and Daly, Moyle, Victoria and Keep river basins and the mid-basin area of the Victoria River basin.

Most estuaries within the drainage division are in a near-pristine condition.

- Two extensively modified estuaries occur in the Mary River Basin. This is the result of natural processes and buffalo changing tidal and freshwater regimes.
- Modified estuaries occur in the Finniss and Drysdale river basins.
- Estuaries in the Adelaide, Finniss, Victoria, Ord, Pentecost, King Edward, Cape Leveque river basins are moderately modified. Most of these basins have higher landscape stress and modified river reaches.

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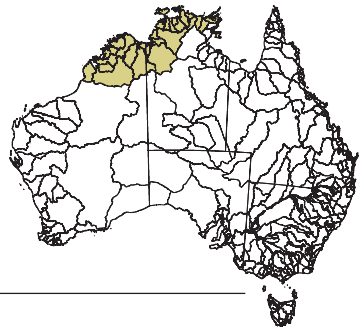

Key ecosystem condition drivers

Climate

Rainfall is highly seasonal and is often associated with monsoonal troughs and cyclonic rain depressions.

Temperature

- High summer temperatures affect water quality (low dissolved oxygen) and biochemical activity (decomposition of organic matter), and place many organisms under thermal stress.

Rainfall

- Intense summer rainfall events create naturally high soil erosion rates and a high potential for accelerated soil erosion. Seasonal rainfall also produces peaked river flow events that have a large sediment and nutrient load transport capacity.
- Low and seasonal rainfall results in large areas of seasonally arid landscapes with low vegetation cover. This can result in naturally high erosion potential and an increased susceptibility to land use associated soil erosion and fire regimes.
- Highly seasonal and variable (intermittent to perennial) natural flow patterns for many of the division's river basins result in a wide range of water quality conditions and increased potential for poor water quality during low flow.

Landscape, topography and soils

- Large river systems (Ord, Victoria, Daly and Fitzroy) have relatively low gradients, predominantly drain expansive savanna woodland plains and form extensive floodplain and coastal wetland complexes.
- Areas of more dissected topography (Kimberley in the south west and Arnhem land in the north east) have short river basins with high gradients.
- Northern rivers basins drain to coastal floodplain and wetland complexes; rivers of the Kimberley drain to a dissected coastal landscape with an extensive archipelago of coastal islands.
- Relatively shallow seas result in low wave energy and large tidal ranges.
- Extensive areas of highly productive seasonal coastal wetlands support important prawn and finfish fisheries.

Soils

- Major soil types (Rudosols, Tenosols, Ferrosols, Kandosols and Hydrosols) have low reserves of organic matter and fertility, have poor water retention, and are prone to acidification, hard setting, crusting and water erosion.

Land use intensity

	Area (km²)	% Area
Nature conservation	57 385	10
Other protected areas and Indigenous	116 496	21
Minimal use	74 622	13
Grazing	307 888	55
Forestry	minimal	–
Dryland agriculture	minimal	–
Irrigated agriculture	minimal	–
Built environment	minimal	–
Water bodies	4 429	< 1

The Timor Sea Drainage Division is one of Australia's least intensively developed and is characterised by landscapes that retain most of their natural ecosystem integrity.

- *Grazing* (50% of total area; more than 80% of some basins e.g. Fitzroy and Lennard) takes place on native pasture rangelands in inland areas in the south. Some pasture improvement (limited tree clearing and sowing of exotic pasture) has occurred on more productive soils and floodplains.
- *Indigenous use* (20% of total area) includes most basins and islands in the north east and a significant proportion of most other basins.
- Isolated areas of more intensive land uses including settlement, *forestry* and pastoral development also occur in *Indigenous use* areas.
- *Minimal use crown land* takes up approximately 13% of total area.
- *Nature conservation* (10% of total area) includes some large individual reserves (e.g. Kakadu occupying 91% of the South Alligator River Basin). River basins with more than 20% of area occupied by nature conservation land use include the Wildman, Prince Reagent, Mary, and East Alligator.
- Intensive land use such as *built environment*, *dryland* and *irrigated agriculture* (less than 0.5% of total area) occur as nodes of development (e.g. Darwin in the Finniss River Basin, Ord River Scheme Irrigation Area). Other basins containing dryland or irrigated agricultural development include the Daly, Mary, Cape Leveque Coast, Adelaide, King Edward and Fitzroy.
- *Forestry* (0.6% of total area) is limited to the Bathurst – Melville islands.

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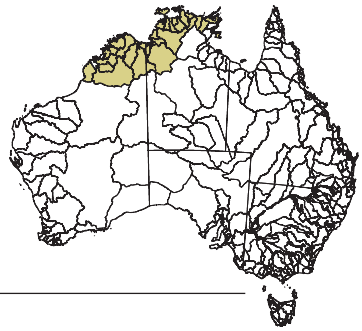

Grazing pressure

Grazing pressure within the western portion of the division peaked during the 1970s with grazing pressure of up to 10 000 – 40 000 dse/km^2 for statistical local areas covering the southern Fitzroy and Ord river basins. Grazing pressure since then has declined in the west but has continued to increase in the east to maximum values of 4000 – 10 000 dse/km^2 in the Finniss River Basin.

Key subregions exposed to grazing pressure impact include the Darwin Coastal Plain and Victoria Bonaparte P3.

Weeds and feral animals

Weeds and feral animals have very significant impacts on ecosystem condition and biodiversity.

- Salvinia, para grass and mimosa are significant weeds of wetland and floodplain habitats and can lead to the exclusion of native wetland vegetation.
- Prickly acacia, mesquite and parkinsonia are weeds of savanna woodlands often associated with high grazing pressure.
- Rubber vine infestation leads to devastation of native riparian vegetation communities and increases in river bank erosion.
- Horses, pigs and buffalo contribute to grazing pressures. Swamp buffalo and pigs are particularly implicated in impacts to riparian and wetland habitats and biota.
- Cats are a common feral predator and a source of predation pressure for ground nesting birds and other small vertebrates typical of the division's grasslands and open woodland ecosystems.
- The ongoing spread of cane toads through the division has been associated with declines of native vertebrate species particularly frog-eating predators.

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Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	56 464 700	55 968 576	496 124	< 1
Rainforest and vine thickets	93 424	93 136	288	< 1
Eucalypt open forests	4 948 508	4 878 336	70 172	1
Eucalypt low open forests	7 044	7 044		0
Eucalypt woodlands	4 309 652	4 229 568	80 084	2
Acacia forests and woodlands	168 948	161 128	7 820	5
Melaleuca forests and woodlands	1 212 588	1 197 132	15 456	1
Other forests and woodlands	427 808	427 808		0
Eucalypt open woodlands	3 007 708	3 004 192	3 516	< 1
Tropical eucalypt woodlands/grasslands	21 854 412	21 637 000	217 412	1
Acacia shrublands	4 547 968	4 543 984	3 984	< 1
Other shrublands	90 020	72 064	17 956	20
Heath	5 384	5 344	40	< 1
Tussock grasslands	5 642 240	5 620 356	21 884	< 1
Hummock grasslands	7 724 816	7 716 880	7 936	< 1
Other grasslands, herblands, sedgelands and rushlands	749 540	746 260	3 280	< 1
Chenopod shrubs, samphire shrubs and forblands	421 620	421 200	420	< 1
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	953 600	930 616	22 984	2

- Only limited areas of the division have been cleared (< 1%) or are used for intensive land uses.
- Tree clearing has occurred mainly in eucalypt woodlands and open forests.
- Native vegetation cover and condition has been more extensively affected by grazing pressure, altered fire regimes and weeds all of which interact with each other.
- Sustained grazing pressure is associated directly and indirectly with reduced ground vegetation cover. Reduced vegetation cover can result in lower fire fuel loads, reduced fire frequency and increase in woody vegetation. Where grazing pressure is less intense, annual, late, dry season burning can reduce woody vegetation and density of savanna woodland tree cover.
- An increased incidence of introduced grass species and an increasing intensity and frequency of fires is observed in some areas. Mission grass, gamba grass and buffel grass are introduced pasture species that are capable of dominating the ground layer and altering the fire ecology and ultimately the vegetation structure. In areas of change in fire regime, the extent and condition of fire-sensitive vegetation communities (i.e. deciduous vine thickets) and associated biota can be extensively impacted. Impacts from changes to vegetation cover are realised through changes to habitat availability, primary productivity and increased soil erosion.

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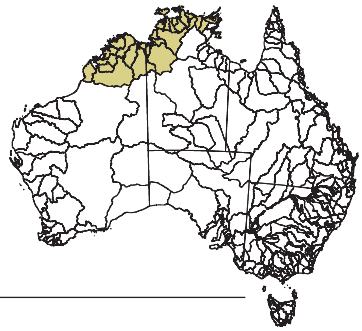

Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			28	Number of groundwater management areas			36
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%	Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	27	96	1.	< 30	30	83
2.	30 – 70	1	4	2.	30 – 70	5	14
3.	70 –100	0		3.	70 – 100	1	3
4.	> 100	0		4.	> 100	0	

Surface water

Surface water use levels within the division are very low.

- One relatively small catchment (Finniss) is impounded for Darwin's domestic water supply and is the only surface water management unit with more than a 30% of sustainable yield development category.

Groundwater

Groundwater resource abstraction rates are also low.

- Only one groundwater management unit has greater than a 70% of sustainable yield development category.

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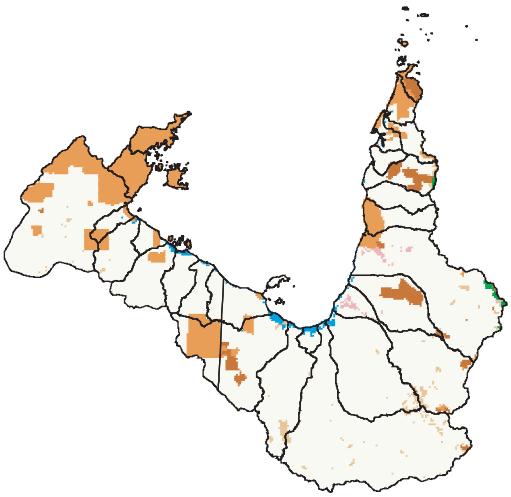
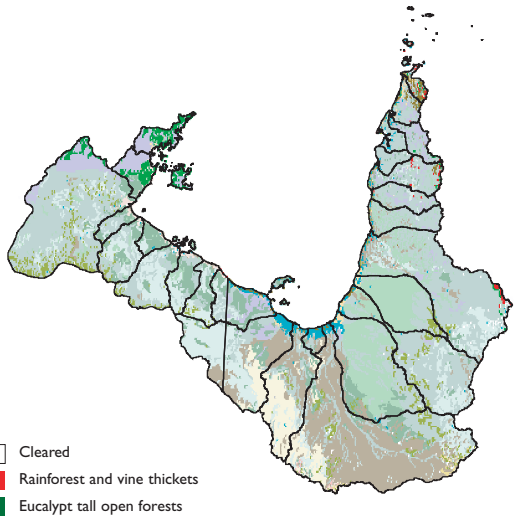
INTEGRATED FINDINGS: Gulf of Carpentaria Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

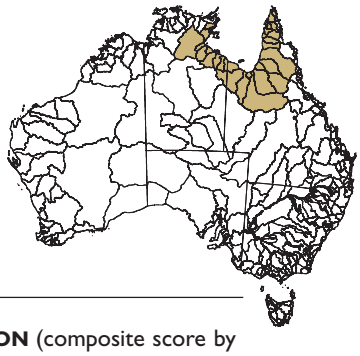
MAJOR VEGETATION GROUPS



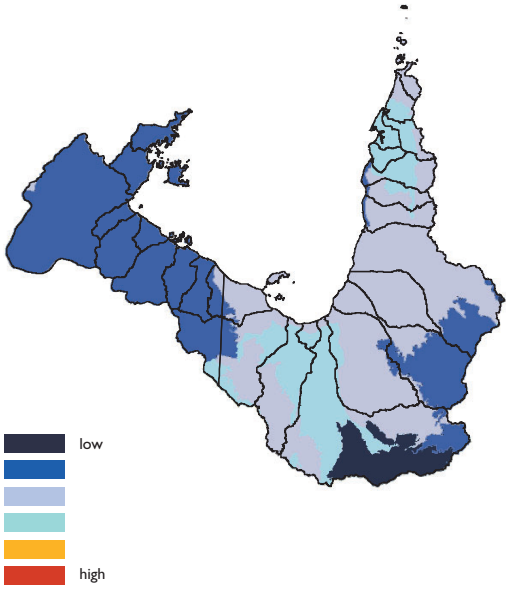
- Cleared
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Tropical eucalypt woodlands/grasslands
- Other shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

GULF OF CARPENTARIA DRAINAGE DIVISION

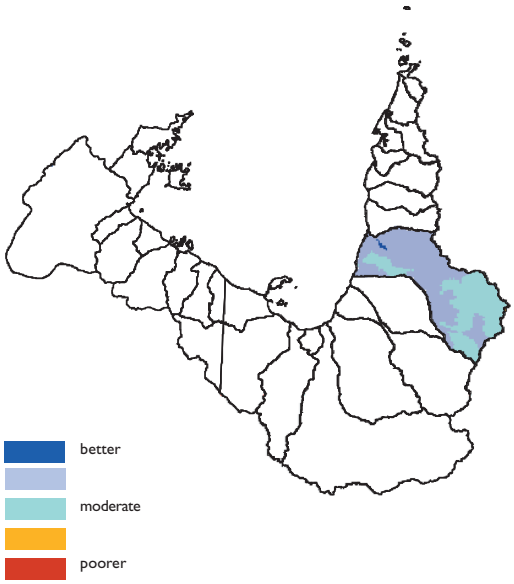
Total area	642 400 km^2
Number of basins	29
Basin areas	566 – 109 728 km^2
Estuary types	tide-dominated estuaries and deltas
Rainfall	566 – 1 803 mm/yr
Evaporation	438 – 786 mm/yr
Run-off	30 – 1 017 mm/yr
Net primary productivity	0.5 – 3.5 tC/ha/yr
Climate types	equatorial savanna across the northern tip of Cape York tropical savanna across the eastern Gulf , the coastal western Gulf and eastern Arnhem Land hot grassland with a winter drought covers more inland and southern areas



LANDSCAPE STRESS (composite index by subregion)

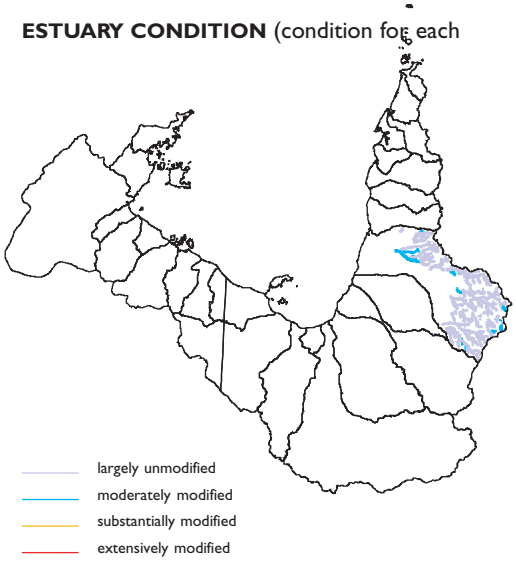


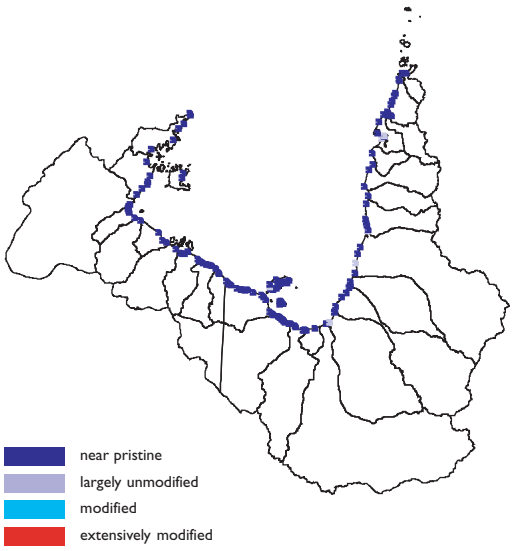
CATCHMENT CONDITION (composite score by 500 km^2 subcatchment)



RIVER CONDITION (environment index by reach)

ESTUARY CONDITION (condition for each estuary)





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Patterns of ecosystem condition

Only one river basin (Mitchell) was included in the catchment and river condition assessments. Most ecosystem condition information for this division is drawn from the landscape health and estuary condition assessments. Land use and vegetation mapping also provide important contextual information.

- Landscapes with low stress especially in the western half of the division (Gulf Coastal and Arnhem Coast subregions) reflect low population density and low intensity land uses.
- Eastern areas have landscapes with higher stress associated with greater land use, weeds and feral animal pressures. These include the southern Gulf Plains subregions (Nicholson, Leichhardt, Morning Inlet, and Flinders river basins) and Weipa Plateau subregion in north western Cape York (Archer, Watson, Embley, Wenlock and Ducie river basins.)
- Tidally-dominated estuary systems predominate. Their condition is near pristine throughout most of the division. Some estuaries with more intensive uses such as ports, are classed as largely unmodified.

Key ecosystem condition drivers

Climate

Temperature

- High summer temperatures affect water quality (low dissolved oxygen) and biochemical activity (decomposition of organic matter), and place many organisms under thermal stresses.

Rainfall

- Low and seasonal rainfall results in large areas of seasonally arid landscapes in which the potential for wildfire may be high and vegetation cover may be low. This can result in naturally high erosion potential.
- Many aquatic and terrestrial biota depend on refuge areas for survival during seasonally arid periods.
- Potentially intense summer rainfall creates naturally high soil erosion potential and peaked river flows that are capable of transporting large loads of sediment and nutrients.
- Highly seasonal and variable (intermittent to perennial) natural flow patterns for many river basins result in a wide range of water quality conditions and increased susceptibility to water quality impacts during low flow.

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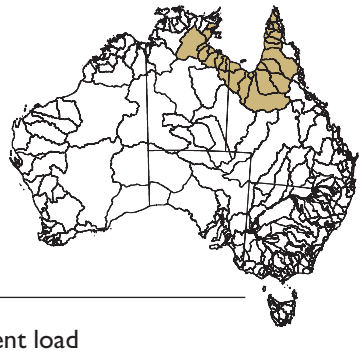


Landscape, topography and soils

Topography

- Relatively limited relief and drained by large, low gradient seasonal rivers. These drain to extensive coastal mangrove – saltpan wetland complexes and in some cases (eastern Gulf) form extensive floodplain wetland systems.
- The shallow nature of the Gulf of Carpentaria limits wave energy within the coastal zone and results in large tidal ranges.
- Naturally turbid surface waters.
- Extensive areas of highly productive seasonal coastal wetlands.

Soils

- Dominant soils (Kandosols, Vertisols, Rudosols, Tenosols, Hydrosols and Sodosols in floodplain and coastal wetland areas) are susceptible to compaction, hard setting, dispersion, poor water retention and low fertility.

Erosion rate and sediment load

The Audit assessments of current soil erosion rates and basin sediment loads did not include the Gulf of Carpentaria Drainage Division.

Nevertheless, it is well known that seasonally arid landscapes with tropical monsoonal climates have naturally high levels of soil erosion and high sediment loads. The Audit's assessments of river basin sediment loads under pre-settlement conditions confirm this. The Gulf of Carpentaria has some of the highest predicted mean annual erosion rates for any drainage division in Australia.

Land use intensity

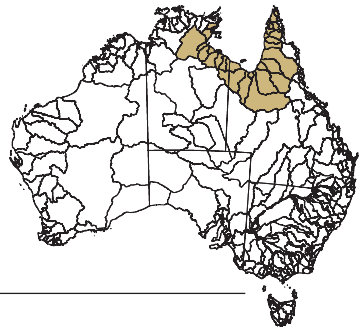
	Area (km²)	% Area
Nature conservation	16 460	3
Other protected areas and Indigenous	79 460	12
Minimal use	14 220	2
Grazing	519 840	81
Forestry	minimal	–
Dryland agriculture	minimal	–
Irrigated agriculture	minimal	–
Built environment	minimal	–
Water bodies	6 780	1

- *Grazing* (81% of total area and the second most extensively grazed division in Australia) is mainly for cattle production using unimproved native pasture rangelands including the very productive Mitchell grass downs. There is some improved pasture (involving tree clearing and sowing of exotic species) in the south and east.
- Extensive coastal wetlands and shallow coastal waters support major commercial prawn and finfish fisheries.
- Mining, tourism and recreational fishing are significant industries and land uses.
- Indigenous people make up a large percentage of the population and *Indigenous* use is the second most dominant land use (12% of total area).
- *Nature conservation* (2.6%) is the lowest percentage of total area of all drainage divisions. Four river basins (Archer, Jardine, Nicholson and Staaten) contain more than 5% nature conservation land use. Eighteen river basins (62%) contain no nature conservation land use.

Grazing pressure

Information collected by the Audit Rangelands Theme indicate that grazing pressure within the division peaked during the 1970s with grazing pressure of up to 4000 – 10 000 dse/km² for statistical local areas. This grazing pressure has been maintained to the present for some statistical local areas.

Key areas of high grazing pressure include subregions within the south of the division.



Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	64 240 000	64 042 844	197 156	< 1
Rainforest and vine thickets	187 200	185 176	2 024	1
Eucalypt open forests	1 039 496	1 029 700	9 796	< 1
Eucalypt woodlands	23 372 916	23 284 428	88 488	< 1
Acacia forests and woodlands	2 035 800	2 018 172	17 628	< 1
Callitris forests and woodlands	188	188		0
Casuarina forests and woodlands	492	492		0
Melaleuca forests and woodlands	6 643 300	6 638 228	5 072	< 1
Other forests and woodlands	5 024 160	5 016 836	7 324	< 1
Eucalypt open woodlands	8 643 784	8 634 016	9 768	< 1
Tropical eucalypt woodlands/grasslands	3 124 972	3 124 176	796	< 1
Acacia open woodlands	102 772	98 828	3 944	4
Acacia shrublands	43 192	41 664	1 528	4
Other shrublands	317 600	314 784	2 816	< 1
Heath	12		12	100
Tussock grasslands	9 303 060	9 290 824	12 236	< 1
Hummock grasslands	2 811 920	2 804 236	7 684	< 1
Other grasslands, herblands, sedgelands and rushlands	243 840	242 780	1 060	< 1
Chenopod shrubs, samphire shrubs and forblands	322 816	322 804	12	< 1
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	954 156	940 008	14 148	1

- Only limited areas of the division have been cleared (< 1%) or used for intensive land uses. Native vegetation cover and condition is mainly affected by grazing pressure and fire regime both of which interact with each other.
- Weeds significantly influence native vegetation condition and interact with fire and grazing pressure.
- Buffel grass, a pasture species, is changing composition of native grasslands and increasing fire intensity.
- Sustained grazing pressure is both directly and indirectly associated with reduced ground vegetation cover. Reduced ground cover results in lower fuel loads, reduced fire frequency and increased numbers of woody weeds to the further detriment of ground vegetation cover. Where grazing pressure has been less intense or better managed, late, dry season burning can result in reduced recruitment of woody vegetation and a decreased density of savanna woodland tree cover.
- Principle impacts of change to vegetation cover are changes to habitat and increased soil erosion.

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Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			32	Number of groundwater management areas			11
	Development category: diversion as a percentage of sustainable flow regime (%)	Number	%		Development category: abstraction as a percentage of sustainable yield (%)	Number	%
1.	< 30	30	94	1.	< 30	4	37
2.	30 – 70	2	6	2.	30 – 70	3	27
3.	70 – 100			3.	70 – 100	1	9
4.	> 100			4.	> 100	3	27

Surface water

Surface water use levels are very low. Small catchments impounded for domestic supplies on the major Torres Straight Islands are the only surface water management units with any significant use.

Groundwater

- 27% of groundwater management units are used beyond a 100% of sustainable yield. Much of this use is associated with bores accessing the Great Artesian Basin.
- Reduced groundwater pressure has led to reductions in the number of naturally flowing thermal springs.

Weeds and feral animals

Many exotic weed and feral animals occur in the drainage division. Some have very significant ecosystem and biodiversity impacts.

- Prickly acacia and parthenium dominate shrub and ground layers to the exclusion of native vegetation in areas of major infestation. Their range is expanding.
- Rubber vine infestation has led to devastation of native riparian vegetation communities and increases in river bank erosion in the south east. Biological controls are showing some promise for limiting its impact.
- Horses, pigs and buffalo contribute to grazing pressure. Pigs are particularly implicated in impacts to riparian and the extensive wetland habitats and biota of the Gulf.
- Cats are a common feral predator while foxes are more localised. Both predate ground-nesting birds and other small vertebrates of grasslands and open woodlands.
- The spread of cane toads during the 1980s was associated with major declines of native vertebrate species particularly frog-eating predators.

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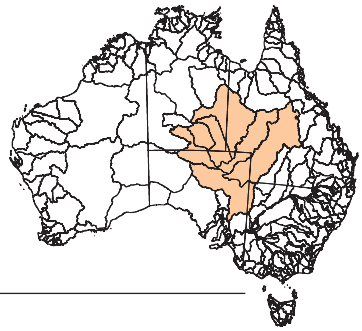
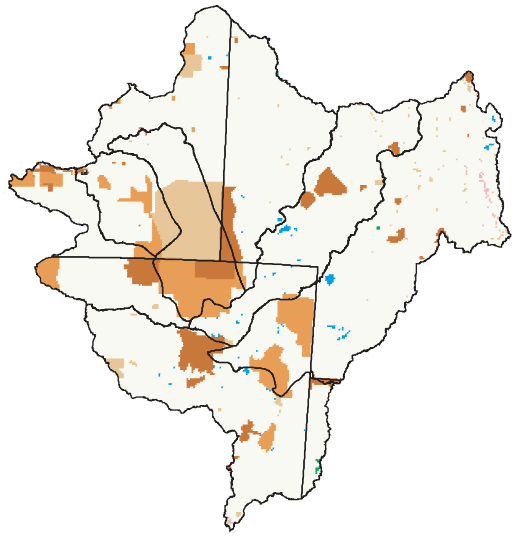


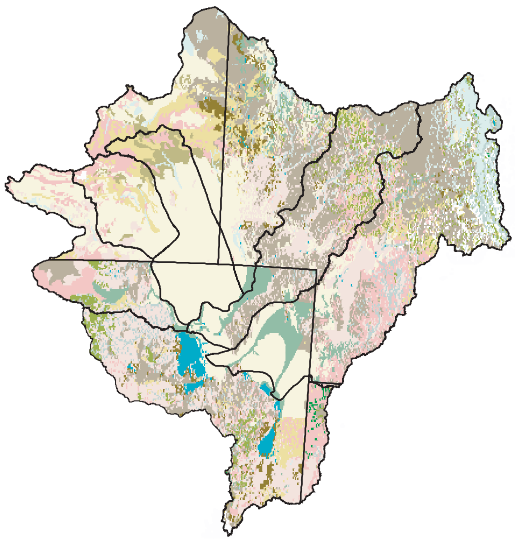
INTEGRATED FINDINGS: Lake Eyre Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS

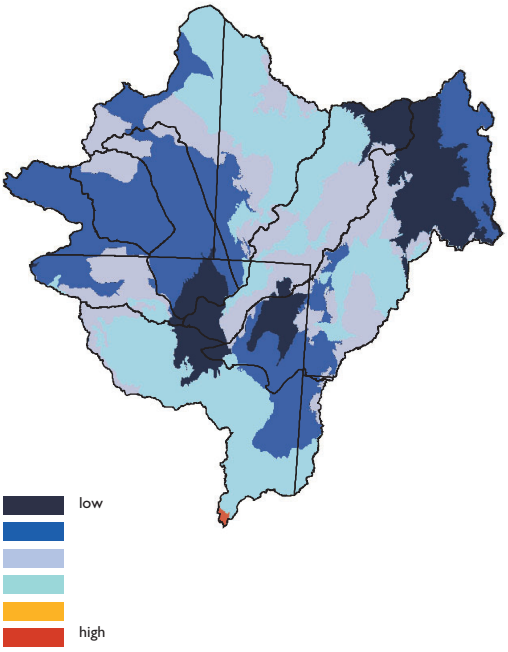


- Cleared
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

LAKE EYRE DRAINAGE DIVISION

Total area	1 164 063 km^2
Number of basins	7
Basin areas	59 653 – 297 570 km^2
Rainfall	160 – 301 mm/yr
Evaporation	159 – 296 mm/yr
Run-off	1 – 5 mm/yr
Net primary productivity	0.1 – 0.5 tC/ha/yr
Climatic types	hot, arid desert in the north hot to warm (persistently dry) grassland in eastern and southern sections

LANDSCAPE STRESS (composite index by subregion)



Patterns of ecosystem condition

Lake Eyre is an internal drainage division with low intensity but extensive land uses. Its landscapes have low to medium stress. Landscapes with higher stress occur in the north (North West Highlands and Mitchell Grass Downs subregions) and south (Stony Plains, Flinders and Olary Ranges and Broken Hill Complex subregions) of the division. These landscapes include the Georgina and Diamantina river basins in the north and the Lake Frome basin in the south. The eastern, western and central areas of the drainage division including the Cooper Creek, Finke, Todd and Hay river basins have landscapes with low stress.

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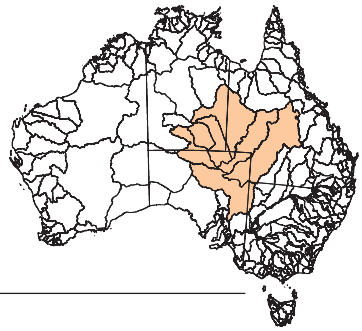


Key ecosystem condition drivers

Climate

- Seasonal or persistent aridity results in low vegetation cover and greater potential for impact from inappropriate fire regimes and wind or water-borne soil erosion.
- Many aquatic and terrestrial biota depend on refuge areas for survival during seasonally arid periods. Biota have adapted to variable conditions and the changing of water quality due to evapoconcentration.
- Low rainfall results in seasonal and low net primary productivity. Native vegetation within the division has a limited growing season tightly coupled to the availability of moisture. Such ecosystems are susceptible to total grazing pressure or inappropriate burning which can set in train long-term downward trends in vegetation recruitment and soil organic carbon content.
- Low and seasonal rainfall results in intermittent river systems with a limited capacity to transport sediment and nutrients and a high potential for water quality impacts. Very arid areas lack defined drainage channels or rivers.

Landscape, topography and soils

Topography

- Landforms typical of desert conditions—plains, inland dunes and sandplains, floodplains, and low relief hills and plateaus. Includes areas of aeolian sand with no surface drainage, areas of drainage radiating from uplands to surrounding plains and two smaller internal drainages that terminate at saline evaporative basins.
- Naturally turbid water quality.
- Low gradient, low energy, slow flow river systems.
- Basins with significant erosion potential but limited sediment transport capacity.

Soils

- Dominant soils (Vertisols, Kandosols, Sodosols, Rudosols and Tenosols) are susceptible to poor water retention; low fertility; low reserves of organic matter; and proneness to compaction, hardsetting, crusting, dispersiveness, wind and water-borne erosion.
- High natural stores of salt within lower reaches of river basins with evapoconcentration leading to salt lakes, the only export mechanism being via wind transport.

Land use intensity

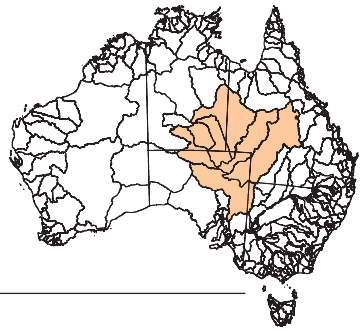
	Area (km²)	% Area
Nature conservation	57 651	5
Other protected areas and Indigenous	82 902	7
Minimal use	63 093	5
Grazing	949 961	82
Forestry	minimal	–
Dryland agriculture	minimal	–
Irrigated agriculture	minimal	–
Built environment	minimal	–
Water bodies	minimal	–

- *Grazing* (81% of total area; more than 70% of most basins; second most extensively grazed drainage division) mainly occurs on native pasture rangelands but at generally low stocking rates due to the division's climatic constraints. Some pasture improvement including sowing of buffel grass has occurred. More intensive pasture development including tree clearing has also occurred in the upper Coopers Creek basin in the north east.
- *Other protected areas* including *Indigenous* use 7% of area, with major occurrences in the Hay (25%), Finke (13%), Todd (15%) and Coopers Creek (7%) basins.
- *Minimal use crown land* takes up 5.4% of total area.
- *Nature conservation* (5% of total area).

Grazing pressure

Conditions and grazing pressure varies greatly across the division. Key areas of high grazing pressure include the Northern Flinders and Murnpeowie subregions and subregions within the Mitchell Grass Downs and Channel Country bioregions. Areas of minimal grazing pressure could be regarded as 'de facto conservation areas'.

Grazing pressure across most of the division increased from the 1960s through to the 1980s. Grazing pressure in the south (lower Diamantina, Cooper and Lake Frome) peaked during the 1980s (4000 – 10 000 dse/km²) . It has since declined to maximum values of between 1 and 2000 dse/km².



Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	116 406 300	114 693 792	1 712 508	1
Eucalypt open forests	9 428	8 800	628	7
Eucalypt low open forests	86 716	86 716		0
Eucalypt woodlands	3 711 436	3 497 236	214 200	6
Acacia forests and woodlands	4 595 908	3 777 948	817 960	18
Callitris forests and woodlands	36 568	35 536	1 032	3
Casuarina forests and woodlands	54 212	54 060	152	<1
Melaleuca forests and woodlands	8 032	7 060	972	12
Other forests and woodlands	4 621 944	4 616 516	5 428	<1
Eucalypt open woodlands	4 352 680	4 235 680	117 000	3
Acacia open woodlands	8 015 536	7 894 736	120 800	2
Mallee woodlands and shrublands	1 996 716	1 985 464	11 252	<1
Acacia shrublands	12 396 456	12 205 332	191 124	2
Other shrublands	2 206 680	2 182 596	24 084	1
Heath	168	168		0
Tussock grasslands	25 191 120	25 003 184	187 936	<1
Hummock grasslands	28 804 664	28 794 004	10 660	<1
Other grasslands, herblands, sedgelands and rushlands	196 632	196 312	320	<1
Chenopod shrubs, samphire shrubs and forblands	18 667 500	18 658 636	8 864	0
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	1 421 548	1 421 452	96	0

- About 1% of the division has been cleared. Area totals for some vegetation types are relatively large and in some cases (e.g. acacia forests and woodlands) form a significant percentage of pre-European extent.
- The main drivers operating on vegetation cover and condition are total grazing pressure, weeds and fire regime all of which interact with each other. Sustained high grazing pressure is both directly and indirectly associated with reduced ground vegetation cover. The widespread loss of topsoil and associated organic matter from reduced vegetation cover is recognised as a significant cause of ecosystem impact within Australia's arid landscapes.
- Buffel grass is an introduced pasture species capable of dominating the ground layer and altering fire ecology that occurs in western and central areas of the division.

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Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			17	Number of groundwater management areas			18
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%	Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	17	100	1.	< 30	5	28
2.	30 – 70	0		2.	30 – 70	1	6
3.	70 – 100	0		3.	70 – 100	3	16
4.	> 100	0		4.	> 100	9	50

Surface water

Surface water use levels within the division are very low, as are the available resources.

- All surface water management areas currently have a Class I development category (< 30% sustainable yield) and pose no potential for significant ecosystem affects.

Groundwater

Groundwater is the major water resource.

- 50% of groundwater management units are exploited beyond a 100% of their sustainable yield.

Much of this groundwater use is associated with bores accessing the Great Artesian Basin. Overexploitation of this resource poses risks for both ecosystem condition and water availability.

- Reduced groundwater pressure has been implicated in reductions in the number of naturally flowing thermal springs that have biodiversity and ecological values.
- Use of Great Artesian Basin bores to provide watering points or free flowing channels for stock leads to increased localised densities of domestic stock, native and feral animals including herbivores and predators.

Bore capping and piping programs are under way.

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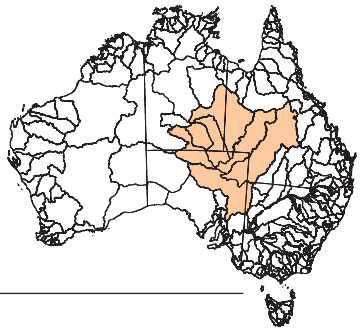


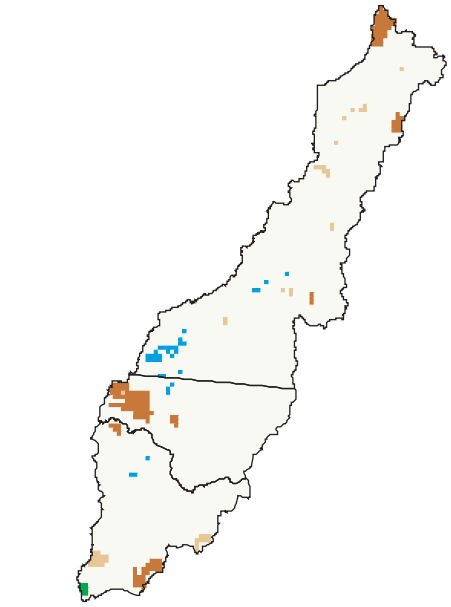
Weeds and feral animals

Given the low intensity land use within much of the drainage division, weeds and feral animals are key agents of change. The relatively wide range of climate zones and habitats means that a large number of exotic weed and feral animal species occur. Some are very significant in terms of ecosystem and biodiversity impacts.

- Prickly acacia and parthenium can dominate the shrub and ground layer (respectively) to the exclusion of native vegetation. Both are expanding in range.
- Goats, camels, donkeys and rabbits contribute to grazing pressure.
- Pigs impact on riparian and wetland habitats and biota.
- Cats and foxes are widespread and are a source of predation pressure for small vertebrates.

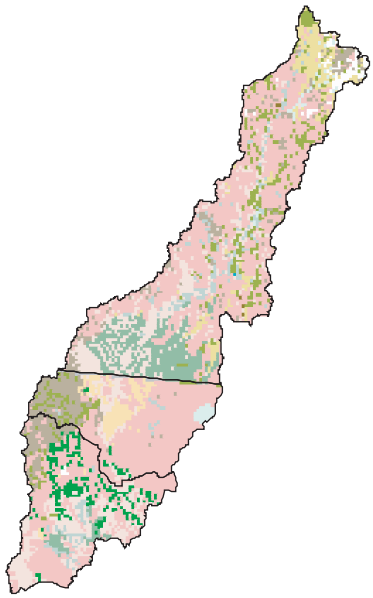
INTEGRATED FINDINGS: Bulloo – Bancannia Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Eucalypt low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Other shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

BULLOO – BANCANNIA DRAINAGE DIVISION

Total area	98 820 km^2
Number of basins	2
Basin areas	23 292 – 75 528 km^2
Rainfall	204 – 284 mm/yr
Evaporation	202 – 281 mm/yr
Run-off	2 – 3 mm/yr
Net primary productivity	0.3 – 0.5 tC/ha/yr
Climate types	hot persistently dry desert in the south hot persistently dry grassland in the north

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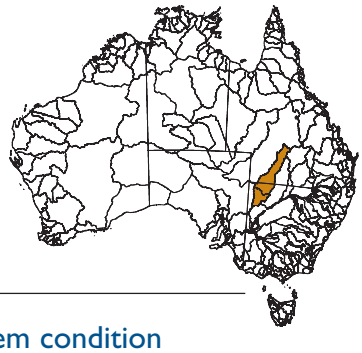
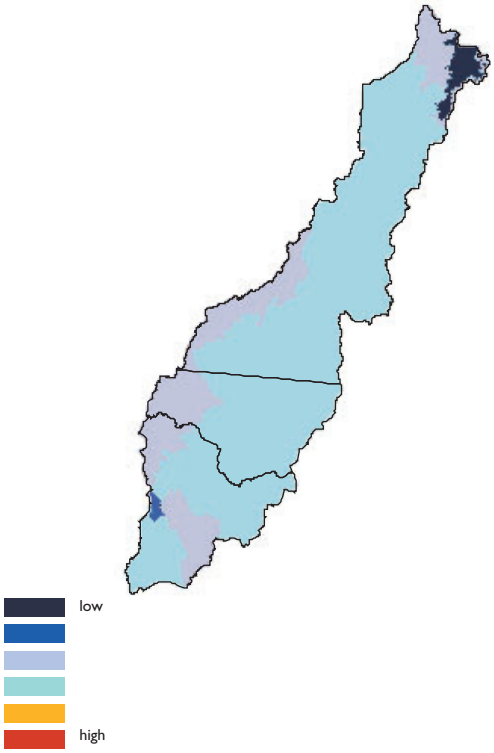


LANDSCAPE STRESS (composite index by subregion)



Patterns of ecosystem condition

This internal drainage division is made up of two basins—Bulloo River and Lake Bancannia. Both basins predominantly contain landscapes with medium stress. Subregions are representatives of the Channel Country, Mulga lands and Broken Hill complex bioregions.

Key ecosystem condition drivers

Climate

- Seasonal or persistent aridity results in low vegetation cover.
- Many aquatic and terrestrial biota depend on refuge areas for survival during seasonally arid periods.
- Low rainfall results in seasonal and low net primary productivity. Native vegetation within the division has a limited growing season tightly coupled to the availability of moisture. Such ecosystems are susceptible to grazing or inappropriate burning which can set in train long-term downward trends in vegetation recruitment and soil organic carbon content.
- Low and intermittent rainfall results in an ephemeral river system with a limited capacity to transport sediment and nutrients. Very arid areas lack defined drainage channels or rivers.

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Landscape, topography and soils

Topography

- Landforms typical of desert conditions—flat plains including inland dunes and sand plains in the north and a terminal evaporative basin – saline lake (Lake Bancannia) in the south.

Soil types

- Soil (Kandosols, Tenosols, Sodosols and Vertisols) are susceptible to poor water retention, low fertility, low reserves of organic matter and low water penetration, and are prone to compaction and smearing, crust formation, dispersivness water and wind erosion.

Land use intensity

	Area (km²)	% Area
Nature conservation	3 911	4
Minimal use	2 191	2
Grazing	91 211	92
Forestry	minimal	–
Dryland agriculture	minimal	–
Built environment	minimal	–
Water bodies	1 353	1

- *Grazing* by sheep and cattle (92% of total area) is the largest aerial proportion for any drainage division. It uses native rangeland and is very extensive due to the arid, low productivity nature of the landscape.
- *Nature conservation* (4% of total area) is the second lowest for any drainage division. It comprises several relatively large national parks.
- *Built environment* occupies the smallest area for any drainage division and is made up of the small town of Quilpie.
- A small area of *forestry* is located in the far south in acacia shrubland.

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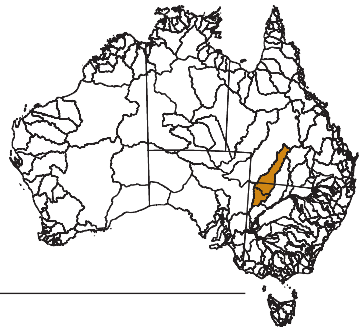

Grazing pressure

- Key areas of higher grazing pressure include the Bulloo Dunefields, White Cliffs Plateau, Central Depression and Barrier Range Outwash subregions and numerous other subregions of the Mulga lands and Channel Country bioregions.

Grazing pressure across most of the division has fluctuated over the decades. During the 1950s grazing pressure in the south measured up to 2000 – 4000 dse/km^2. This decreased during the 1960s and increased again through the 1970s and 1980s peaking at a grazing pressure of 4000 – 10 000 dse/km^2 in the north. Since that time grazing pressure has declined to maximum values of 1 – 2000 dse/km^2 over most of the division with higher values still recorded in the north.

Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	9 882 000	9 746 480	135 520	1
Eucalypt low open forests	315 476	315 476		0
Eucalypt woodlands	305 244	305 204	40	< 1
Acacia forests and woodlands	639 400	596 780	42 620	7
Callitris forests and woodlands	40 252	40 252		0
Casuarina forests and woodlands	54 320	54 320		0
Other forests and woodlands	599 864	599 864		0
Eucalypt open woodlands	94 776	90 940	3 836	4
Acacia open woodlands	439 632	413 236	26 396	6
Acacia shrublands	4 876 656	4 826 988	49 668	1
Other shrublands	4 840	4 840		0
Tussock grasslands	744 344	731 488	12 856	2
Hummock grasslands	2 124	2 124		0
Other grasslands, herblands, sedgelands and rushlands	223 404	223 396	8	0
Chenopod shrubs, samphire shrubs and forblands	1 501 752	1 501 656	96	< 1
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	3 456	3 456		0

- About 1% of the drainage division has been cleared of native vegetation.
- Primary concerns for vegetation management are grazing, fire regime and weed control.
- Vegetation types cleared are those more suited for improved pasture development including acacia shrublands, acacia forests and woodlands, acacia open woodlands, tussock grasslands, and eucalypt open woodlands.

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Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			3	Number of groundwater management areas			1
Development category: diversion as a percentage of sustainable flow regime (%)		Number	%	Development category: abstraction as a percentage of sustainable yield (%)		Number	%
1.	< 30	3	100	1.	< 30		0
2.	30 – 70	0		2.	30 – 70		0
3.	70 – 100	0		3.	70 – 100		0
4.	> 100	0		4.	> 100	1	100

Surface water

Surface water resources in the Bulloo – Bancannia Drainage Division are very limited.

- Three surface water management areas within the division have extraction levels below 30% of sustainable yield.

Groundwater

- The single groundwater management unit lies within the Great Artesian Basin Groundwater Province and has an abstraction rate greater than a 100% of sustainable yield.

As with other Great Artesian Basin resources, improved management including bore capping and piping has long-term benefits for water availability, stock management and biodiversity values.

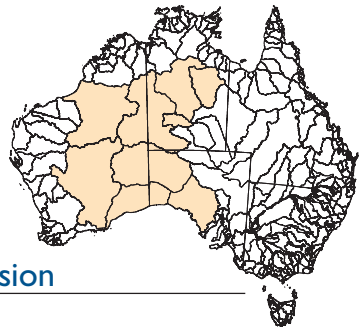
Weeds and feral animals

Feral animals are a significant pressure in areas identified as having more stressed landscapes including the West Bulloo, Urisino Sandplains and White cliffs Plateau subregions within the Mulga Bioregion.

Feral animal species include:

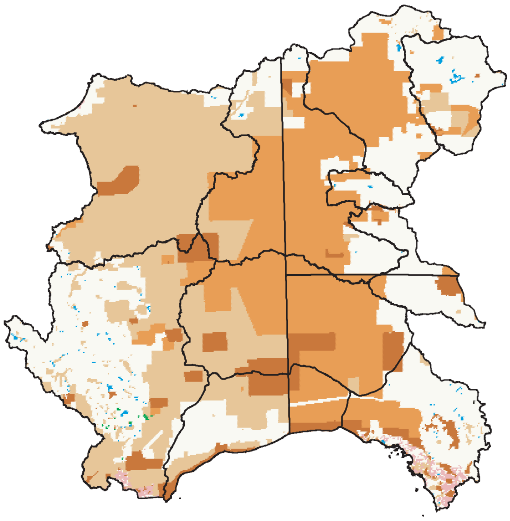
- major predators of native wildlife (cats, foxes); and
- grazers and disturbers of native vegetation (rabbits, goats, pigs).

Although assessments did not indicate dense infestations of weed species, a relatively long list of weed species are recorded as present including some recognised to pose ecosystem and production concerns including parthenium, prickly acacia, parkinsonia and mesquite.



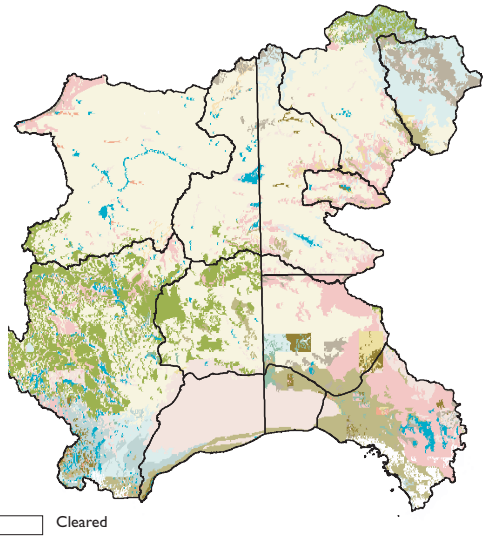
INTEGRATED FINDINGS: Western Plateau Drainage Division

LAND USE



- nature conservation
- other protected areas including Indigenous uses
- minimal use
- livestock grazing
- forestry
- dryland agriculture
- irrigated agriculture
- built environment
- water bodies

MAJOR VEGETATION GROUPS



- Cleared
- Eucalypt low open forests
- Acacia forests and woodlands
- Casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

WESTERN PLATEAU DRAINAGE DIVISION

Total area	2 454 564 km^2
Number of basins	9
Basin areas	38 836 – 494 827 km^2
Estuary types	tide-dominated strand plains and tidal creeks inverse wave-dominated estuaries
Rainfall	189 – 398 mm/yr
Evaporation	188 – 374 mm/yr
Run-off	1 – 25 mm/yr
Net primary productivity	0.2 – 0.6 tC/ha/yr
Climate types	hot, persistently dry desert and grassland over the bulk of the division temperate Mediterranean to temperate grasslands in the south east

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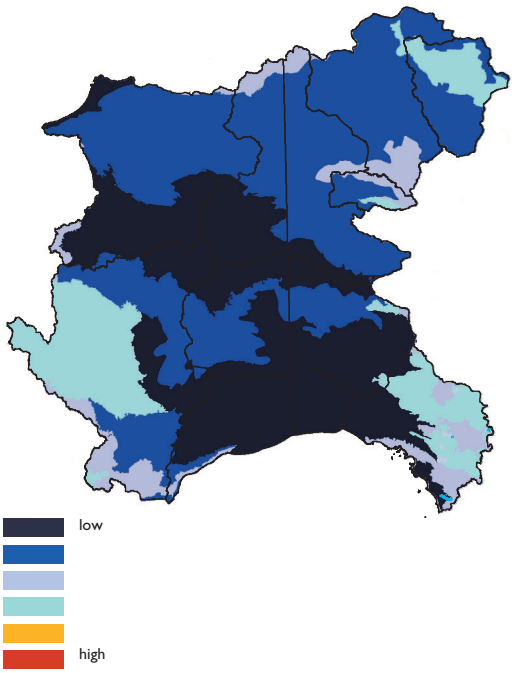
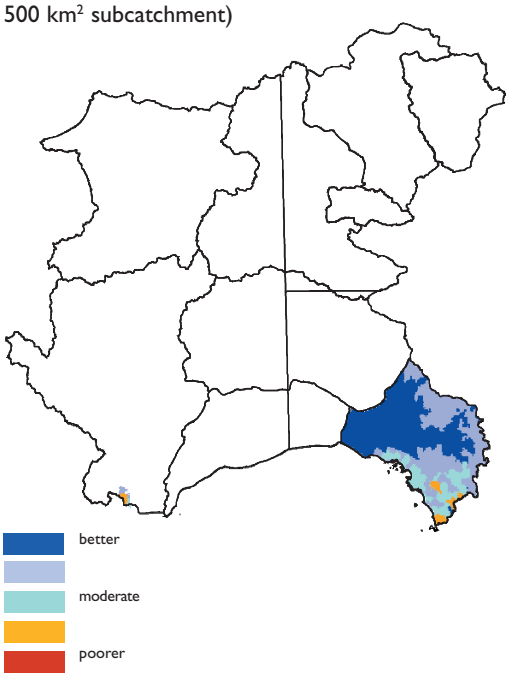
LANDSCAPE STRESS (composite index by subregion)



CATCHMENT CONDITION (composite score by 500 km² subcatchment)



Patterns of ecosystem condition

The Western Plateau is vast. It is dominated by desert climate zones and undifferentiated surface water drainages. Most of the division has relatively unstressed landscapes.

- Areas of higher landscape stress are in the north east (e.g. Barkly Tablelands and Mitchell Grass Downs subregions), the south west (e.g. Murchison bioregion) and the south east (e.g. Gawler bioregion) within the Gairdner Basin.

Due to the very arid climate there are few estuaries.

- The estuaries on the remote north-west coast (small tidal-dominated strand plains and tidal creeks) are near pristine.
- Estuaries on the south coast (inverse wave-dominated estuaries) range from near pristine to extensively modified, reflecting the more intensive land use of adjoining catchments.

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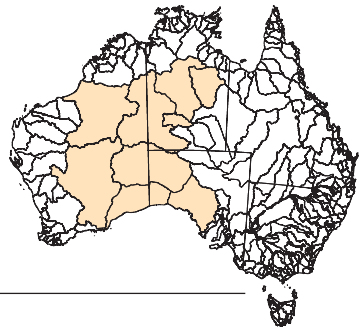


Key ecosystem condition drivers

Climate

The tropical northern margin is influenced by inland movement of monsoon-associated rainfall. The northern climate is predominantly a seasonal desert and hot grassland climate with low summer rainfall and winter drought.

The southern margin experiences lower temperatures and warm persistently dry desert and grassland.

The south-east margin experiences winter rainfall and grades from temperate Mediterranean with distinctively dry and warm summer to a temperate climate with distinctly dry and hot summers to warm grasslands with summer drought.

- Seasonal or persistent aridity results in low vegetation cover and high potential for impacts from inappropriate fire regimes and wind or water-borne soil erosion.
- Aquatic and terrestrial biota depend on refuge areas for survival during seasonally arid periods.
- Low rainfall results in seasonal and low net primary productivity. Native vegetation has a limited growing season tightly coupled to the availability of sufficient moisture. Such ecosystems are susceptible to grazing pressure and inappropriate burning which can affect vegetation recruitment and soil organic carbon content.

Landscape, topography and soils

Landscape

- Dominated by aeolian landforms including inland dunes and sand plains. Other desert landforms include limestone plains (Nullarbor), lakes, floodplains, low and high relief hills, and plateaus.
- Limited coordinated drainage with mainly uncoordinated surface flow, aeolian sand, and paleodrainage systems that incorporate aligned river lakes. Other drainage systems include areas of no surface drainage upon limestone plains, drainage radiating from uplands to surrounding plains and internal drainage systems (to Lake Disappointment, Gregory Lake and Lake Woods).

Soils

- Soils (Tenosols, Rudosols, Kandosols, Calcarosols and saline Hydrosols) are susceptible to poor water retention, low fertility and low reserves organic matter, and are prone to hardsetting, crusting, wind and water-borne erosion.

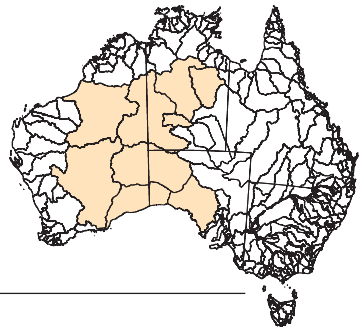
Land use intensity

	Area (km²)	% Area
Nature conservation	162 746	7
Other protected areas and Indigenous	727 409	30
Minimal use	777 619	32
Grazing	758 831	31
Forestry	minimal	–
Dryland agriculture	15 848	< 1
Irrigated agriculture	minimal	–
Built environment	minimal	–
Water bodies	minimal	–

- Most of the *minimal use crown land* occurs in the western portion of the division (e.g. Sandy Desert, Salt Lake, Nullarbor and Warburton basins).
- Most of the *other protected areas* and *Indigenous* use occurs in a continuous block running from north to south in the east of the division with significant proportions of the Mackay, Warburton and Wiso river basins.
- *Grazing* occurs across about a third of the division area (in the north east, south west and south east).
- *Nature conservation* has an uneven distribution varying from up to 18% of the Nullarbor basin to less than 1% of those basins most suitable for grazing (Barkly, Burt and Wiso).
- *Dryland agriculture* (less than 1% of total area) is found in the higher rainfall temperate south east.

Grazing pressure

Stock density in the eastern portion of the division increased from the 1960s to the 1980s. Animal density peaked in the 1980s (4000 – 10 000 dse/km²) for statistical local areas in the eastern Gairdner, Mackay and Burt basins. Since then animal density has declined to maximum values of between 1 – 2000 dse/km² over the entire division. Most of the division is not grazed other than by native and feral animals. Key areas of higher total grazing pressure include Mitchell Grass Downs, Burt Plain and Myall Plains subregions and other subregions of the Gawler, Simpson – Strzelecki and Stony Plains bioregions.



Native vegetation

	Pre-European area (ha)	Present day area (ha)	Cleared area (ha)	% Change
Native vegetation cover	245 456 400	242 538 220	2 918 180	1
Eucalypt low open forests	156	156		0
Eucalypt woodlands	6 708 888	6 565 372	143 516	2
Acacia forests and woodlands	25 243 492	25 195 908	47 584	< 1
Casuarina forests and woodlands	1 056 248	1 056 248		0
Melaleuca forests and woodlands	181 444	181 436	8	< 1
Other forests and woodlands	339 568	339 568		0
Eucalypt open woodlands	13 212 844	13 047 800	165 044	1
Acacia open woodlands	2 236 676	2 236 676		0
Mallee woodlands and shrublands	16 215 448	14 004 184	2 211 264	14
Low closed forests and closed shrublands	25 908	25 908		0
Acacia shrublands	21 873 072	21 612 312	260 760	1
Other shrublands	2 011 040	1 966 952	44 088	2
Heath	374 304	363 576	10 728	3
Tussock grasslands	6 579 076	6 576 204	2 872	< 1
Hummock grasslands	119 233 036	119 220 680	12 356	< 1
Other grasslands, herblands, sedgelands and rushlands	442 732	442 732		0
Chenopod shrubs, samphire shrubs and forblands	25 484 300	25 484 192	108	0
Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs	4 155 328	4 137 468	17 860	< 1

- About 1% of the drainage division has been cleared. Most of this has been mallee woodlands and shrublands. Broadscale clearing has now essentially ceased.
- The most significant drivers operating on vegetation cover and condition are total grazing pressure, weed infestation and fire regime.

  Lack of managed fire regimes can, for example, cause significant impacts. Species such as the rufous hare wallaby depend on the successional mosaic of post-fire regeneration to provide habitat and food resources. This is not provided where wildfire results in burning of extensive areas during a single fire.

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Water use and hydrology

Surface water				Groundwater			
Number of surface water management areas			14	Number of groundwater management areas			63
	Development category: diversion as a percentage of sustainable flow regime (%)	Number	%		Development category: abstraction as a percentage of sustainable yield (%)	Number	%
1.	< 30	14	100	1.	< 30	50	79
2.	30 – 70	0		2.	30 – 70	5	8
3.	70 – 100	0		3.	70 – 100	8	13
4.	> 100	0		4.	> 100	0	

Surface water

Surface water resources are very limited.

- All surface water management area have development categories below 30% of sustainable yield.

Groundwater

Groundwater resources within the division are limited.

- 13% of groundwater management areas have a development category of 70 – 100% of sustainable yield.

Weeds and feral animals

Given the low intensity of land use within the division, many weeds and feral animals have prominence as drivers of change in ecosystem condition.

- Mesquite, prickly acacia and parkinsonia are weeds of savanna grasslands.
- Goats and rabbits contribute to grazing pressure.
- Foxes and cats are widespread feral predators, which place predation pressure on small vertebrates.

Investing for the future

Key natural resource management challenges and opportunities

Australia faces many natural resource management challenges and opportunities as Australians seek to fine tune land use patterns and land, water and vegetation management practices. Within agricultural landscapes the overall objective must be to maximise profitability while minimising impact on the resource base. Communities are demanding high quality environments. To achieve this, trade-offs between productive use and conservation goals will need to be made, and the community must understand these so that benefits can be maximised for the wider public interest. Gaining an understanding of these issues requires full resource accounting that identifies social, economic and environmental benefits and costs of resource use.

The Audit assessment of Australia's catchments, rivers and estuaries contributes to this understanding by assessing the status of these systems in relation to current resource use patterns.

Key challenges

Land use

Many areas of Australia are incapable of sustaining the land uses that we have allocated to them. Drought, floods, fires, soil erodibility and fertility, topography and water balance are issues to consider as we seek more sustainable land use. The major challenge for Australia is to make land use more sustainable within the context and constraints of our natural resources, maintaining or enhancing productivity while minimising off-site impacts.

Australian land uses have foundations in practices imported with settlers from Europe; these have often been implemented without accounting for the differences in Australian landscapes and climate.

For example, early European settlers did not consider the threat of flooding when settling on the Hawkesbury and Hunter floodplains. Floods devastated these settlements not long after.

In Europe, treated sewage is piped into estuaries where snowmelt-flushed rivers swiftly remove it. In Australian tide-dominated estuaries which have long flushing times, this practice has led to high levels of nutrients being trapped in the estuaries, causing algal blooms that are only flushed out to marine environments by major floods.

The high density stocking of introduced hard hoofed grazing animals early in Australia's settlement also resulted in rapid changes to native pasture composition and major declines in productivity.

Responses to land use impacts have included:

- flood and erosion control for agricultural and urban areas;
- Australia-wide natural resource management programs such as soil conservation, Landcare, Natural Heritage Trust and the National Action Plan for Salinity and Water Quality; and
- restructuring initiatives for agriculture (e.g. water reform, rural adjustment schemes).

Land use management challenges

The key challenges that need to be addressed to deliver sustainable land use include:

- land use planning that fully recognises land capability including the potential for off-site impacts;
- maintaining ongoing commitment to improvement of land use practices;
- redesigning more intensively used landscapes to mimic and incorporate landscape functions that help maintain ecosystem health; and
- developing innovative new industries and land uses that are sustainable within the Australian landscape.

Strategic revegetation: an important part of vegetation management

Vegetation management

Australian Native Vegetation Assessment 2001 (NLWRA 2001c) details the type and extent of native vegetation loss across Australia. Approximately 67% of Australia's native vegetation in the intensively used areas (principally the agricultural and urban zones) has been cleared or substantially modified.

Biodiversity values, habitat fragmentation and nature conservation are discussed in the Audit *Australian Biodiversity Assessment 2002* (NLWRA in prep.). Cover and vigour of native or introduced vegetation are key factors in minimising:

- soil erosion and degradation;
- changes to catchment hydrology;
- landscape water balance; and
- water quality deterioration.

With information provided by Audit assessments, regional natural resource managers and policy makers are now better equipped to address key challenges including:

- How do we best determine priorities for expenditure in revegetation versus improved management of existing remnant native vegetation?
- How do we best manage vegetation clearing, recognising continued community needs for improved infrastructure—roads, power lines, and urban and agricultural development?
- How do we best encourage land use practices that leave vegetative cover as a buffer against soil erosion and degradation and to trap sediment moving from the landscape into waterways?
- How do we best determine priorities for nature conservation values versus productive uses of our vegetation?

Vegetation management challenges

Key challenges include strategic revegetation, protection and management to:

- maintain or enhance important landscape functional elements such as:
  - riparian and floodplain forests;
  - run-off detention and sediment sink areas (i.e. wetlands); and
  - groundwater recharge areas.
- meet biodiversity conservation needs such as:
  - improving connectivity of habitat remnants;
  - increasing endangered species habitat; and
  - rehabilitating endangered vegetation communities.

Extensive grazing management

Grazing is a major land use in many catchments in terms of the area of catchment used (e.g. two thirds of the North Coast Drainage Division is occupied by livestock grazing), with the major proportion involving grazing of unimproved native pastures in the rangelands. Financial returns per hectare are low and the level of investment in protective management is also low. In tropical Australia, the dry conditions of early summer in much of this grazing land leads to reduced ground cover, exacerbating the already high soil erosion hazard associated with the onset of intense monsoon rains at the end of the 'annual drought'.

Extensive grazing management challenges

Key challenges for improved management of extensive grazing areas include:

- increased emphasis on pasture management by linking on-farm activities to climate variability, use of conservative stocking (related to land type), drought planning, increased paddock spelling and rotational grazing;
- reducing stock impact through use of off-river watering points and riparian and erodable slope exclusion fencing; and
- supporting and funding the development of integrated natural resource management strategies for extensive grazing areas that address the interaction between key issues such as pasture management, stock density, feral animals, weeds, fire management, location and density of watering points and biodiversity.

Soil erosion and management

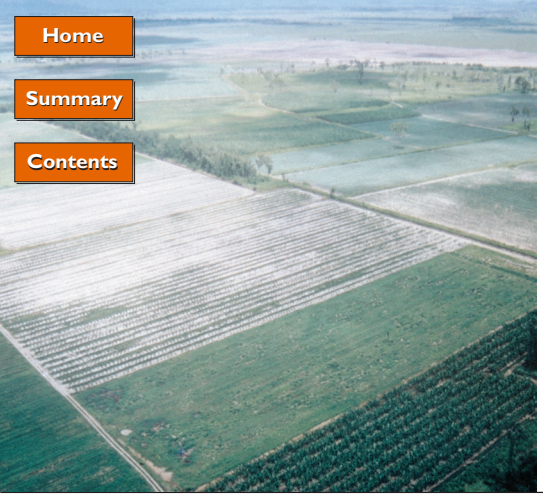
Accelerated soil erosion is a primary driver of natural resource degradation. It affects terrestrial, riverine, coastal and marine ecosystems by reducing primary productivity, changing catchment hydrology, smothering habitats and degrading water quality. Erosion processes and rates vary across Australia (NLWRA 2001b).

Improved soil management would provide significant returns in improved ecosystem condition. Until the 1980s, soil management and erosion control was a large part of government assistance to landholders. This assistance has declined but soil management remains an imperative.

Acidification, fertility loss, compaction and other elements of structural decline are also significant soil degradation issues that have off-farm impacts. Improved practice on-farm is the key to soil management and reducing off-farm impacts.

The Audit has assessed the sources and sinks of water-borne soil erosion (hillslope, gully and riverbank) and their relative contribution to sediment loads exported to Australia's coasts and estuaries at a catchment and river reach scale (NLWRA 2001b). Supported by Audit information and analytical frameworks the key challenges for regional resource managers and policy makers include:

- Where can investment best deliver gains—at local, catchment, State or national scales?
- What instruments are required to encourage improved soil management practices?



Agriculture on tropical floodplains: a soil erosion management challenge

Soil erosion management challenges

Strategies for managing soil erosion and sediment loads include:

- avoiding development of erosion prone soils and slopes;
- maintenance of ground cover and soil structure;
- ensuring nutrient uptake and export balance on farms;
- protection or rehabilitation of riparian land; and
- use of detention basins and wetlands to trap sediment.

Eutrophication and nutrient management

Increased nutrient loads from both diffuse and point sources are a major cause of change in riverine and estuarine condition. Nutrient loads, particularly phosphorus, are strongly linked to eroded sediment loads and therefore much of the nutrient issue will be managed by managing soil erosion.

Similar questions on beneficiaries, costs and relative priorities as those for soil erosion and land use face regional planners and policy makers.

Nutrient management challenges

Key management responses required for nutrient issues include:

- continued improvement in management of soil erosion;
- improved on-farm nutrient management practices;
- increased adoption of precision agriculture;
- redesign of point source discharges to include land application of effluent;
- tertiary sewage treatment, especially for coastal urban areas; and
- protection or reinstatement of catchment retention areas and nutrient sinks – riparian forests, floodplain wetlands and constructed urban wetlands / detention basins.

Landscape water balance and dryland salinity management

Dryland salinity is a problem resulting from changing the landscape water balance by replacing deep-rooted perennial native vegetation, which is efficient at using available water, with shallow-rooted agricultural crop species, which are relatively inefficient in terms of available water usage. It is ironic that on the driest inhabited continent on Earth, Australian agriculture has a sustainability issue relating to surplus water mobilising and relocating salts stored in subsurface soil profiles.

The National Action Plan for Salinity and Water Quality provides a framework for management and policy responses. Audit work designating groundwater flow systems (NLWRA 2001f) and assessing management options for differing systems (NLWRA 2001g) demonstrates the complexities and challenges involved in salinity management. Management scenarios need to deal with complexities such as response times, options for land use change, the scale of change, and trade-offs in terms of cost and benefit. Salinity management strategies such as revegetation and land use changes, which are primarily targeted at production outcomes, also offer synergies in terms of potentially significant ecosystem health benefits.

Challenges for regional groups and policy makers in combating dryland salinity include:

- the large scale of land use change required;
- limited opportunities for remediation; and
- many benefits of salinity control are realised off-farm.

Landscape water balance and dryland salinity management challenges

The response to this natural resource management challenge falls into two categories.

- much of northern Australia needs a proactive approach in preventing salinity (NLWRA 2001e). In most cases, this is best achieved through vegetation management and particularly by maintaining health and vigour of native vegetation.
- in southern Australia, salinity management may best be achieved using a combination of activities including:
  - adapting farming systems to be more water use efficient (using species such as lucerne and phalaris);
  - changing or diversifying land use (e.g. plantation forestry);
  - growing salt-tolerant crop and pasture species;
  - engineering to protect key assets (e.g. wetlands or urban infrastructure); and
  - living with salinity and developing saline resource industries (e.g. aquaculture).

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Water resource use management

The *Australian Water Resources Assessment 2000* (NLWRA 2001f) details the extent of water resource commitment, the continuing demands for water and the need for increased water use efficiency across all sectors. Water extraction is a key driver of ecological change in our river systems. However, demands for provision of environmental flows needs to be tempered with a recognition of the economic and social importance of irrigation—producing about 50% of Australia's agricultural production (NLWRA 2001g). The challenges facing regional planners and policy makers are recognised in the Council of Australian Governments Water Reform initiatives.

Water resource use management challenges

Key challenges for the improved management of water resource use include:

- improving assessment capacity to better define the dynamic nature of water resources (including seasonal and annual variation) and to assess consequences of policy and investment options;
- improving understanding of the economic, social and environmental values associated with patterns of water use
- determining limits to water resource use that balance both environmental and development requirements;
- where cost-effective, fostering improved water use efficiency for urban, industrial and agricultural uses;
- determining the most cost-effective water resource development opportunities;
- mechanisms for encouraging sustainable development;
- conjunctive use of surface and groundwater; and
- overall improved water resource management as part of natural resource management.

Lawn Hill River, Queensland

River and estuary management

Rivers and estuaries are key common property resources and have historically suffered misuse and neglect—the 'tragedy of the commons' (Hardin 1968), leading to degradation where major management and rehabilitation activities are required.

While recognising the need for river and estuarine rehabilitation, many river reaches and estuaries remain in near-pristine condition. Protective management of these is essential and far more cost-effective than remedial works.

Challenges for regional river and estuary managers and policy makers include:

- developing priorities and resourcing for remedial works and activities;
- designing and implementing protective management initiatives, to provide a representative system of riverine and estuarine reserves and to protect elements of the landscape that maintain river and estuary health (i.e. riparian and wetland areas);
- integrating riverine and estuarine management within wider ranging catchment management initiatives; and
- building increased community understanding of the values of rivers and estuaries and how best to improve all land use practices to minimise impact on these common property resources.

River and estuary management challenges

Challenges for riverine management include:

- riparian zone protection and rehabilitation including revegetation and riverbank erosion control works;
- catchment management targeted at reducing sediment and nutrient load inputs;
- the design and operation of water resource infrastructure including provision of environmental flows and fish passage and maintenance or enhancement of floodplain habitat connectivity; and
- remedial works and catchment management activities to reduce water pollution, dealing with both point and diffuse sources.

Challenges for estuarine management include:

- remedial works and catchment management activities to improve water quality, dealing with nutrient and sediment loads from both point and diffuse pollution sources;
- rehabilitation of estuary banks and associated floodplain wetlands;
- re-establishment of tidal flows and entrance processes;
- provision of fish passage;
- restructuring of flood mitigation works for multiple objectives; and
- fisheries and fish habitat management.

Biodiversity conservation and management

The level of representation of Australia's ecosystems within reserves (NLWRA 2001a, 2001c) points to the need for concerted efforts in biodiversity conservation, including off-park programs and special initiatives for river and estuary conservation. Detailed assessments of Australia's biodiversity status and management implications will be reported in the Audit *Australian Biodiversity Assessment* in 2002.

Urban and built environment catchment management

Australia's east coast, including much of the New South Wales coast and south-east Queensland, has the fastest growing urban populations in Australia. The impacts of this population density and that of other major urban centres on natural resource and catchment, river and estuary include loss of native vegetation, increased sediment, nutrient and other pollutant loads to waterways, changed catchment hydrology, increased water use and physical modifications to rivers and estuaries.

Urban and built environment catchment management challenges

Key challenges for natural resource managers and policy makers within urban catchments include:

- redesigning urban and built environment catchments to accommodate biophysical processes important to downstream ecosystems; and
- planning and implementing development management strategies that minimise the impact of infrastructure and urban uses on key natural resources—rivers, estuaries and coastal zones.

Sustainable oyster production in estuaries is dependent on catchment and river management

Integrating catchment, river and estuary management

The Audit undertook assessments based on an understanding of biophysical processes and documenting the causes of impact, to provide a basis for developing management strategies and tracking the effectiveness of management activities. Armed with the Audit information and analytical frameworks, the challenges now facing catchment, river and estuary managers and policy makers include:

- how best to link or integrate institutional arrangements for catchment planning, management and works across the management needs of catchments, rivers and estuaries;
- building recognition of differing levels of susceptibility and response times and resilience in our rivers and estuaries (based on their ecology and the relative importance of process drivers such as tidal and freshwater flows) into management responses;
- coordinated use of legislative and regulatory instruments to provide a more integrated and multi-objective management regime at State and local government scales; and
- generating an improved understanding of the linked nature of catchments, rivers, estuaries and near shore marine systems including the impacts of land use on other resources (e.g. fisheries) amongst the Australian community.

Tracing the links between land management and aquatic ecosystem condition—addressing the cause of the problem

- Gaining an understanding of how land management can change aquatic ecosystems will help identify appropriate management responses.
- Algae blooms in rivers and estuaries are generally considered a water quality problem associated with excessive nutrient levels - eutrophication. However, by examining the dominant source of the nutrients, the primary driver of this 'water quality' issue (and the appropriate focus for management responses) can be traced back to a 'land management' issue.
- Phosphates, the nutrients primarily responsible for algae blooms, are usually transported with fine sediment and deposited in rivers and estuaries. The nutrients attached to the sediment leads to blooms when water clarity, mixing and temperature are favourable. Algal blooms may in turn lead to a continued nutrient cycling problem, providing further opportunities for blooms. In some systems, regardless of the amount of nutrients available, algal blooms never occur. For example, waterways that are turbid may never provide favourable light conditions for algal growth. Nutrient loads in these systems may have other important impacts on riverine ecology (e.g. fungal disease in aquatic biota).
- Understanding the likely response of systems to perturbation allows performance targets to be set and management actions developed to address the cause of the problem. In this case, we need to focus on the source and supply of nutrients rather than the algal bloom (the symptom or indicator of dysfunction).

WORKING TOWARDS INTEGRATED NATURAL RESOURCE MANAGEMENT

Integrated management models

Total catchment management or *integrated catchment management* based regional planning and management processes provide a good framework for improved natural resource management. Recognising that issues vary regionally, varied approaches are essential. Key ingredients include:

- **multi-faceted approaches**: across disciplines and issues;
- **planning**: based on regions of common or linked management interests;
- **spatial assessment and management frameworks**: considering available data, scale of management responses and the 'total' system for example catchments, bioregions, groundwater flow system, landscape / land system units;
- **partnerships**: wide ranging partnerships, across industries, government, science and community groups;
- **commitment**: facilitation, resources and commitment provided by local, State and Commonwealth governments;
- **shared vision**: a shared vision for the region, recognising trade-offs between competing social, economic and environmental demands;
- **solutions focus**: pragmatic and solution-orientated activities, making best use of, sometimes incomplete, data and scientific understanding;
- **cost-effective**: emphasis on key components where improvement can be achieved, based on an analysis of costs, benefits and likely return on investment of various opportunities; and
- **opportunistic**: identifying key management opportunities, promoting common property resource stewardship and protective management of ecosystems in natural condition.

Toolkit of management activities

A mix of tools is required to address natural resource management issues at a range of scales. The challenge for regional managers is to select the most appropriate tools. These tools include:

- **preventative measures** such as land use planning that recognises the constraints and capabilities of the land;
- **protective measures** that protect key natural areas managed principally for nature conservation values and/or the maintenance of landscape functions;
- **rehabilitation measures** that target key degraded resources;
- **extension** that builds an understanding of how natural systems operate, appropriate practices to maintain function and how to maximise sustainable production;
- **decision support systems** that integrate biophysical, social and economic needs;
- **best practice management** that seeks continuous improvement in natural resource management so that off-site impacts are minimised;
- **demonstration sites** to provide examples of improvement as catalysts for change;
- **policy initiatives** that translate natural resource management aspirations into outcomes;
- **incentives** to off set the costs that individuals must often bear when implementing practices to manage and protect common property resources;
- **legislation and regulatory approaches** to underpin natural resource outcomes; and
- **monitoring and evaluation** to assess progress of resource condition and program outcomes.

Building an information-based approach to natural resource management

Building on the lessons from the Audit

Based on progress made by the Audit, key guiding principles for subsequent assessments of Australia's catchments, rivers and estuaries include:

- be **user and purpose driven**: all information products need to be based on meeting the needs of natural resource managers at both regional and broader scales;
- be **based on regional data** where possible, resource assessment frameworks and regional data collection need to be co-designed to enable regional data to be incorporated into broader assessment frameworks and provided to clients (such as State of the Environment reporting) as integrated information products;
- use **common spatial frameworks** in order to be able to better integrate outputs and data across assessments, common spatial frameworks that integrate and link river reaches with sub-catchments, river basins and estuaries;
- provide **integrated assessments**: assessment activities should be timed and based on assessment and reporting frameworks that allow comprehensive integration between catchment, river and estuary components;
- include **biophysical classification**: conceptual models and analytical frameworks based on the predominant biophysical processes within catchment, river and estuarine systems are needed to improve the resolution of condition assessments for specific systems in specific regions;
- be **comparable**: comparability is essential for Australia-wide perspectives, however, data, assessment criteria and management requirements will differ regionally;
- **build on existing activities**: assessment methods need to build on and/or incorporate outputs of State assessment activities;
- include **targeted and standardised data collection**: improve collection of key data, gain agreement on assessment methods and effectively monitor change—includes defining data requirements such as quality and standards for collection;
- **develop cost-effective technologies**: innovative and inexpensive methods of data collection need to be developed (e.g. realising the full promise of remote sensing techniques);
- **determine trend**: while recognising that there is limited data available on trend, an assessment of change in condition should be attempted in the next assessment, building on the current assessment as a basis;
- include **reference condition**: reference condition or benchmarks for catchments, rivers and estuaries would provide more rigorous condition assessments;

- take account of **variability in time and space**: methods and analytical frameworks need to be sensitive to episodic and catastrophic events;
- include **additional biota indicators**: biota as indicators of ecosystem condition, need to be more comprehensively included in assessment activities, data limitations point to the need for strategic data collection; and
- include a **human dimension**: an integrated approach includes social and economic components and assesses and evaluates costs and benefits of various management activities.

Assessment as a framework for program adjustment and priority setting

Priorities for natural resource management will change as information on particular issues and their implications becomes available, implying the need for:

- ongoing assessment with reporting at regular intervals as a key input to program development;
- inclusion of enhanced information sets or conceptual models to provide up-to-date approaches to integrated natural resource management;
- reassessment of management activities and works priorities in the light of progress monitoring; and
- review and as necessary realignment of assessment and management activities incorporating results of research.

Assessment and reporting of the condition of Australia's catchments, rivers and estuaries needs to be an ongoing process. Five-yearly intervals could be most cost effective for Australia–wide assessment and reporting. Ongoing assessment will enable regional groups to undertake more frequent reporting and review to ensure efficiencies and effectiveness in their management programs.

MEETING AUDIT OBJECTIVES

Objective 1. Clear understanding of the status of, and changes in, the nation's land, vegetation and water resources and implications for their sustainable use.

- Understanding of the drivers of change, and process linkages between ecosystems is necessary to meet this objective. The integrated biophysical frameworks used in *Australian Catchment, River and Estuary Assessment 2002* identify key processes affecting the condition of these systems and the implications of existing resource use patterns, for their sustainable use.

Objective 2. Providing an interpretation of the costs and benefits—economic, environmental and social—of land and water resource change and any remedial actions.

- Cause of problems and key remedial actions were identified partially meeting this objective. Preliminary overview of the economic and social values of these public resources is presented.
- The Audit report *Australians and Natural Resources* (in prep.) provides further information on economic and social aspects of natural resources management including an assessment of the costs of poor water quality.

Objective 3. Developing a national information system of compatible and readily accessible resource data.

- The river assessment initiative as a framework for continued monitoring and assessment has defined river reaches across Australia. These river reaches provide a fundamental data set on which to base management as well as information collection and will be refined and agreed to as part of ongoing Audit activities.
- The Audit estuary assessment has built on a prior database and, through the Atlas, now provides a database framework and information set to continually monitor and assess the condition of Australia's estuaries. The challenge of coordinating this task Australia-wide has been taken up through the Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, building on partnerships established by the Audit across Australia.
- The catchment assessment initiative has developed a method for displaying and integrating information across biophysical datasets—a key tool to aid decision makers in setting priorities and targets for both protective management and remedial action.
- Consistent resource assessment methods applied Australia-wide for *Australian Catchment, River and Estuary Assessment 2002* have delivered compatible national information products. These are available at a range of scales and readily accessible through the Australian Natural Resource Atlas.

Objective 4. Producing national land, vegetation and water—surface and groundwater—assessments as integrated components of the Audit.

- The Audit has attempted integration across the biophysical environment in a catchment context. While much remains to be done, the systems-based research underpinning the Audit is already recognised as world-leading.
- *Australian Catchment, River and Estuary Assessment 2002* is an integrated component of the Audit, building on Audit outputs (e.g. water, vegetation and land use activities).

Objective 5. Ensuring integration with, and collaboration between, other relevant initiatives.

- As noted in the *Acknowledgement* section all activities in this assessment would not be possible without partnerships across science, agencies and industry.

Objective 6. Providing a framework for monitoring Australia's land and water resources in an ongoing and structured way.

- Working Australia-wide across jurisdictions *Australian Catchment, River and Estuary Assessment 2002* has facilitated the development of new assessment and reporting frameworks for catchments, rivers and estuaries. Examples include the OzEstuaries database, estuary categorisation and river reaches. These will continue to provide a framework for monitoring of Australia's land and water resources beyond the life of the current Audit.

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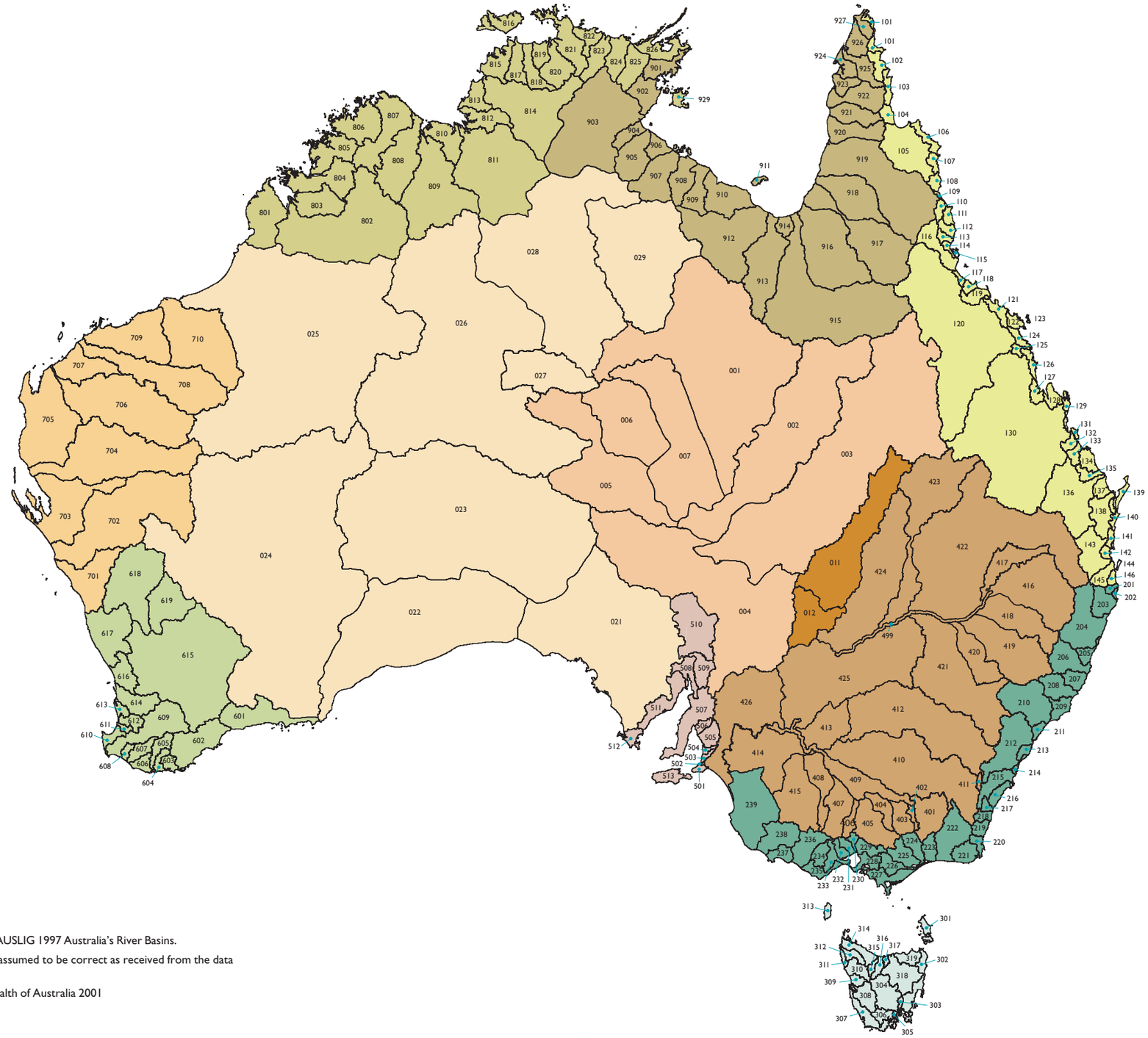
APPENDIX 1. AUSTRALIA'S RIVER BASINS AND DRAINAGE DIVISIONS



Source:

Derived from AUSLIG 1997 Australia's River Basins.

Data used are assumed to be correct as received from the data suppliers.

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River basins

1. North-East Coast Drainage Division

101 Jacky Jacky Creek
102 Olive – Pascoe Rivers
103 Lockhart River
104 Stewart River
105 Normanby River
106 Jeannie River
107 Endeavour River
108 Daintree River
109 Mossman River
110 Barron River
111 Mulgrave – Russell River
112 Johnstone River
113 Tully River
114 Murray River (Qld)
115 Hinchinbrook Island
116 Herbert River
117 Black River
118 Ross River
119 Haughton River
120 Burdekin River
121 Don River
122 Proserpine River
123 Whitsunday Island
124 O'Connell River
125 Pioneer River
126 Plane Creek
127 Styx River
128 Shoalwater Creek
129 Water Park Creek
130 Fitzroy River (Qld)
131 Curtis Island
132 Calliope River
133 Boyne River
134 Baffle Creek
135 Kolan River
136 Burnett River
137 Burrum River
138 Mary River (Qld)
139 Fraser Island
140 Noosa River
141 Maroochy River
142 Pine River
143 Brisbane River
144 Stradbroke Island
145 Logan – Albert Rivers
146 South Coast

2. South-East Coast Drainage Division

201 Tweed River
202 Brunswick River
203 Richmond River
204 Clarence River
205 Bellinger River
206 Macleay River
207 Hastings River
208 Manning River
209 Karuah River
210 Hunter River
211 Macquarie – Tuggerah Lakes
212 Hawkesbury River
213 Sydney Coast – Georges River
214 Wollongong Coast
215 Shoalhaven River
216 Clyde River – Jervis Bay
217 Moruya River
218 Tuross River
219 Bega River
220 Towamba River
221 East Gippsland
222 Snowy River
223 Tambo River
224 Mitchell River
225 Thomson River
226 Latrobe River
227 South Gippsland
228 Bunyip River
229 Yarra River
230 Maribyrnong River
231 Werribee River
232 Moorabool River
233 Barwon River
234 Lake Corangamite
235 Otway Coast
236 Hopkins River
237 Portland Coast
238 Glenelg River
239 Millicent Coast

3. Tasmania Drainage Division

301 Flinders – Cape Barren Islands
302 East Coast
303 Coal River
304 Derwent River
305 Kingston Coast
306 Huon River
307 South-West Coast
308 Gordon River
309 King – Henty Rivers
310 Pieman River
311 Sandy Cape Coast
312 Arthur River
313 King Island
314 Smithton – Burnie Coast
315 Forth River
316 Mersey River
317 Rubicon River
318 Tamar River
319 Piper – Ringarooma Rivers

4. Murray–Darling Drainage Division

401 Upper Murray River
402 Kiewa River
403 Ovens River
404 Broken River
405 Goulburn River
406 Campaspe River
407 Loddon River
408 Avoca River
409 Murray – Riverina
410 Murrumbidgee River
411 Lake George
412 Lachlan River
413 Benanee
414 Mallee
415 Wimmera – Avon Rivers
416 Border Rivers
417 Moonie River
418 Gwydir River
419 Namoi River
420 Castlereagh River
421 Macquarie – Bogan Rivers
422 Condamine – Culgoa Rivers
423 Warrego River
424 Paroo River
425 Darling River
426 Lower Murray River
499 Barwon Darling Management Area

5. South Australian Gulf Drainage Division

501 Fleurieu Peninsula
502 Myponga River
503 Onkaparinga River
504 Torrens River
505 Gawler River
506 Wakefield River
507 Broughton River
508 Mambray Coast
509 Willochra Creek
510 Lake Torrens
511 Spencer Gulf
512 Eyre Peninsula
513 Kangaroo Island

6. South-West Coast Drainage Division

601 Esperance Coast
602 Albany Coast
603 Denmark River
604 Kent River
605 Frankland River
606 Shannon River
607 Warren River
608 Donnelly River
609 Blackwood River
610 Busselton Coast
611 Preston River
612 Collie River
613 Harvey River
614 Murray River (WA)
615 Avon River
616 Swan Coast
617 Moore – Hill Rivers
618 Yarra Yarra Lakes
619 Ninghan

7. Indian Ocean Drainage Division

701 Greenough River
702 Murchison River
703 Wooramel River
704 Gascoyne River
705 Lyndon – Minilya Rivers
706 Ashburton River
707 Onslow Coast
708 Fortescue River
709 Port Hedland Coast
710 De Grey River

8. Timor Sea Drainage Division

801 Cape Leveque Coast
802 Fitzroy River (WA)
803 Lennard River
804 Isdell River
805 Prince Regent River
806 King Edward River
807 Drysdale River
808 Pentecost River
809 Ord River
810 Keep River
811 Victoria River
812 Fitzmaurice River
813 Moyle River
814 Daly River
815 Finniss River
816 Bathurst and Melville Islands
817 Adelaide River
818 Mary River (WA)
819 Wildman River
820 South Alligator River
821 East Alligator River
822 Goomadeer River
823 Liverpool River
824 Blyth River
825 Goyder River
826 Buckingham River

9. Gulf of Carpentaria Drainage Division

901 Koolatong River
902 Walker River
903 Roper River
904 Towns River
905 Limmen Bight River
906 Rosie River
907 McArthur River
908 Robinson River
909 Calvert River
910 Settlement Creek
911 Mornington Island
912 Nicholson River
913 Leichhardt River
914 Morning Inlet
915 Flinders River
916 Norman River
917 Gilbert River
918 Staaten River
919 Mitchell River (Qld)
920 Coleman River
921 Holroyd River
922 Archer River
923 Watson River
924 Embley River
925 Wenlock River
926 Ducie River
927 Jardine River
928 Torres Strait Islands
929 Groote Eylandt

10. Lake Eyre Drainage Division

001 Georgina River
002 Diamantina River
003 Cooper Creek
004 Lake Frome
005 Finke River
006 Todd River
007 Hay River

11. Bulloo – Bancannia Drainage Division

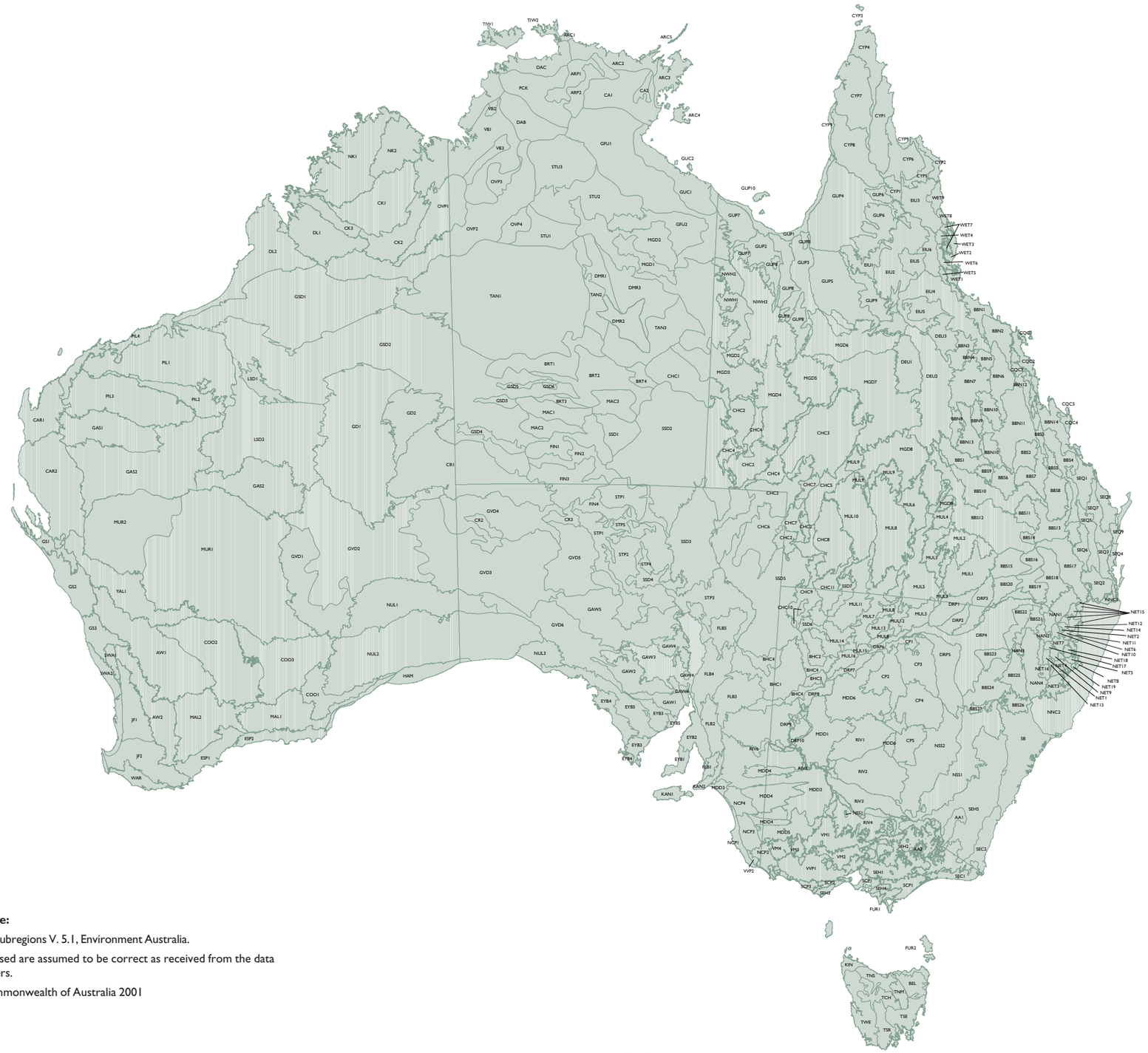
011 Bulloo River
012 Lake Bancannia

12. Western Plateau Drainage Division

021 Gairdner
022 Nullarbor
023 Warburton
024 Salt Lake
025 Sandy Desert
026 Mackay
027 Burt
028 Wiso
029 Barkly

How Sum Contents

APPENDIX 2. IBRA 5.1 BIOREGIONS AND SUBREGIONS OF AUSTRALIA



Source:

IBRA Subregions V. 5.1, Environment Australia.

Data used are assumed to be correct as received from the data suppliers.

Australian Alps

AA1	New South Wales Alps
AA2	Victorian Alps

Arnhem Coast

ARC1	Arnhem Coast P1
ARC2	Arnhem Coast P2
ARC3	Arnhem Coast P3
ARC4	Arnhem Coast P4 Groote
ARC5	Arnhem Coast P5 Wessels

Arnhem Plateau

ARP1	Arnhem Plateau P1
ARP2	Arnhem Plateau P2

Avon Wheatbelt

AW1	Avon Wheatbelt 1
AW2	Avon Wheatbelt 2

Brigalow Belt North

BBN1	Townsville Plains
BBN2	Bogie River Hills
BBN3	Cape River Hills
BBN4	Beucazon Hills
BBN5	Wyarra Hills
BBN6	Northern Bowen Basin
BBN7	Belyando Downs
BBN8	Upper Belyando Floodout
BBN9	Anakie Inlier
BBN10	Basalt Downs
BBN11	Isaac - Comet Downs
BBN12	Nebo - Connors Ranges
BBN13	South Drummond Basin
BBN14	Marlborough Plains

Brigalow Belt South

BBS1	Claude River Downs
BBS2	Woorabinda
BBS3	Boomer Range
BBS4	Mount Morgan Ranges
BBS5	Callide Creek Downs
BBS6	Arcadia
BBS7	Dawson River Downs
BBS8	Banana - Auburn Ranges
BBS9	Buckland Basalts
BBS10	Carnarvon Ranges
BBS11	Taroom Downs
BBS12	Southern Downs
BBS13	Barakula
BBS14	Dulacca Downs
BBS15	Weribone High
BBS16	Tara Downs
BBS17	Eastern Darling Downs
BBS18	Inglewood Sandstones
BBS19	Moonie R. - Commoron Creek
BBS20	Moonie - Barwon Interfluve
BBS21	Northern Basalts
BBS22	Northern Outwash
BBS23	Pilliga Outwash
BBS24	Pilliga
BBS25	Liverpool Plains
BBS26	Liverpool Range
BBS27	Talbragar Valley

Legend continued on next page

Hot Summ Contents

IBRA 5 subregions

Broken Hill Complex
BHC1 Barrier Range
BHC2 Mootwingee Downs
BHC3 Scopes Range
BHC4 Barrier Range Outwash

Burt Plain
BRT1 Burt Plain P1
BRT2 Burt Plain P2
BRT3 Burt Plain P3
BRT4 Burt Plain P4

Central Arnhem
CA1 Central Arnhem P1
CA2 Central Arnhem P2

Carnarvon
CAR1 Cape Range
CAR2 Wooramel

Channel country
CHC1 Toko Plains
CHC2 Sturt Stony Desert
CHC3 Goneaway Tablelands
CHC4 Diamantina-Eyre
CHC5 Cooper Plains
CHC6 Coongie
CHC7 Lake Pure
CHC8 Noccundra Slopes
CHC9 Tibooburra Downs
CHC10 Core Ranges
CHC11 Bulloo

Central Kimberley
CK1 Pentecost
CK2 Hart
CK3 Mount Eliza

Coolgardie
COO1 Mardabilla
COO2 Southern Cross
COO3 Eastern Goldfield

Cobar Peneplain
CP1 Boorindal Plains
CP2 Barnato Downs
CP3 Canbelego Downs
CP4 Nymagee-Rankins Springs
CP5 Lachlan Plains

Central Mackay Coast
CQC1 Whitsunday
CQC2 Proserpine - Sarina Lowlands
CQC3 Clarke - Connors Ranges
CQC4 Byfield
CQC5 Manifold

Central Ranges
CR1 Mann-Musgrave Block
CR2 Wataru
CR3 Everard Block

Cape York Peninsula
CYP1 Coen - Yamba Inlier
CYP2 Starke Coastal Lowlands
CYP3 Cape York - Torres Strait
CYP4 Jardine - Pascoe Sandstones
CYP5 Battle Camp Sandstones
CYP6 Laura Lowlands
CYP7 Weipa Plateau
CYP8 (Northern) Holroyd Plain
CYP9 Coastal Plains

Daly Basin
DAB Daly Basin

Darwin Coastal
DAC Darwin Coastal

Desert Uplands
DEU1 Prairie - Torrens Creeks Alluvials
DEU2 Alice Tableland
DEU3 Cape-Campaspe Plains

Dampierland
DL1 Fitzroy Trough
DL2 Pindanland

Davenport Murchison Ranges
DMR1 Davenport Murchison Range P1
DMR2 Davenport Murchison Range P2
DMR3 Davenport Murchison Range P3

Darling Riverine Plains
DRP1 Culgoa-Bokhara
DRP2 Narran-Lightning Ridge
DRP3 Warrambool-Moonie
DRP4 Castlereagh-Barwon
DRP5 Bogan-Macquarie
DRP6 Louth Plains
DRP7 Wilcannia Plains
DRP8 Menindee
DRP9 Great Darling Anabranch
DRP10 Pooncarie-Darling

Einasleigh Uplands
EIU1 Georgetown - Croydon
EIU2 Kidston
EIU3 Hodgkinson Basin
EIU4 Broken River
EIU5 Undara - Toomba Basalts
EIU6 Herberton - Wairuna

Esperance Plains
ESP1 Fitzgerald
ESP2 Recherche

Eyre Yorke Block
EYB1 Southern Yorke
EYB2 St Vincent
EYB3 Eyre Hills
EYB4 Talia
EYB5 Eyre Mallee

Finke
FIN1 Finke P1
FIN2 Finke P2
FIN3 Tieyon
FIN4 Pedirka

Flinders Lofty Block
FLB1 Mount Lofty Ranges
FLB2 Broughton
FLB3 Olary Spur
FLB4 Southern Flinders
FLB5 Northern Flinders

Flinders
FUR1 Wilsons Promontory
FUR2 Flinders

Gasgoyne
GAS1 Ashburton
GAS2 Carnegie
GAS3 Augustus

Gawler
GAW1 Myall Plains
GAW2 Gawler Volcanics
GAW3 Gawler Lakes
GAW4 Arcoona Plateau
GAW5 Kingoonya

Gibson Desert
GD1 Lateritic Plain
GD2 Dune Field

Gulf Fall and Uplands
GFU1 McArthur - South Nicholson Basins
GFU2 Gulf Fall and Uplands P2

Geraldton Sandplains
GS1 Edel
GS2 Geraldton Hills
GS3 Leseur Sandplain

Great Sandy Desert
GSD1 McLarty
GSD2 Mackay
GSD3 Great Sandy Desert P3
GSD4 Great Sandy Desert P4
GSD5 Great Sandy Desert P5
GSD6 Great Sandy Desert P6

Gulf Coastal
GUC1 Gulf Coastal P1
GUC2 Gulf Coastal P2 Pellews

Gulf Plains
GUP1 Karumba Plains
GUP2 Armraynald Plains
GUP3 Woondoola Plains
GUP4 Mitchell - Gilbert Fans
GUP5 Claraville Plains
GUP6 Holroyd Plain - Red Plateau
GUP7 Doomadgee Plains
GUP8 Donors Plateau
GUP9 Gilberton Plateau
GUP10 Wellesley Islands

Great Victoria Desert
GVD1 Shield
GVD2 Central
GVD3 Maralinga
GVD4 Kintore
GVD5 Tallaringa
GVD6 Yellabinna

Hampton
HAM Hampton

Jarrah Forrest
JF1 Northern Jarrah Forest
JF2 Southern Jarrah Forest

Kanmantoo
KAN1 Kangaroo Island
KAN2 Fleurieu

Little Sandy Desert
LSD1 Rudall
LSD2 Trainor

MacDonnell Ranges
MAC1 MacDonnell Ranges P1
MAC2 MacDonnell Ranges P2
MAC3 MacDonnell Ranges P3

Mallee
MAL1 Eastern Mallee
MAL2 Western Mallee

Murray Darling Depression
MDD1 South Olary Plain
MDD2 Murray Mallee
MDD3 Murray Lakes and Coorong
MDD4 Lowan Mallee
MDD5 Wimmera
MDD6 Darling Depression

Mitchell Grass Downs
MGD1 Mitchell Grass Downs P1
MGD2 Barkly Tableland
MGD3 Georgina Limestone
MGD4 Southwestern Downs
MGD5 Kynuna Plateau
MGD6 Northern Downs
MGD7 Central Downs
MGD8 Southern Wooded Downs

Mulga Lands
MUL1 West Balonne Plains
MUL2 Eastern Mulga Plains
MUL3 Nebine Plains
MUL4 North Eastern Plains
MUL5 Warrego River Plains
MUL6 Langlo Plains
MUL7 Cuttaburra-Paroo
MUL8 West Warrego
MUL9 Northern Uplands
MUL10 West Bulloo
MUL11 Urisino Sandplains
MUL12 Warrego Sands
MUL13 Kerribree Basin
MUL14 White Cliffs Plateau
MUL15 Paroo Overflow
MUL16 Paroo-Darling Sands

Murchison
MUR1 Eastern Murchison
MUR2 Western Murchison

Nandewar
NAN1 Northern Complex
NAN2 Inverell Basalts
NAN3 Kaputar
NAN4 Peel

Naracoorte Coastal Plain
NCP1 Bridgewater
NCP2 Glenelg Plain
NCP3 Lucindale
NCP4 Tintinara

New England Tableland
NET1 Bundarra Downs
NET2 Beardy River Hills
NET3 Walcha Plateau
NET4 Armidale Plateau
NET5 Wongwibinda Plateau
NET6 Deepwater Downs
NET7 Glenn Innes-Guyra Basalts
NET8 Ebor Basalts
NET9 Moredun Volcanics
NET10 Severn River Volcanics
NET11 Northeast Forest Lands
NET12 Tenterfield Plateau
NET13 Yarrowyck-Kentucky Downs
NET14 Binghi Plateau
NET15 Stanthorpe Plateau
NET16 Eastern Nandewars
NET17 Tingha Plateau
NET18 Nightcap
NET19 Round Mountain

Northern Kimberley
NK1 Mitchell
NK2 Berkeley

NSW North Coast
NNC1 Scenic Rim
NNC2 NSW North Coast 2

NSW South Western Slopes
NSS1 Upper Slopes
NSS2 Lower Slopes

Nullabor
NUL1 Carlisle
NUL2 Nullabor Plain
NUL3 Yalata

Mount Isa Inlier
NWH1 Southwestern Plateaus & Floodouts
NWH2 Thorntonia
NWH3 Mount Isa Inlier

Ord Victoria Plain
OVP1 Ord
OVP2 South Kimberley Interzone
OVP3 Ord-Victoria Plains P3
OVP4 Ord-Victoria Plains P4

Pine Creek
PCK Pine Creek

Pilbara
PIL1 Chichester
PIL2 Fortescue
PIL3 Hamersley
PIL4 Roebourne

Riverina
RIV1 Lachlan
RIV2 Murrumbidgee
RIV3 Murray Fans
RIV4 Victorian Riverina
RIV5 Robinvale Plains
RIV6 Murray Scroll Belt

Sydney Basin (bioregion)
SB Sydney Basin

South East Coastal Plain
SCP1 Gippsland Plain
SCP2 Otway Plain
SCP3 Warrnambool Plain

South East Corner
SEC1 East Gippsland Lowlands
SEC2 South East Coastal Ranges

South Eastern Highlands
SEH1 Highlands-Southern Fall
SEH2 Highlands-Northern Fall
SEH3 Otway Ranges
SEH4 Strzelecki Ranges
SEH5 South Eastern Highlands

South Eastern Queensland
SEQ1 Burnett - Curtis Hills and Ranges
SEQ2 Moreton Basin
SEQ3 Southeast Hills and Ranges
SEQ4 Southern Coastal Lowlands
SEQ5 Brisbane - Barambah Volcanics
SEQ6 South Burnett
SEQ7 Gympie Block
SEQ8 Burnett - Curtis Coastal Lowlands
SEQ9 Great Sandy

Simpson-Strzelecki Dunefields
SSD1 Simpson-Strzelecki Dunefields P1
SSD2 Simpson Desert
SSD3 Dieri
SSD4 Warriner
SSD5 Strzelecki Desert
SSD6 Central Depression
SSD7 Bulloo Dunefields

Stony Plains
STP1 Breakaways
STP2 Oodnadatta
STP3 Murnpeowie
STP4 Peake-Dennison Inlier
STP5 Macumba

Sturt Plateau
STU1 Sturt Plateau P1
STU2 Sturt Plateau P2
STU3 Sturt Plateau P3

Swan Coastal Plain
SWA1 Dandarragan Plateau
SWA2 Perth

Tanami
TAN1 Tanami P1
TAN2 Tanami P2
TAN3 Tanami P3

Tasmania (bioregions only)
BEL Ben Lomond
KIN King
TCH Tasmanian Central Highlands
TNM Tasmanian Northern Midlands
TNS Tasmanian Northern Slopes
TSE Tasmanian South East
TSR Tasmanian Southern Ranges
TWE Tasmanian West

Tiwi Coburg
TIW1 Tiwi-Cobourg P1
TIW2 Tiwi-Cobourg P2

Victoria Bonaparte
VB1 Victoria Bonaparte P1
VB2 Victoria Bonaparte P2
VB3 Victoria Bonaparte P3

Victorian Midlands
VM1 Goldfields
VM2 Central Victorian Uplands
VM3 Greater Grampians
VM4 Dundas Tablelands

Victorian Volcanic Plain
VVP1 Victorian Volcanic Plain
VVP2 Mount Gambier

Warren
WAR Warren

Wet Tropics
WET1 Herbert
WET2 Tully
WET3 Innisfail
WET4 Atherton
WET5 Paluma - Seaview
WET6 Kirrama - Hinchinbrook
WET7 Bellenden Ker - Lamb
WET8 Macalister
WET9 Daintree - Bloomfield

Yalgoo
YAL Yalgoo

APPENDIX 3. SUMMARY ASSESSMENT FINDINGS FOR EACH RIVER BASIN

Summary findings from the catchment, river and estuary assessments are presented as aggregated index scores at a river basin scale (Appendix 1).

River basin assessment attributes

Attribute	Units	Description
Land use		
Nature conservation	%	Areas used for nature conservation that meet IUCN reserve guidelines.
Other protected areas	%	Managed resource protection area including indigenous use.
Minimal use	%	Areas with minimal use – primarily crown land.
Livestock grazing	%	Grazing using native pastures in relatively natural environments.
Forestry	%	Production, plantation or farm forestry.
Dryland agriculture	%	Grazing modified pastures, cropping or horticulture.
Irrigated agriculture	%	Irrigated modified pastures, irrigated cropping or irrigated horticulture.
Built environment	%	Residential, transport or communication.
Water	%	Lakes, reservoirs, rivers, wetlands or estuaries.
Catchment condition		
Land condition	index	Based on relative rank scores for dryland salinity risk/hazard, soil degradation hazard and hillslope erosion ratio indicators.
Water condition	index	Based on relative rank scores for suspended sediment load, pesticide hazard, industrial point source hazard, nutrient point source hazard and impoundment density indicators.
Biota condition	index	Based on relative rank scores for native vegetation fragmentation and extent, protected areas, road density, feral animal density and weed density indicators.
Composite	index	An overall score combining relative rank scores for all land, water and biota condition indicators.
River condition		
Aquatic biota (macroinvertebrates) condition: index	index	A linear ecological gradient between 0 and 1 to describe distance from reference extremely impaired (0 – 0.28), severely impaired (0.28 – 0.55), significantly impaired (0.55 – 0.83), and reference condition (0.83 – 1.00).
Environment index	index	A linear ecological gradient between 0 and 1 to describe distance from reference condition: extensively modified (0 – 0.25), substantially modified (0.25 – 0.50), moderately modified (0.50 – 0.75) and largely unmodified (0.75 – 1.00).
Catchment disturbance subindex	index	A subindex of the environment index based on land cover change.
Hydrological disturbance subindex	index	A subindex of the environment index based on change to flow regimes from river regulation, flow diversion or extraction.
Nutrient and suspended sediment load subindex	index	A subindex of the environment index based on changes to suspended sediment and total nutrient loads, and toxicant levels.
Habitat subindex	index	A subindex of the environment index based on bed condition, riparian vegetation, and river and floodplain connectivity.
Riparian vegetation	index	Contributes to the habitat subindex and is an estimate of extent of riparian tree cover.
Estuary condition		
Condition	class	Estuaries are classified near pristine, largely unmodified, modified or extensively modified. Indices include measures of state (ecosystem integrity, water and sediment quality, fish health, habitat condition) and pressure (utilisation and susceptibility).
Class	class	Estuaries are dominated by either wave, tide or river energies.
Subclass	class	Six subclasses further describe the influencing energies on estuaries and coastal waterways: wave-dominated estuary, strandplain, tide dominated estuary, tidal flat/creek, wave-dominated delta, and tide-dominated delta. The subclass 'other' includes drowned river valleys, embayments and small coastal lagoons, lakes and creeks.

	Basin number		001	002	003	004	005	006	007	011	012
	Basin name	Units	Georgina River	Diamantina River	Coopers Creek	Lake Frome	Finke River	Todd River	Hay River	Bulloo River	Lake Bancannia
LAND USE	Nature conservation	%	3.1	5.5	1.6	8.1	9.0	1.0	10.6	4.1	3.5
LAND USE	Other protected areas	%	1.5	2.5	7.3	2.9	13.4	15.1	25.4	0.0	0.0
LAND USE	Minimal use	%	3.5	1.4	2.2	1.8	0.5	12.8	33.9	2.1	2.7
LAND USE	Livestock grazing	%	91.6	89.4	87.5	85.7	77.0	70.7	30.0	92.3	92.2
LAND USE	Forestry	%	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.5
LAND USE	Dryland agriculture	%	0.0	0.1	0.6	0.2	0.0	0.0	0.0	0.0	0.0
LAND USE	Irrigated agriculture	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LAND USE	Built environment	%	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
LAND USE	Water	%	0.3	1.1	0.9	1.0	0.1	0.0	0.0	1.5	1.0
CATCHMENT CONDITION	Catchment land condition	index									
CATCHMENT CONDITION	Catchment water condition	index									
CATCHMENT CONDITION	Catchment biota condition	index									
CATCHMENT CONDITION	Catchment condition – composite	index									
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index									
RIVER CONDITION	Environment index	index									
RIVER CONDITION	Catchment disturbance subindex	index									
RIVER CONDITION	Hydrological disturbance subindex	index									
RIVER CONDITION	Nutrient and suspended sediment load subindex	index									
RIVER CONDITION	Habitat subindex	index									
RIVER CONDITION	Riparian vegetation	index									

	Basin number		101		102
	Basin name	Units	Jacky Jacky Creek		Olive/Pascoe Rivers
LAND USE	Nature conservation	%	27.0		4.1
LAND USE	Other protected areas	%	21.0		34.5
LAND USE	Minimal use	%	1.6		2.3
LAND USE	Livestock grazing	%	49.5		58.2
LAND USE	Forestry	%	0.0		0.0
LAND USE	Dryland agriculture	%	0.0		0.2
LAND USE	Irrigated agriculture	%	0.0		0.0
LAND USE	Built environment	%	0.1		0.0
LAND USE	Water	%	0.7		0.8
CATCHMENT CONDITION	Catchment land condition	index	1		1
CATCHMENT CONDITION	Catchment water condition	index	2		2
CATCHMENT CONDITION	Catchment biota condition	index	2		2
CATCHMENT CONDITION	Catchment condition – composite	index	1		2
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	–		0.78
RIVER CONDITION	Environment index	index	0.63		0.7
RIVER CONDITION	Catchment disturbance subindex	index	0.73		0.78
RIVER CONDITION	Hydrological disturbance subindex	index	1		1
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.32		0.44
RIVER CONDITION	Habitat subindex	index	1		1
RIVER CONDITION	Riparian vegetation	index	–		–

Estuaries in 101

317 Q100, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

318 Harmer Creek, QLD
Condition: near pristine
Class: river
Subclass: tide delta

319 Q102, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

320 Macmillan River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

321 Olive River, QLD
Condition: near pristine
Class: river
Subclass: wave delta

322 Q105, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

323 Glennie Inlet, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

324 Kangaroo River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

325 Hunter Inlet, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

326 Pascoe River, QLD
Condition: near pristine
Class: river
Subclass: wave delta

327 Claudie River, QLD
Condition: near pristine
Class: river
Subclass: wave delta

021 Gairdner		022 Nullarbor	023 Warburton Lake	024 Salt Desert	025 Sandy		026 Mackay	027 Burt	028 Wiso	029 Barkly
11.1	**Estuaries in 021**	17.5	12.3	6.7	4.3	**Estuaries in 025**	2.4	0.5	0.1	1.0
16.8	534 Venus Bay, SA Condition: largely unmodified Class: tide Subclass: other	20.5	60.3	4.0	1.6	688 Port Smith, WA Condition: near pristine Class: wave Subclass: strandplain	62.3	32.3	56.3	9.6
4.7		29.5	23.5	39.8	86.7		14.7	0.9	1.4	12.0
60.6		32.5	4.0	47.4	7.2		20.5	65.5	42.0	76.0
0.0	535 Baird Bay, SA Condition: modified Class: tide Subclass: other	0.0	0.0	0.2	0.0	689 Yardoogarra Creek, WA Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	0.0	0.0	0.0
5.7		0.0	0.0	0.8	0.1		0.0	0.0	0.0	0.0
0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
0.1	536 Blanche Port, SA Condition: modified Class: tide Subclass: other	0.0	0.0	0.0	0.0	690 Dampier Creek (Broome), WA Condition: largely unmodified Class: tide Subclass: tidal flat/creek	0.0	0.0	0.0	0.0
1.0		0.0	0.0	1.1	0.1		0.2	0.8	0.2	1.3
2	537 Smokey Bay, SA Condition: near pristine Class: tide Subclass: other					691 Willies Creek, WA Condition: near pristine Class: tide Subclass: tidal flat/creek				
1										
2										
2	538 Tourville Bay, SA Condition: near pristine Class: tide Subclass: other					692 Carnot Bay, WA Condition: near pristine Class: tide Subclass: other				

103 Lockhart River			104 Stewart River	105 Normanby River	
11.2	**Estuaries in 103**		2.1	22.4	**Estuaries in 105**
56.5	328 Lockhardt River, QLD Condition: near pristine Class: tide Subclass: tide estuary	334 Breakfast Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	0.0	339 Normanby River, QLD Condition: near pristine Class: river Subclass: tide delta
9.1			9.1	4.9	
9.6	329 Nesbit River, QLD Condition: near pristine Class: river Subclass: wave delta	335 Stewart River, QLD Condition: near pristine Class: river Subclass: wave delta	61.2	69.9	340 Marrett River, QLD Condition: near pristine Class: river Subclass: tide delta
12.9			25.7	2.0	
0.0			0.9	0.0	
0.0	330 Q113, QLD Condition: near pristine Class: wave Subclass: strandplain	336 Five-Mile Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	0.0	
0.1			0.1	0.0	
0.5			1.0	0.7	
1	331 Chester River, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	337 North Kennedy River, QLD Condition: near pristine Class: river Subclass: tide delta	1	2	
3			2	1	
1			1	2	
2	332 Rocky River, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	338 Bizant River, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	2	1	
–			–	–	
0.77			0.68	0.77	
0.91	333 Massey Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek		0.68	0.72	
1			1	1	
0.55			0.44	0.63	
1			0.98	0.99	
–			–	0.99	

Home
Summary
Contents

		Basin number	106
		Basin name	Jeannie River
LAND USE	Nature conservation	%	37.3
	Other protected areas	%	16.1
	Minimal use	%	3.2
	Livestock grazing	%	40.5
	Forestry	%	0.0
	Dryland agriculture	%	0.2
	Irrigated agriculture	%	0.0
	Built environment	%	0.0
	Water	%	2.7
CATCHMENT CONDITION	Catchment land condition	index	1
	Catchment water condition	index	1
	Catchment biota condition	index	2
	Catchment condition – composite	index	1
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	–
	Environment index	index	0.83
	Catchment disturbance subindex	index	0.8
	Hydrological disturbance subindex	index	1
	Nutrient and suspended sediment load subindex	index	0.72
	Habitat subindex	index	1
	Riparian vegetation	index	1

Estuaries in 106

341 Q124, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

342 Q125, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

343 Saltwater Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

344 Wakooka Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

345 Q128, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

346 Howick River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

347 Rocky Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

348 Dead Dog Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

349 Jeannie River, QLD
Condition: near pristine
Class: river
Subclass: wave delta

350 Hummock Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

351 Q134, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

352 Starke River, QLD
Condition: near pristine
Class: river
Subclass: tide delta

353 Q136, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

354 Q137, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

355 Q138, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

356 Q139, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

357 Q140, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

358 Mcivor River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

359 Endeavour River, QLD
Condition: largely unmodified
Class: river
Subclass: wave delta

		Basin number	110		111	112	
		Basin name	Barron River		Mulgrave–Russell River	Johnstone River	
LAND USE	Nature conservation	%	2.2	**Estuaries in 110**	32.5	13.4	**Estuaries in 112**
	Other protected areas	%	0.0	371 Half Moon Creek, QLD Condition: not assessed Class: tide Subclass: tidal flat/creek	7.7	0.0	376 Moresby River, QLD Condition: modified Class: tide Subclass: tide estuary
	Minimal use	%	10.8		15.9	18.4	
	Livestock grazing	%	38.8		2.7	11.1	377 Liverpool Creek, QLD Condition: largely unmodified Class: river Subclass: wave delta
	Forestry	%	35.5	372 Barron River, QLD Condition: modified Class: river Subclass: wave delta	17.7	26.0	
	Dryland agriculture	%	7.0		13.2	26.8	
	Irrigated agriculture	%	1.1		0.8	1.6	
	Built environment	%	4.1	373 Trinity Inlet, QLD Condition: modified Class: tide Subclass: tidal flat/creek	7.5	0.7	378 Maria Creek, QLD Condition: largely unmodified Class: river Subclass: wave delta
	Water	%	0.5		2.1	2.1	
CATCHMENT CONDITION	Catchment land condition	index	3		3	3	
	Catchment water condition	index	4	374 Mutchero Inlet/Russell Mulgrave, QLD Condition: modified Class: river Subclass: wave delta	4	4	379 Hull River, QLD Condition: largely unmodified Class: river Subclass: wave delta
	Catchment biota condition	index	3		3	4	
	Catchment condition – composite	index	4		3	4	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.81	375 Johnstone River, QLD Condition: modified Class: river Subclass: tide delta	0.97	0.89	
	Environment index	index	0.66		0.77	0.7	
	Catchment disturbance subindex	index	0.54		0.78	0.66	
	Hydrological disturbance subindex	index	0.78		1	1	
	Nutrient and suspended sediment load subindex	index	0.56		0.6	0.52	
	Habitat subindex	index	0.95		0.91	0.97	
	Riparian vegetation	index	0.92		0.89	0.96	

107 Endeavour River		108 Daintree River			109 Mossman River	
4.1	**Estuaries in 107**	31.1	**Estuaries in 108**		17.5	**Estuaries in 109**
26.7	360 Annan River, QLD Condition: largely unmodified Class: river Subclass: wave delta	0.6	362 Bloomfield River, QLD Condition: near pristine Class: river Subclass: wave delta	367 Saltwater Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	0.0	370 Mowbray River, QLD Condition: largely unmodified Class: river Subclass: tide delta
6.8		20.9			20.6	
45.4		8.8	363 Noah Creek, QLD Condition: near pristine Class: river Subclass: wave delta		18.9	
15.9	361 Bauer Inlet, QLD Condition: near pristine Class: wave Subclass: other	35.4		368 Mossman River, QLD Condition: largely unmodified Class: river Subclass: tide delta	27.9	
0.3		2.9			7.9	
0.0		0.0	364 Cooper Creek, QLD Condition: near pristine Class: river Subclass: wave delta		0.0	
0.0		0.0			4.7	
0.7		0.3		369 Dicksons Inlet, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	2.5	
3		2	365 Mackenzie Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek		2	
2		2			2	
3		1			3	
2		2			3	
–		0.91	366 Daintree River, QLD Condition: near pristine Class: river Subclass: tide delta		0.86	
0.72		0.79			0.78	
0.76		0.78			0.71	
1		1			1	
0.5		0.65			0.68	
1		0.99			0.97	
1		0.99			0.94	

113 Tully River		114 Murray River (Qld)	115 Hinchinbrook Island	
3.0	**Estuaries in 113**	32.0	100.0	**Estuaries in 115**
0.0	380 Tully River, QLD Condition: modified Class: river Subclass: wave delta	0.2	0.0	387 Coral Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
6.7		6.5	0.0	
19.1		24.9	0.0	
64.1	381 Murray River, QLD Condition: largely unmodified Class: river Subclass: wave delta	30.4	0.0	388 Q171, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
4.7		2.1	0.0	
0.2		0.4	0.0	
0.1	382 Dallachy Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.2	0.0	389 Deep Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
2.0		3.3	0.0	
3	383 Wreck Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	3		390 Zoe Bay, QLD Condition: near pristine Class: wave Subclass: strandplain
4		2		
3		3		
4	384 Meunga Creek, QLD Condition: largely unmodified Class: river Subclass: tide delta	3		391 Gentle Annie Creek, QLD Condition: modified Class: river Subclass: wave delta
0.95		0.94		
0.78		0.81		
0.71	385 Hinchinbrook Channel, QLD Condition: largely unmodified Class: tide Subclass: other	0.73		392 Victoria Creek, QLD Condition: modified Class: river Subclass: wave delta
1		1		
0.76		0.74		
0.77	386 Missionary Bay, QLD Condition: near pristine Class: tide Subclass: other	0.98		
0.72		0.98		

Home
Summary
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Basin number		116			117	
Basin name	Units	Herbert River			Black River	
LAND USE						
Nature conservation	%	13.6	**Estuaries in 116**		10.5	**Estuaries in 117**
Other protected areas	%	0.0	393 Palm Creek, QLD Condition: modified Class: river Subclass: wave delta		4.7	397 Crystal Creek, QLD Condition: largely unmodified Class: river Subclass: wave delta
Minimal use	%	13.8			19.1	
Livestock grazing	%	55.6	394 Orient Creek, QLD Condition: modified Class: river Subclass: wave delta		43.1	398 Ollera Creek, QLD Condition: largely unmodified Class: river Subclass: wave delta
Forestry	%	10.1			16.5	
Dryland agriculture	%	5.8			4.4	
Irrigated agriculture	%	0.2	395 Cattle Creek, QLD Condition: modified Class: tide Subclass: tide estuary		1.3	399 Rollingstone Creek, QLD Condition: largely unmodified Class: river Subclass: wave delta
Built environment	%	0.2			0.3	
Water	%	0.8			0.1	
CATCHMENT CONDITION						
Catchment land condition	index	2	396 Fig Tree Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek		3	400 Leichhardt Creek, QLD Condition: near pristine Class: river Subclass: wave delta
Catchment water condition	index	3			2	
Catchment biota condition	index	3			3	
Catchment condition – composite	index	3			2	
RIVER CONDITION						
Aquatic biota (macroinvertebrates) index	index	0.95	781 Herbert River, QLD Condition: modified Class: river Subclass: tide delta		0.86	401 Sleeper Log Creek, QLD Condition: largely unmodified Class: river Subclass: wave delta
Environment index	index	0.76			0.76	
Catchment disturbance subindex	index	0.67			0.71	
Hydrological disturbance subindex	index	–			–	
Nutrient and suspended sediment load subindex	index	0.76			0.7	
Habitat subindex	index	0.91			1	
Riparian vegetation	index	0.94			1	

Basin number		120	121			122	
Basin name	Units	Burdekin River	Don River			Proserpine River	
LAND USE							
Nature conservation	%	1.1	5.4	**Estuaries in 121**		14.4	**Estuaries in 122**
Other protected areas	%	0.1	0.0	421 Euri Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek		0.0	423 Yeates Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
Minimal use	%	5.0	5.1			20.4	
Livestock grazing	%	89.8	82.9	422 Don River, QLD Condition: modified Class: wave Subclass: wave estuary		41.4	424 Longford Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
Forestry	%	1.0	0.0			9.9	
Dryland agriculture	%	2.5	0.6			6.7	
Irrigated agriculture	%	0.1	0.9			3.6	425 Gregory River, QLD Condition: near pristine Class: river Subclass: tide delta
Built environment	%	0.0	0.1			0.3	
Water	%	0.3	5.0			3.1	
CATCHMENT CONDITION							
Catchment land condition	index	4	3			2	426 Miralda Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
Catchment water condition	index	2	2			2	
Catchment biota condition	index	3	4			3	
Catchment condition – composite	index	3	3			3	427 Repulse Creek, QLD Condition: near pristine Class: river Subclass: tide delta
RIVER CONDITION							
Aquatic biota (macroinvertebrates) index	index	0.91	–			0.81	
Environment index	index	0.56	0.58			0.61	
Catchment disturbance subindex	index	0.63	0.63			0.66	428 Proserpine River, QLD Condition: modified Class: river Subclass: tide delta
Hydrological disturbance subindex	index	0.52	–			–	
Nutrient and suspended sediment load subindex	index	0.38	0.38			0.42	
Habitat subindex	index	0.85	0.95			0.89	429 Thompson Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek
Riparian vegetation	index	0.96	0.93			0.87	

	118 Ross River		119 Haughton River	
402 Bluewater Creek, QLD Condition: largely unmodified Class: river Subclass: wave delta	8.6	**Estuaries in 118**	12.1	**Estuaries in 119**
403 Althaus Creek, QLD Condition: largely unmodified Class: river Subclass: wave delta	0.0	405 Bohle River, QLD Condition: modified Class: river Subclass: tide delta	0.0	408 Alligator Creek, QLD Condition: largely unmodified Class: river Subclass: tide delta
404 Black River, QLD Condition: modified Class: river Subclass: wave delta	14.2	406 Ross River, QLD Condition: modified Class: tide Subclass: tidal flat/creek	9.5	409 Crocodile Creek, QLD Condition: near pristine Class: river Subclass: tide delta
	35.3	407 Sandfly Creek, QLD Condition: modified Class: tide Subclass: tidal flat/creek	54.3	410 Haughton River, QLD Condition: modified Class: river Subclass: tide delta
	3.5		0.7	411 Barramundi Creek, QLD Condition: largely unmodified Class: river Subclass: tide delta
	0.7		1.5	412 Q195, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek
	0.3		7.1	413 Barratta Creek, QLD Condition: modified Class: river Subclass: tide delta
	35.7		12.2	414 Mud Creek, QLD Condition: largely unmodified Class: wave Subclass: strandplain
	1.8		2.6	415 Plantation Creek, QLD Condition: largely unmodified Class: wave Subclass: strandplain
	3		3	416 Burdekin River, QLD Condition: modified Class: river Subclass: tide delta
	4		2	417 Rocky Ponds Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	4		5	418 Nobbies Inlet, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	4		4	419 Elliot River, QLD Condition: near pristine Class: tide Subclass: other
	0.87		0.77	420 Branch Creek, QLD Condition: near pristine Class: wave Subclass: strandplain
	0.61		0.64	
	0.66		0.65	
	–		–	
	0.66		0.49	
	0.54		0.93	
	0.78		0.96	

123 Whitsunday Island	124 O'Connell River			125 Pioneer River
94.8	10.3	**Estuaries in 124**		6.8
0.0	0.0	430 O'Connell River, QLD Condition: largely unmodified Class: river Subclass: tide delta	437 Constant Creek, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	0.0
0.0	30.0			32.1
1.4	36.6			17.9
0.0	7.6	431 Dempster Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	438 Q221, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	21.3
2.8	11.3			10.9
0.9	3.2	432 Hervey Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	439 Reliance/Leila Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	9.7
0.0	0.3			1.3
0.0	0.7			0.1
	3	433 Blackrock Creek, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	440 Q223, QLD Condition: modified Class: tide Subclass: tidal flat/creek	3
	3			4
	3			3
	4	434 Murray Creek, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	441 Pioneer River, QLD Condition: extensively modified Class: river Subclass: tide delta	4
	0.89			0.94
	0.6	435 Victor Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	442 Bakers Creek, QLD Condition: modified Class: tide Subclass: tide estuary	0.61
	0.69			0.72
	–			0.51
	0.38	436 Plantation Creek, QLD Condition: largely unmodified Class: wave Subclass: strandplain	443 Sandy Creek, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	0.46
	0.97			0.92
	0.97			1

	Basin number		126			127
	Basin name	Units	Plane Creek			Styx River
LAND USE	Nature conservation	%	5.8	**Estuaries in 126**		6.4
LAND USE	Other protected areas	%	0.0	444 Louisa Creek, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	451 Walter Hall Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	0.0
LAND USE	Minimal use	%	29.4			11.1
LAND USE	Livestock grazing	%	30.8	445 Castrades Inlet, QLD Condition: largely unmodified Class: wave Subclass: wave estuary	452 Marion Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	76.3
LAND USE	Forestry	%	4.1			1.7
LAND USE	Dryland agriculture	%	18.2			2.1
LAND USE	Irrigated agriculture	%	10.2	446 Sarina Inlet, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	453 Basin Creek, QLD Condition: largely unmodified Class: river Subclass: tide delta	0.0
LAND USE	Built environment	%	0.1			0.2
LAND USE	Water	%	1.5			2.4
CATCHMENT CONDITION	Catchment land condition	index	4	447 Rocky Dam Creek, QLD Condition: modified Class: tide Subclass: tide estuary	454 West Hill Creek, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	3
CATCHMENT CONDITION	Catchment water condition	index	4			2
CATCHMENT CONDITION	Catchment biota condition	index	4			3
CATCHMENT CONDITION	Catchment condition – composite	index	4	448 Coconut Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	455 Carmila Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	3
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.92			–
RIVER CONDITION	Environment index	index	0.54	449 Cape Creek, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	456 Feather Creek, QLD Condition: largely unmodified Class: river Subclass: tide delta	0.58
RIVER CONDITION	Catchment disturbance subindex	index	0.63			0.62
RIVER CONDITION	Hydrological disturbance subindex	index	–			1
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.29	450 Knobler Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek		0.25
RIVER CONDITION	Habitat subindex	index	1			0.92
RIVER CONDITION	Riparian vegetation	index	1			0.88

	Basin number		129			130
	Basin name	Units	Water Park Creek			Fitzroy River (Qld)
LAND USE	Nature conservation	%	16.2	**Estuaries in 129**		3.7
LAND USE	Other protected areas	%	0.4	473 Q256, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	480 Causeway Lake, QLD Condition: modified Class: wave Subclass: wave estuary	0.4
LAND USE	Minimal use	%	56.6			9.9
LAND USE	Livestock grazing	%	14.5			65.6
LAND USE	Forestry	%	9.7	474 Q257, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	481 Cawarral Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	6.8
LAND USE	Dryland agriculture	%	0.9			12.5
LAND USE	Irrigated agriculture	%	0.0			0.2
LAND USE	Built environment	%	0.2	475 Canoe Passage, QLD Condition: near pristine Class: tide Subclass: other	482 Pumpkin Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	0.6
LAND USE	Water	%	1.4			0.3
CATCHMENT CONDITION	Catchment land condition	index	3	476 Q259, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	483 Fitzroy River, QLD Condition: modified Class: tide Subclass: tide estuary	4
CATCHMENT CONDITION	Catchment water condition	index	2			3
CATCHMENT CONDITION	Catchment biota condition	index	3			4
CATCHMENT CONDITION	Catchment condition – composite	index	3	477 Island Head Creek, QLD Condition: near pristine Class: tide Subclass: tide estuary	484 Curtis Island Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	3
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.8			0.89
RIVER CONDITION	Environment index	index	0.77	478 Port Clinton, QLD Condition: near pristine Class: tide Subclass: other	485 The Narrows, QLD Condition: largely unmodified Class: tide Subclass: other	0.49
RIVER CONDITION	Catchment disturbance subindex	index	0.81			0.65
RIVER CONDITION	Hydrological disturbance subindex	index	–			0.32
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.66	479 Corio Bay, QLD Condition: largely unmodified Class: tide Subclass: tide estuary	486 Calliope River, QLD Condition: modified Class: river Subclass: tide delta	0.34
RIVER CONDITION	Habitat subindex	index	1			0.84
RIVER CONDITION	Riparian vegetation	index	1			0.89

	128
	Shoalwater Creek
	7.1
	0.0
	45.6
	43.6
	0.3
	0.9
	0.1
	0.1
	2.3
	4
	2
	3
	3
	–
	0.76
	0.75
	1
	0.61
	0.9
	0.94

Estuaries in 127

457 Clairview Creek, QLD
Condition: largely unmodified
Class: tide
Subclass: tide estuary

458 Saint Lawrence Creek, QLD
Condition: largely unmodified
Class: tide
Subclass: tide estuary

459 Waverly Creek, QLD
Condition: largely unmodified
Class: tide
Subclass: tide estuary

460 Styx River, QLD
Condition: largely unmodified
Class: tide
Subclass: tide estuary

461 Herbert Creek, QLD
Condition: largely unmodified
Class: tide
Subclass: tide estuary

462 Q245, QLD
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

463 Q246, QLD
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

464 Thirsty Sound, QLD
Condition: largely unmodified
Class: tide
Subclass: other

Estuaries in 128

465 Ross Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

466 Raspberry Creek, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

467 Oyster Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

468 Shoalwater Creek, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

469 Georges Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

470 Head Creek, QLD
Condition: near pristine
Class: tide
Subclass: other

471 East Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

472 Wadallah Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

	131	132	133	134
	Curtis Island	Calliope River	Boyne River	Baffle Creek
	9.0	0.2	3.1	8.6
	0.0	0.1	0.0	0.2
	14.0	12.5	26.0	30.9
	15.3	34.2	13.3	42.7
	12.2	6.1	12.0	11.3
	0.0	0.4	0.0	5.2
	0.0	0.0	0.0	0.2
	32.9	44.8	44.7	0.4
	16.5	1.7	0.9	0.5
	2	4	3	3
	2	3	4	2
	3	5	3	1
	2	4	4	3
	–	0.98	0.86	0.92
	0.74	0.52	0.67	0.57
	0.67	0.61	0.65	0.65
	1	–	0.86	–
	0.61	0.29	0.5	0.34
	1	0.79	0.76	0.99
	1	0.75	0.92	0.99

Estuaries in 132

487 Auckland Inlet, QLD
Condition: extensively modified
Class: tide
Subclass: tidal flat/creek

488 Boyne River, QLD
Condition: modified
Class: river
Subclass: tide delta

489 Colloseum Inlet, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

490 Rodd'S Harbour, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

491 Pancake Creek/Jenny Lind Creek, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

Estuaries in 133

1033 Port Curtis, QLD
Condition: modified
Class: tide
Subclass: other

Estuaries in 134

492 Eurimbula Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

493 Round Hill Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

494 Blackwater/Mitchell Creek, QLD
Condition: near pristine
Class: river
Subclass: wave delta

495 Baffle Creek, QLD
Condition: near pristine
Class: river
Subclass: tide delta

496 Littabella Creek, QLD
Condition: largely unmodified
Class: river
Subclass: wave delta

497 Kolan River, QLD
Condition: modified
Class: river
Subclass: wave delta

	Basin number		135	136		137	
	Basin name	Units	Kolan River	Burnett River		Burrum River	
LAND USE	Nature conservation	%	0.2	0.7	**Estuaries in 136** 498 Burnett River, QLD Condition: extensively modified Class: river Subclass: tide delta 499 Elliot River, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek	7.4	**Estuaries in 137** 500 Coonar Creek, QLD Condition: largely unmodified Class: wave Subclass: strandplain 501 Theodolite/Lagoon Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek 502 Burrum River, QLD Condition: largely unmodified Class: river Subclass: tide delta 503 Beelbi Creek, QLD Condition: largely unmodified Class: tide Subclass: tidal flat/creek 504 Great Sandy Strait, QLD Condition: largely unmodified Class: tide Subclass: other 505 Noosa River, QLD Condition: largely unmodified Class: wave Subclass: wave estuary 783 Hervey Bay, QLD Condition: largely unmodified Class: tide Subclass: other
LAND USE	Other protected areas	%	0.0	0.1		0.0	
LAND USE	Minimal use	%	33.1	18.1		32.3	
LAND USE	Livestock grazing	%	43.4	60.2		21.7	
LAND USE	Forestry	%	13.3	14.5		26.8	
LAND USE	Dryland agriculture	%	3.8	4.8		4.1	
LAND USE	Irrigated agriculture	%	5.5	1.0		6.8	
LAND USE	Built environment	%	0.3	0.4		0.5	
LAND USE	Water	%	0.3	0.2		0.4	
CATCHMENT CONDITION	Catchment land condition	index	4	5		3	
CATCHMENT CONDITION	Catchment water condition	index	4	3		4	
CATCHMENT CONDITION	Catchment biota condition	index	3	2		3	
CATCHMENT CONDITION	Catchment condition – composite	index	4	4		4	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	–	0.84		0.8	
RIVER CONDITION	Environment index	index	0.48	0.53		0.65	
RIVER CONDITION	Catchment disturbance subindex	index	0.68	0.63		0.65	
RIVER CONDITION	Hydrological disturbance subindex	index	–	0.72		0.96	
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.22	0.23		0.43	
RIVER CONDITION	Habitat subindex	index	0.69	0.74		0.76	
RIVER CONDITION	Riparian vegetation	index	0.91	0.76		1	

	Basin number		142		143	
	Basin name	Units	Pine River		Brisbane River	
LAND USE	Nature conservation	%	1.6	**Estuaries in 142** 511 Caboolture River, QLD Condition: modified Class: river Subclass: tide delta 512 Burpengary Creek, QLD Condition: modified Class: tide Subclass: tidal flat/creek 513 Pine River, QLD Condition: extensively modified Class: tide Subclass: tide estuary 514 Nundah/Cabbage Tree Creek, QLD Condition: extensively modified Class: tide Subclass: tidal flat/creek 515 Brisbane Airport Floodway/ Kedron Brook, QLD Condition: extensively modified Class: tide Subclass: tidal flat/creek	1.4	**Estuaries in 143** 516 Brisbane River, QLD Condition: extensively modified Class: river Subclass: tide delta 517 Tingalpa Creek, QLD Condition: extensively modified Class: river Subclass: tide delta 518 Hilliards Creek, QLD Condition: modified Class: tide Subclass: tidal flat/creek
LAND USE	Other protected areas	%	0.0		0.0	
LAND USE	Minimal use	%	26.0		20.4	
LAND USE	Livestock grazing	%	33.4		53.7	
LAND USE	Forestry	%	7.6		11.1	
LAND USE	Dryland agriculture	%	3.0		4.1	
LAND USE	Irrigated agriculture	%	1.0		2.5	
LAND USE	Built environment	%	26.3		6.4	
LAND USE	Water	%	1.0		0.3	
CATCHMENT CONDITION	Catchment land condition	index	5		5	
CATCHMENT CONDITION	Catchment water condition	index	5		4	
CATCHMENT CONDITION	Catchment biota condition	index	3		3	
CATCHMENT CONDITION	Catchment condition – composite	index	5		5	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.87		0.87	
RIVER CONDITION	Environment index	index	0.56		0.5	
RIVER CONDITION	Catchment disturbance subindex	index	0.58		0.59	
RIVER CONDITION	Hydrological disturbance subindex	index	–		0.47	
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.44		0.32	
RIVER CONDITION	Habitat subindex	index	0.71		0.7	
RIVER CONDITION	Riparian vegetation	index	0.8		0.63	

138 Mary River (Qld)		139 Fraser Island	140 Noosa River	141 Maroochy River	
1.4	**Estuaries in 138** 782 Mary River, QLD Condition: extensively modified Class: tide Subclass: tide estuary	99.2	41.3	5.3	**Estuaries in 141** 506 Maroochy River, QLD Condition: modified Class: wave Subclass: wave estuary 507 Mooloolah River, QLD Condition: modified Class: river Subclass: wave delta 508 Currimundi Creek, QLD Condition: modified Class: wave Subclass: strandplain 509 Moreton Bay, QLD Condition: modified Class: wave Subclass: wave estuary 510 Pumicestone Passage, QLD Condition: modified Class: tide Subclass: other
0.0		0.0	0.0	0.0	
24.9		0.5	19.0	17.0	
36.8		0.0	9.5	21.2	
28.4		0.0	24.7	20.5	
5.9		0.0	2.9	13.2	
1.3		0.0	0.6	1.3	
0.6		0.0	1.0	15.9	
0.1		0.0	0.9	5.2	
5			3	5	
4			3	5	
2			1	3	
4			3	5	
0.88			–	0.72	
0.57			0.77	0.56	
0.61			0.75	0.5	
–			1	–	
0.4			0.64	0.42	
0.78			0.91	0.95	
0.81			0.91	0.91	

144 Stradbroke Island		145 Logan–Albert River		146 South Coast	
38.4	**Estuaries in 144** 521 Southern Moreton Bay, QLD Condition: modified Class: tide Subclass: other 522 Tallebudgera Creek, QLD Condition: modified Class: tide Subclass: tidal flat/creek	8.4	**Estuaries in 145** 519 Eprapah Creek, QLD Condition: modified Class: tide Subclass: tidal flat/creek 520 Logan Albert River, QLD Condition: modified Class: river Subclass: tide delta	8.1	**Estuaries in 146** 784 Nerang River, QLD Condition: modified Class: river Subclass: wave delta 785 Coomera River, QLD Condition: extensively modified Class: river Subclass: tide delta 786 Pimpama River, QLD Condition: modified Class: river Subclass: tide delta 787 Coombabah Lake, QLD Condition: extensively modified Class: tide Subclass: tide estuary 523 Currumbin Creek, QLD Condition: modified Class: tide Subclass: tidal flat/creek
0.0		0.0		0.0	
21.4		13.1		33.4	
4.8		55.4		14.7	
0.0		1.6		3.4	
0.2		2.6		3.1	
0.2		1.8		0.1	
26.2		16.6		35.3	
7.2		0.3		1.5	
2		4		4	
3		5		4	
3		3		4	
3		4		4	
0.7		0.87		0.81	
–		0.58		0.64	
–		0.6		0.53	
–		0.88		–	
–		0.31		0.61	
–		0.75		0.9	
–		0.77		0.84	

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	Basin number		201		202
	Basin name	Units	Tweed River		Brunswick River
LAND USE	Nature conservation	%	16.2		7.3
	Other protected areas	%	0.0		0.0
	Minimal use	%	26.2		24.8
	Livestock grazing	%	39.7		46.4
	Forestry	%	2.2		0.0
	Dryland agriculture	%	13.5		16.1
	Irrigated agriculture	%	0.2		2.8
	Built environment	%	1.6		1.4
	Water	%	0.5		0.6
CATCHMENT CONDITION	Catchment land condition	index	4		4
	Catchment water condition	index	5		4
	Catchment biota condition	index	2		2
	Catchment condition – composite	index	4		4
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.63		0.42
	Environment index	index	0.62		0.65
	Catchment disturbance subindex	index	0.57		0.51
	Hydrological disturbance subindex	index	–		–
	Nutrient and suspended sediment load subindex	index	0.61		0.64
	Habitat subindex	index	0.68		1
	Riparian vegetation	index	0.53		1

Estuaries in 201

1 Tweed River, NSW
Condition: modified
Class: wave
Subclass: wave estuary

2 Cudgen Lake, NSW
Condition: extensively modified
Class: tide
Subclass: tidal flat/creek

788 Cobaki Broadwater, NSW
Condition: largely unmodified
Class: other
Subclass: other

789 Tallow Creek, NSW
Condition: modified
Class: wave
Subclass: strandplain

790 Lake Ainsworth, NSW
Condition: modified
Class: other
Subclass: other

791 Lake Arragan And River, NSW
Condition: near pristine
Class: wave
Subclass: other

792 Lake Cakora/Lagoon, NSW
Condition: near pristine
Class: wave
Subclass: other

793 Arrawarra/Yarrawarra Creek, NSW
Condition: largely unmodified
Class: wave
Subclass: other

	Basin number		205
	Basin name	Units	Bellinger River
LAND USE	Nature conservation	%	26.7
	Other protected areas	%	0.0
	Minimal use	%	11.5
	Livestock grazing	%	28.0
	Forestry	%	29.4
	Dryland agriculture	%	1.8
	Irrigated agriculture	%	1.1
	Built environment	%	0.7
	Water	%	0.8
CATCHMENT CONDITION	Catchment land condition	index	3
	Catchment water condition	index	4
	Catchment biota condition	index	1
	Catchment condition – composite	index	3
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.75
	Environment index	index	0.61
	Catchment disturbance subindex	index	0.65
	Hydrological disturbance subindex	index	–
	Nutrient and suspended sediment load subindex	index	0.46
	Habitat subindex	index	0.81
	Riparian vegetation	index	0.69

Estuaries in 205

10 Sandon River, NSW
Condition: near pristine
Class: river
Subclass: wave delta

11 Wooli Wooli River, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

12 Station Creek, NSW
Condition: near pristine
Class: wave
Subclass: other

13 Corindi River/Red Rock River, NSW
Condition: largely unmodified
Class: river
Subclass: wave delta

14 Woolgoolga Lake, NSW
Condition: extensively modified
Class: wave
Subclass: wave estuary

15 Moonee Creek And Lagoon, NSW
Condition: largely unmodified
Class: wave
Subclass: other

16 Boambee Creek, NSW
Condition: modified
Class: river
Subclass: wave delta

17 Bonville Creek, NSW
Condition: largely unmodified
Class: river
Subclass: wave delta

18 Bellinger River, NSW
Condition: modified
Class: river
Subclass: wave delta

19 Deep Creek, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

20 Nambucca River, NSW
Condition: extensively modified
Class: river
Subclass: wave delta

794 Hearns Lake, NSW
Condition: largely unmodified
Class: wave
Subclass: other

795 Coffs Harbour Creek, NSW
Condition: extensively modified
Class: wave
Subclass: other

796 Dalhousie Creek And Lagoon, NSW
Condition: largely unmodified
Class: wave
Subclass: strandplain

	203 Richmond River		204 Clarence River	
Estuaries in 202	11.0	**Estuaries in 203**	16.5	**Estuaries in 204**
3 Cudgera Creek, NSW Condition: largely unmodified Class: wave Subclass: strandplain	0.0 22.9 47.9	8 Evans River, NSW Condition: modified Class: river Subclass: wave delta	0.0 31.3 31.1	9 Clarence River, NSW Condition: extensively modified Class: wave Subclass: wave estuary
4 Mooball Creek, NSW Condition: modified Class: wave Subclass: strandplain	9.8 6.5 1.0		15.7 4.2 0.1	1000 Jerusalem Creek, NSW Condition: near pristine Class: wave Subclass: strandplain
5 Brunswick River, NSW Condition: extensively modified Class: river Subclass: wave delta	0.6 0.3		0.1 0.9	
6 Belongil Creek, NSW Condition: modified Class: wave Subclass: other	4 4 3		3 4 2	
7 Richmond River, NSW Condition: extensively modified Class: river Subclass: wave delta	4 0.59 0.63 0.62		3 0.72 0.59 0.68	
	– 0.44 0.71 0.56		– 0.39 0.86 0.78	

	206 Macleay River		207 Hastings River		208 Manning River
	21.9	**Estuaries in 206**	23.6	**Estuaries in 207**	12.5
797 Oyster Creek, NSW Condition: largely unmodified Class: wave Subclass: strandplain	0.0 20.0 37.0	21 Macleay River, NSW Condition: extensively modified Class: river Subclass: wave delta	0.0 27.7 24.2	22 Hastings River, NSW Condition: extensively modified Class: river Subclass: wave delta	0.0 33.5 35.6
798 South West Rocks Creek, NSW Condition: extensively modified Class: wave Subclass: other	5.3 15.5 0.0		22.0 1.0 0.5	23 Lake Cathie/Innes, NSW Condition: modified Class: wave Subclass: wave estuary	15.8 1.7 0.6
799 Saltwater Lagoon, NSW Condition: modified Class: wave Subclass: wave estuary	0.2 0.1		0.6 0.4	24 Camden Haven River, NSW Condition: modified Class: wave Subclass: wave estuary	0.2 0.1
800 Korogoro Creek, NSW Condition: largely unmodified Class: wave Subclass: strandplain	3 3 2		4 4 1	25 Manning River, NSW Condition: extensively modified Class: river Subclass: wave delta	4 4 1
801 Killick Creek, NSW Condition: modified Class: wave Subclass: strandplain	3 0.85 0.56		3 0.84 0.58	26 Khappinghat Creek, NSW Condition: near pristine Class: river Subclass: wave delta	3 0.8 0.64
802 Myall Lake And Myall River, NSW Condition: largely unmodified Class: wave Subclass: wave estuary	0.68 –		0.7 –		0.67 –
803 Tilligery Creek, NSW Condition: largely unmodified Class: wave Subclass: wave estuary	0.35 0.76 0.65		0.36 0.84 0.76		0.5 0.85 0.76

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	Basin number		209		210	211	
	Basin name	Units	Karuah River		Hunter River	Macquarie – Tuggerah Lakes	
LAND USE	Nature conservation	%	17.3	**Estuaries in 209** 27 Wallis Lake, NSW Condition: modified Class: wave Subclass: wave estuary 28 Smiths Lake, NSW Condition: largely unmodified Class: wave Subclass: other 29 Port Stephens, NSW Condition: largely unmodified Class: wave Subclass: wave estuary 30 Hunter River, NSW Condition: extensively modified Class: wave Subclass: wave estuary 1029 Karuah River, NSW Condition: largely unmodified Class: river Subclass: tide delta	20.2	2.6	**Estuaries in 211** 31 Lake Macquarie, NSW Condition: extensively modified Class: wave Subclass: wave estuary 32 Tuggerah Lakes, NSW Condition: extensively modified Class: wave Subclass: wave estuary 33 Brisbane Water, NSW Condition: extensively modified Class: wave Subclass: wave estuary 34 Hawkesbury River, NSW Condition: extensively modified Class: tide Subclass: other 35 Pittwater, NSW Condition: modified Class: tide Subclass: other
LAND USE	Other protected areas	%	0.0		0.0	0.0	
LAND USE	Minimal use	%	34.7		13.3	19.2	
LAND USE	Livestock grazing	%	27.8		54.8	5.5	
LAND USE	Forestry	%	13.9		3.4	22.2	
LAND USE	Dryland agriculture	%	3.1		5.5	0.3	
LAND USE	Irrigated agriculture	%	0.2		1.4	0.1	
LAND USE	Built environment	%	0.2		1.1	37.3	
LAND USE	Water	%	2.6		0.3	12.6	
CATCHMENT CONDITION	Catchment land condition	index	3		3	4	
CATCHMENT CONDITION	Catchment water condition	index	3		4	5	
CATCHMENT CONDITION	Catchment biota condition	index	1		4	2	
CATCHMENT CONDITION	Catchment condition – composite	index	3		4	4	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.87		0.67	0.62	
RIVER CONDITION	Environment index	index	0.59		0.58	0.56	
RIVER CONDITION	Catchment disturbance subindex	index	0.65		0.71	0.55	
RIVER CONDITION	Hydrological disturbance subindex	index	–		0.81	–	
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.43		0.34	0.5	
RIVER CONDITION	Habitat subindex	index	0.76		0.6	0.63	
RIVER CONDITION	Riparian vegetation	index	0.66		0.42	0.47	

	Basin number		214		215	
	Basin name	Units	Wollongong Coast		Shoalhaven River	
LAND USE	Nature conservation	%	24.6	**Estuaries in 214** 41 Lake Illawarra, NSW Condition: extensively modified Class: wave Subclass: wave estuary 42 Minnamurra River, NSW Condition: modified Class: river Subclass: wave delta 815 Bellambi Lake, NSW Condition: extensively modified Class: wave Subclass: other 816 Fairy Creek, NSW Condition: modified Class: wave Subclass: strandplain 1030 Towradgi Creek, NSW Condition: extensively modified Class: wave Subclass: other	24.3	**Estuaries in 215** 43 Shoalhaven/Crookhaven River, NSW Condition: extensively modified Class: river Subclass: wave delta 44 Wollumboola Lake, NSW Condition: largely unmodified Class: wave Subclass: wave estuary 45 Jervis Bay, NSW Condition: largely unmodified Class: tide Subclass: other 46 Currambeen Creek, NSW Condition: largely unmodified Class: river Subclass: wave delta 47 Saint Georges Basin, NSW Condition: modified Class: wave Subclass: wave estuary 817 Werri Lagoon, NSW Condition: modified Class: wave Subclass: wave estuary 818 Crooked River And Lagoon, NSW Condition: largely unmodified Class: wave Subclass: other
LAND USE	Other protected areas	%	0.0		0.0	
LAND USE	Minimal use	%	9.0		22.0	
LAND USE	Livestock grazing	%	26.1		32.8	
LAND USE	Forestry	%	0.1		11.2	
LAND USE	Dryland agriculture	%	2.3		8.8	
LAND USE	Irrigated agriculture	%	0.4		0.2	
LAND USE	Built environment	%	33.5		0.3	
LAND USE	Water	%	3.7		0.4	
CATCHMENT CONDITION	Catchment land condition	index	3		3	
CATCHMENT CONDITION	Catchment water condition	index	5		4	
CATCHMENT CONDITION	Catchment biota condition	index	1		2	
CATCHMENT CONDITION	Catchment condition – composite	index	3		4	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.47		0.82	
RIVER CONDITION	Environment index	index	0.67		0.63	
RIVER CONDITION	Catchment disturbance subindex	index	0.57		0.69	
RIVER CONDITION	Hydrological disturbance subindex	index	–		–	
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.73		0.48	
RIVER CONDITION	Habitat subindex	index	0.76		0.76	
RIVER CONDITION	Riparian vegetation	index	0.59		0.85	

		212 Hawkesbury River		213 Sydney Coast – Georges River	
		42.6	**Estuaries in 212**	3.4	**Estuaries in 213**
36 Narrabeen Lagoon, NSW Condition: extensively modified Class: wave Subclass: wave estuary		0.0	805 Wamberal Lagoon, NSW Condition: extensively modified Class: wave Subclass: other	0.0	810 Curl Curl/Harbord Lagoon, NSW Condition: extensively modified Class: wave Subclass: other
37 Port Jackson, NSW Condition: extensively modified Class: tide Subclass: other		11.8	806 Terrigal Lagoon, NSW Condition: modified Class: wave Subclass: other	24.6	811 Manly Lagoon And Creek, NSW Condition: extensively modified Class: wave Subclass: other
38 Botany Bay, NSW Condition: extensively modified Class: tide Subclass: other		23.9	807 Avoca Lake, NSW Condition: modified Class: wave Subclass: other	2.8	812 Cooks River, NSW Condition: extensively modified Class: tide Subclass: tidal flat/creek
39 Port Hacking, NSW Condition: modified Class: tide Subclass: other		4.5	808 Cockrone Lake, NSW Condition: extensively modified Class: wave Subclass: other	0.0	813 Georges River, NSW Condition: extensively modified Class: tide Subclass: other
40 Port Kembla Harbour, NSW Condition: extensively modified Class: wave Subclass: wave estuary		7.4	809 Dee Why Lagoon, NSW Condition: extensively modified Class: wave Subclass: other	0.0	814 Bellambi Creek, NSW Condition: extensively modified Class: wave Subclass: other
		0.5		0.3	
		9.0		67.0	
		0.3		1.6	
		4		5	
		5		5	
		2		1	
		4		5	
		0.66		0.28	
		0.63		0.56	
		0.72		0.49	
		–		–	
		0.49		0.49	
		0.75		0.75	
		0.85		0.66	

216 Clyde River – Jervis Bay	
22.6	**Estuaries in 216**
0.0	48 Swan Lake, NSW Condition: largely unmodified Class: wave Subclass: wave estuary
21.8	49 Lake Conjola, NSW Condition: modified Class: wave Subclass: wave estuary
5.8	50 Narrawallee Inlet, NSW Condition: largely unmodified Class: wave Subclass: wave estuary
45.6	51 Burrill Lake, NSW Condition: largely unmodified Class: wave Subclass: wave estuary
1.9	52 Tabourie Lake, NSW Condition: modified Class: wave Subclass: wave estuary
0.2	53 Meroo Lake, NSW Condition: near pristine Class: wave Subclass: wave estuary
0.3	54 Willinga Lake, NSW Condition: near pristine Class: wave Subclass: wave estuary
1.7	55 Durras Lake, NSW Condition: near pristine Class: wave Subclass: wave estuary
2	56 Clyde River/Batemans Bay, NSW Condition: largely unmodified Class: tide Subclass: other
4	57 Tomaga River, NSW Condition: largely unmodified Class: river Subclass: wave delta
1	819 Berrara Creek, NSW Condition: largely unmodified Class: wave Subclass: other
3	820 Nerrindillah Creek, NSW Condition: largely unmodified Class: wave Subclass: other
0.88	821 Mollymook Creek, NSW Condition: largely unmodified Class: wave Subclass: other
0.73	822 Ulladulla Harbour/Millards Creek, NSW Condition: extensively modified Class: wave Subclass: other
0.73	823 Termeil Lake, NSW Condition: near pristine Class: wave Subclass: wave estuary
–	824 Kioloa Lagoon, NSW Condition: largely unmodified Class: wave Subclass: other
0.63	825 Cullendulla Creek, NSW Condition: largely unmodified Class: tide Subclass: tidal flat/creek
0.87	826 Candlagan Creek And Lagoon, NSW Condition: largely unmodified Class: river Subclass: wave delta
0.89	827 Congo Creek And Lagoon, NSW Condition: largely unmodified Class: wave Subclass: other

	Basin number		217		218	
	Basin name	Units	Moruya River		Tuross River	
LAND USE	Nature conservation	%	42.5	**Estuaries in 217**	27.2	**Estuaries in 218**
	Other protected areas	%	0.0	58 Moruya River, NSW Condition: modified Class: wave Subclass: wave estuary	0.0	63 Wagonga Inlet, NSW Condition: modified Class: wave Subclass: wave estuary
	Minimal use	%	25.1		12.8	
	Livestock grazing	%	9.2	59 Coila Lake, NSW Condition: modified Class: wave Subclass: wave estuary	8.0	64 Corunna Lake, NSW Condition: largely unmodified Class: wave Subclass: wave estuary
	Forestry	%	19.8		44.6	
	Dryland agriculture	%	2.8		5.8	
	Irrigated agriculture	%	0.0	60 Tuross Lake, NSW Condition: modified Class: wave Subclass: wave estuary	0.4	829 Lake Brunderee, NSW Condition: near pristine Class: wave Subclass: other
	Built environment	%	0.3		0.1	
	Water	%	0.2		1.1	
CATCHMENT CONDITION	Catchment land condition	index	3	61 Lake Brou, NSW Condition: largely unmodified Class: wave Subclass: wave estuary	3	830 Lake Tarourga, NSW Condition: near pristine Class: wave Subclass: wave estuary
	Catchment water condition	index	3		3	
	Catchment biota condition	index	2		1	
	Catchment condition – composite	index	3	62 Lake Mummuga, NSW Condition: largely unmodified Class: wave Subclass: wave estuary	3	831 Kianga Lake, NSW Condition: modified Class: wave Subclass: other
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	1		0.88	
	Environment index	index	0.66	828 Meringo Creek And Lagoon, NSW Condition: largely unmodified Class: wave Subclass: other	0.74	832 Nangudga Lake, NSW Condition: largely unmodified Class: wave Subclass: wave estuary
	Catchment disturbance subindex	index	0.81		0.77	
	Hydrological disturbance subindex	index	–		–	
	Nutrient and suspended sediment load subindex	index	0.45		0.62	
	Habitat subindex	index	0.95		0.9	833 Baragoot Lake, NSW Condition: largely unmodified Class: wave Subclass: other
	Riparian vegetation	index	0.92		0.94	

	Basin number		220			221
	Basin name	Units	Towamba River			East Gippsland
LAND USE	Nature conservation	%	39.8	**Estuaries in 220**		30.0
	Other protected areas	%	0.0	76 Pambula Lake, NSW Condition: largely unmodified Class: wave Subclass: wave estuary	835 Back Lagoon, NSW Condition: modified Class: wave Subclass: other	0.0
	Minimal use	%	14.2			4.5
	Livestock grazing	%	8.1			1.0
	Forestry	%	36.9	77 Curalo Lagoon, NSW Condition: extensively modified Class: wave Subclass: wave estuary	836 Twofold Bay / Eden, NSW Condition: modified Class: tide Subclass: other	63.5
	Dryland agriculture	%	0.2			0.7
	Irrigated agriculture	%	0.1			0.1
	Built environment	%	0.1	78 Nullica River, NSW Condition: largely unmodified Class: wave Subclass: wave estuary	837 Nadgee Lake And Inlet, NSW Condition: near pristine Class: wave Subclass: other	0.0
	Water	%	0.4			0.0
CATCHMENT CONDITION	Catchment land condition	index	3			3
	Catchment water condition	index	4	79 Towamba River, NSW Condition: largely unmodified Class: wave Subclass: wave estuary		3
	Catchment biota condition	index	1			1
	Catchment condition – composite	index	3			3
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.97 (NSW)	80 Wonboyn River, NSW Condition: largely unmodified Class: wave Subclass: wave estuary		0.99 (NSW) 1 (Vic)
	Environment index	index	0.64 (NSW)			0.71 (NSW) 0.74 (Vic)
	Catchment disturbance subindex	index	0.65 (NSW)			0.69 (NSW) 0.68 (Vic)
	Hydrological disturbance subindex	index	–			1 (NSW) 0.65 (Vic)
	Nutrient and suspended sediment load subindex	index	0.5 (NSW)			0.51 (NSW) 0.77 (Vic)
	Habitat subindex	index	0.98 (NSW)			1 (NSW) 0.99 (Vic)
	Riparian vegetation	index	0.97 (NSW)			1

For further Victorian river information see www.vic.waterdata.net/isc

219
Bega River
38.2
0.0
16.7
30.3
9.5
2.2
2.5
0.1
0.4
3
4
2
3
0.94
0.61
0.7
–
0.48
0.7
0.61

Estuaries in 219

65 Tilba Tilba Lake, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

66 Wallaga Lake, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

67 Bermagui River, NSW
Condition: modified
Class: wave
Subclass: wave estuary

68 Cuttagee Lake, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

69 Murrah Lagoon, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

70 Wapengo Lagoon, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

71 Middle Lagoon, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

72 Nelson Lagoon, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

73 Bega River, NSW
Condition: modified
Class: wave
Subclass: wave estuary

74 Wallagoot Lake, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

75 Merimbula Lake, NSW
Condition: modified
Class: wave
Subclass: wave estuary

834 Bunga Lagoon, NSW
Condition: largely unmodified
Class: wave
Subclass: wave estuary

81 Merrica River, NSW
Condition: near pristine
Class: wave
Subclass: other

222
Snowy River
32.0
0.5
9.8
24.7
21.9
11.0
0.1
0.1
0.0
3
4
2
4
0.77 (NSW) 1 (Vic)
0.65 (NSW) 0.81 (Vic)
0.68 (NSW) 0.71 (Vic)
1
0.47 (NSW) 0.76 (Vic)
0.7 (NSW) 0.98 (Vic)
0.6 (NSW) 1 (Vic)

Estuaries in 221

602 Mallacoota Inlet, VIC
Condition: near pristine
Class: wave
Subclass: wave estuary

603 Betka River, VIC
Condition: near pristine
Class: wave
Subclass: wave estuary

604 Wingan Inlet, VIC
Condition: near pristine
Class: wave
Subclass: wave estuary

605 Mueller River, VIC
Condition: not assessed
Class: wave
Subclass: wave estuary

606 Tamboon Inlet, VIC
Condition: largely unmodified
Class: wave
Subclass: wave estuary

607 Sydenham Inlet, VIC
Condition: largely unmodified
Class: wave
Subclass: wave estuary

910 Shipwreck Creek, VIC
Condition: near pristine
Class: wave
Subclass: other

911 Benedore River, VIC
Condition: near pristine
Class: wave
Subclass: other

912 Red River, VIC
Condition: near pristine
Class: wave
Subclass: wave estuary

913 Easby Creek, VIC
Condition: near pristine
Class: wave
Subclass: wave estuary

915 Thurra River, VIC
Condition: near pristine
Class: wave
Subclass: other

Estuaries in 222

608 Yeerung River, VIC
Condition: near pristine
Class: wave
Subclass: strandplain

609 Snowy River, VIC
Condition: modified
Class: wave
Subclass: wave estuary

For further Victorian river information see www.vic.waterdata.net/isc

	Basin number		223		224	225	226	227
	Basin name	Units	Tambo River		Mitchell River	Thomson River	Latrobe River	South Gippsland
LAND USE	Nature conservation	%	4.4	**Estuaries in 223**	30.5	22.1	5.3	12.2
LAND USE	Other protected areas	%	0.0	610 Lake Tyers, VIC Condition: largely unmodified Class: wave Subclass: wave estuary	0.5	0.6	1.5	1.9
LAND USE	Minimal use	%	7.1		5.5	5.3	7.9	4.5
LAND USE	Livestock grazing	%	13.4		10.9	20.7	15.8	31.4
LAND USE	Forestry	%	67.1	611 Gippsland Lakes, VIC Condition: extensively modified Class: wave Subclass: wave estuary	48.3	42.2	33.2	13.5
LAND USE	Dryland agriculture	%	7.2		3.4	4.5	21.7	33.9
LAND USE	Irrigated agriculture	%	0.1		0.5	3.7	2.1	1.2
LAND USE	Built environment	%	0.2		0.3	0.3	11.0	0.6
LAND USE	Water	%	0.4		0.1	0.7	1.4	0.5
CATCHMENT CONDITION	Catchment land condition	index	4		4	4	4	4
CATCHMENT CONDITION	Catchment water condition	index	4		3	3	4	3
CATCHMENT CONDITION	Catchment biota condition	index	1		1	2	3	4
CATCHMENT CONDITION	Catchment condition – composite	index	3		3	4	4	4
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	1		1	0.97	0.88	0.92
RIVER CONDITION	Environment index	index	0.79		0.86	0.77	0.71	0.68
RIVER CONDITION	Catchment disturbance subindex	index	0.65		0.74	0.68	0.54	0.5
RIVER CONDITION	Hydrological disturbance subindex	index	0.97		0.93	0.76	0.74	0.72
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.78		0.91	0.83	0.8	0.69
RIVER CONDITION	Habitat subindex	index	0.94		0.98	0.86	0.87	1
RIVER CONDITION	Riparian vegetation	index	0.84		1	0.95	1	–

	Basin number		231			232
	Basin name	Units	Werribee River			Moorabool River
LAND USE	Nature conservation	%	8.6	**Estuaries in 231**		4.4
LAND USE	Other protected areas	%	0.0	621 Laverton Creek, VIC Condition: extensively modified Class: tide Subclass: other	626 Swan Bay, VIC Condition: modified Class: tide Subclass: other	0.1
LAND USE	Minimal use	%	6.0			11.7
LAND USE	Livestock grazing	%	38.6			39.1
LAND USE	Forestry	%	14.6	622 Skeleton Creek, VIC Condition: modified Class: wave Subclass: other	627 Barwon River, VIC Condition: modified Class: wave Subclass: wave estuary	3.3
LAND USE	Dryland agriculture	%	21.8			33.7
LAND USE	Irrigated agriculture	%	1.1			0.4
LAND USE	Built environment	%	8.4	623 Werribee River, VIC Condition: modified Class: river Subclass: wave delta	628 Thompson Creek, VIC Condition: modified Class: wave Subclass: strandplain	7.3
LAND USE	Water	%	0.1			0.0
CATCHMENT CONDITION	Catchment land condition	index	5			5
CATCHMENT CONDITION	Catchment water condition	index	4	624 Little River, VIC Condition: modified Class: tide Subclass: other		5
CATCHMENT CONDITION	Catchment biota condition	index	5			5
CATCHMENT CONDITION	Catchment condition – composite	index	5			5
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.83	625 Limeburners Bay, VIC Condition: modified Class: tide Subclass: tidal flat/creek		0.96
RIVER CONDITION	Environment index	index	0.44			0.49
RIVER CONDITION	Catchment disturbance subindex	index	0.53			0.49
RIVER CONDITION	Hydrological disturbance subindex	index	0.59			0.75
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.07			0.17
RIVER CONDITION	Habitat subindex	index	0.96			0.83
RIVER CONDITION	Riparian vegetation	index	1			–

For further Victorian river information see www.vic.waterdata.net/isc

	228 Bunyip River	229 Yarra River	230 Maribyrnong River
Estuaries in 227 612 Jack Smith Lake,VIC Condition: near pristine Class: wave Subclass: wave estuary 613 Corner Inlet,VIC Condition: largely unmodified Class: tide Subclass: other 614 Shallow Inlet,VIC Condition: largely unmodified Class: wave Subclass: wave estuary 615 Anderson Inlet,VIC Condition: modified Class: wave Subclass: wave estuary 616 Western Port Bay,VIC Condition: modified Class: tide Subclass: other 617 Port Phillip Bay,VIC Condition: modified Class: tide Subclass: other 618 Patterson River,VIC Condition: modified Class: tide Subclass: other 916 Merriman Creek,VIC Condition: near pristine Class: wave Subclass: other 917 Darby River,VIC Condition: largely unmodified Class: wave Subclass: other 918 Tidal River,VIC Condition: largely unmodified Class: wave Subclass: strandplain 919 Powlett River,VIC Condition: near pristine Class: wave Subclass: strandplain	8.7	21.6	1.1
	0.0	0.0	0.0
	6.6	9.9	10.5
	29.0	15.7	46.4
	3.7	11.6	4.9
	21.3	10.4	27.9
	2.3	1.3	0.1
	27.8	28.9	8.9
	0.0	0.1	0.0
	4	4	5
	5	4	3
	4	3	4
	5	4	5
	0.86	0.8	0.93
	0.62	0.64	0.58
	0.45	0.53	0.46
	0.63	0.59	0.68
	0.63	0.7	0.46
	0.88	0.81	0.87
	0.04	0.69	0.29

Estuaries in 230

619 Yarra River,VIC
Condition: modified
Class: river
Subclass: wave delta

620 Kororoit Creek,VIC
Condition: extensively modified
Class: tide
Subclass: tidal flat/creek

233 Barwon River	234 Lake Corangamite	235 Otway Coast
0.6	11.4	14.6
1.4	0.6	0.1
3.0	1.5	8.3
42.3	38.9	26.5
9.0	2.5	22.4
35.9	43.0	26.6
0.5	0.6	0.4
6.8	1.1	0.6
0.3	0.4	0.2
5	5	4
4	4	4
5	5	4
5	5	4
0.88	0.87	0.96
0.43	0.57	0.72
0.5	0.53	0.56
–	0.53	0.88
0.15	0.49	0.66
0.92	0.77	1
0.52	0.3	1

Estuaries in 235

629 Aire River,VIC
Condition: modified
Class: wave
Subclass: wave estuary

630 Curdies Inlet,VIC
Condition: modified
Class: wave
Subclass: wave estuary

920 Anglesea River,VIC
Condition: modified
Class: river
Subclass: wave delta

921 Painkalac Creek/Aireys Inlet,VIC
Condition: largely unmodified
Class: wave
Subclass: strandplain

922 Erskine River,VIC
Condition: largely unmodified
Class: wave
Subclass: strandplain

923 Saint George River,VIC
Condition: near pristine
Class: wave
Subclass: other

924 Cumberland River,VIC
Condition: largely unmodified
Class: wave
Subclass: other

925 Jamieson River,VIC
Condition: largely unmodified
Class: wave
Subclass: other

926 Wye River,VIC
Condition: largely unmodified
Class: wave
Subclass: strandplain

927 Kennett River,VIC
Condition: largely unmodified
Class: wave
Subclass: other

928 Grey River,VIC
Condition: largely unmodified
Class: wave
Subclass: other

929 Skenes Creek,VIC
Condition: modified
Class: wave
Subclass: other

930 Barham River,VIC
Condition: modified
Class: wave
Subclass: strandplain

931 Elliot River,VIC
Condition: not assessed
Class: wave
Subclass: other

932 Gellibrand River,VIC
Condition: modified
Class: wave
Subclass: wave estuary

933 Sherbrook River,VIC
Condition: largely unmodified
Class: wave
Subclass: other

934 Port Campbell River,VIC
Condition: largely unmodified
Class: tide
Subclass: tide estuary

1034 Spring Creek,VIC
Condition: modified
Class: river
Subclass: wave delta

1035 Anderson Creek,VIC
Condition: largely unmodified
Class: wave
Subclass: other

1036 Wild Dog Creek,VIC
Condition: largely unmodified
Class: wave
Subclass: other

For further Victorian river information see www.vic.waterdata.net/isc

	Basin number		236		237	
	Basin name	Units	Hopkins River		Portland Coast	
LAND USE	Nature conservation	%	1.5	**Estuaries in 236** 631 Hopkins River, VIC Condition: modified Class: river Subclass: wave delta 632 Moyne River, VIC Condition: modified Class: wave Subclass: wave estuary 935 Merri River, VIC Condition: extensively modified Class: wave Subclass: other	5.8	**Estuaries in 237** 633 Lake Yambuk, VIC Condition: largely unmodified Class: wave Subclass: wave estuary 634 Fitzroy River, VIC Condition: modified Class: wave Subclass: strandplain 635 Surrey River, VIC Condition: largely unmodified Class: wave Subclass: strandplain 636 Glenelg River, VIC Condition: modified Class: wave Subclass: wave estuary
LAND USE	Other protected areas	%	0.4		0.3	
LAND USE	Minimal use	%	0.8		0.8	
LAND USE	Livestock grazing	%	48.2		41.0	
LAND USE	Forestry	%	1.5		9.6	
LAND USE	Dryland agriculture	%	44.9		41.2	
LAND USE	Irrigated agriculture	%	0.2		0.4	
LAND USE	Built environment	%	1.9		0.5	
LAND USE	Water	%	0.5		0.1	
CATCHMENT CONDITION	Catchment land condition	index	5		4	
CATCHMENT CONDITION	Catchment water condition	index	3		2	
CATCHMENT CONDITION	Catchment biota condition	index	5		4	
CATCHMENT CONDITION	Catchment condition – composite	index	5		4	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.8		0.91	
RIVER CONDITION	Environment index	index	0.45		0.63	
RIVER CONDITION	Catchment disturbance subindex	index	0.55		0.56	
RIVER CONDITION	Hydrological disturbance subindex	index	0.89		1	
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	0.009849		0.41	
RIVER CONDITION	Habitat subindex	index	0.87		0.98	
RIVER CONDITION	Riparian vegetation	index	0.03		–	

	Basin number		301	
	Basin name	Units	Flinders – Cape Barren Islands	
LAND USE	Nature conservation	%	8.0	**Estuaries in 301** 867 North East River, TAS Condition: near pristine Class: wave Subclass: wave estuary 868 Foochow Inlet, TAS Condition: near pristine Class: wave Subclass: strandplain 869 Middle Inlet, TAS Condition: near pristine Class: wave Subclass: strandplain 870 Patriarch River, TAS Condition: near pristine Class: wave Subclass: other 871 Sellars Lagoon, TAS Condition: near pristine Class: wave Subclass: other 872 Cameron Inlet, TAS Condition: near pristine Class: wave Subclass: wave estuary 873 Logan Lagoon, TAS Condition: near pristine Class: wave Subclass: other 874 Pats River, TAS Condition: modified Class: wave Subclass: other 875 Mines Creek, TAS Condition: near pristine Class: wave Subclass: other 876 Dover River, TAS Condition: near pristine Class: wave Subclass: other 877 Lee River, TAS Condition: near pristine Class: wave Subclass: other 878 Shag Lagoon, TAS Condition: near pristine Class: wave Subclass: other
LAND USE	Other protected areas	%	2.6	
LAND USE	Minimal use	%	47.7	
LAND USE	Livestock grazing	%	24.7	
LAND USE	Forestry	%	1.5	
LAND USE	Dryland agriculture	%	13.2	
LAND USE	Irrigated agriculture	%	0.0	
LAND USE	Built environment	%	0.1	
LAND USE	Water	%	0.4	
CATCHMENT CONDITION	Catchment land condition	index		
CATCHMENT CONDITION	Catchment water condition	index		
CATCHMENT CONDITION	Catchment biota condition	index		
CATCHMENT CONDITION	Catchment condition – composite	index		
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index		
RIVER CONDITION	Environment index	index		
RIVER CONDITION	Catchment disturbance subindex	index		
RIVER CONDITION	Hydrological disturbance subindex	index		
RIVER CONDITION	Nutrient and suspended sediment load subindex	index		
RIVER CONDITION	Habitat subindex	index		
RIVER CONDITION	Riparian vegetation	index		

For further Victorian river information see www.vic.waterdata.net/isc

238	239	
Glenelg River	Millicent Coast	
14.3	11.3	**Estuaries in 239** 839 Lake George, SA Condition: extensively modified Class: wave Subclass: wave estuary 840 American River, SA Condition: modified Class: wave Subclass: other 841 Cygnet River, SA Condition: modified Class: wave Subclass: other
0.1	0.1	
2.3	1.5	
30.7	27.7	
12.2	5.3	
39.7	51.3	
0.2	1.5	
0.2	0.3	
0.1	1.1	
4	4	
3	3	
5	4	
4	4	
0.95 (Vic)	–	
0.39 (Vic)		
0.62 (Vic)		
0.33 (Vic)		
0.06 (Vic)		
0.82 (Vic)		
0.75 (Vic)		

879 Modder River, TAS
Condition: near pristine
Class: wave
Subclass: wave estuary

880 Rices River, TAS
Condition: near pristine
Class: wave
Subclass: other

881 Rocky Head Rivulet, TAS
Condition: near pristine
Class: wave
Subclass: other

882 Thirsty Lagoon, TAS
Condition: near pristine
Class: tide
Subclass: other

	Basin number		302
	Basin name	Units	East Coast
LAND USE	Nature conservation	%	9.5
	Other protected areas	%	1.1
	Minimal use	%	24.5
	Livestock grazing	%	14.8
	Forestry	%	36.3
	Dryland agriculture	%	12.7
	Irrigated agriculture	%	0.1
	Built environment	%	0.3
	Water	%	0.1
CATCHMENT CONDITION	Catchment land condition	index	2
	Catchment water condition	index	3
	Catchment biota condition	index	3
	Catchment condition – composite	index	3
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.89
	Environment index	index	0.72
	Catchment disturbance subindex	index	0.59
	Hydrological disturbance subindex	index	–
	Nutrient and suspended sediment load subindex	index	0.73
	Habitat subindex	index	0.96
	Riparian vegetation	index	0.95

Estuaries in 302

561 Little Musselroe River, TAS
Condition: modified
Class: river
Subclass: wave delta

562 Great Musselroe River, TAS
Condition: modified
Class: wave
Subclass: wave estuary

563 Ansons Bay, TAS
Condition: modified
Class: wave
Subclass: wave estuary

564 Georges Bay, TAS
Condition: modified
Class: wave
Subclass: wave estuary

565 Scamander River, TAS
Condition: modified
Class: wave
Subclass: wave estuary

566 Henderson Lagoon, TAS
Condition: modified
Class: wave
Subclass: wave estuary

567 Douglas River, TAS
Condition: largely unmodified
Class: wave
Subclass: other

568 Great Swanport, TAS
Condition: near pristine
Class: wave
Subclass: wave estuary

569 Little Swanport, TAS
Condition: modified
Class: wave
Subclass: wave estuary

570 Spring Bay, TAS
Condition: modified
Class: tide
Subclass: other

571 Prosser River, TAS
Condition: modified
Class: wave
Subclass: wave estuary

572 Earlham Lagoon, TAS
Condition: modified
Class: tide
Subclass: tide estuary

573 Frederick Henry Bay, TAS
Condition: not assessed
Class: tide
Subclass: other

574 Blackman Bay, TAS
Condition: modified
Class: wave
Subclass: wave estuary

	Basin number		303	304	305		306
	Basin name	Units	Coal River	Derwent River	Kingston Coast		Huon River
LAND USE	Nature conservation	%	1.3	10.6	4.1	**Estuaries in 305**	47.4
	Other protected areas	%	0.4	7.8	2.3	1016 Garden Island, TAS Condition: modified Class: wave Subclass: other	0.1
	Minimal use	%	20.9	25.1	33.4		9.7
	Livestock grazing	%	38.2	18.8	9.1		8.5
	Forestry	%	8.3	22.6	18.5	1017 North West Bay, TAS Condition: extensively modified Class: tide Subclass: other	27.6
	Dryland agriculture	%	28.2	12.6	9.5		5.3
	Irrigated agriculture	%	1.2	0.9	0.0		1.0
	Built environment	%	1.2	1.1	22.0	1018 Browns River, TAS Condition: extensively modified Class: wave Subclass: wave estuary	0.4
	Water	%	0.1	0.5	0.1		0.1
CATCHMENT CONDITION	Catchment land condition	index	4	2	2	1019 Pipeclay Lagoon, TAS Condition: modified Class: wave Subclass: wave estuary	1
	Catchment water condition	index	3	5	4		3
	Catchment biota condition	index	3	2	3		1
	Catchment condition – composite	index	4	3	3	1020 Grindstone, TAS Condition: modified Class: wave Subclass: other	2
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.78	0.79	0.89		1
	Environment index	index	0.44	0.64	0.79		0.85
	Catchment disturbance subindex	index	0.51	0.72	0.67	1021 Lisdillon Lagoon, TAS Condition: modified Class: wave Subclass: other	0.94
	Hydrological disturbance subindex	index	–	0.64	–		–
	Nutrient and suspended sediment load subindex	index	0.41	0.67	0.85		0.79
	Habitat subindex	index	0.41	0.55	1		0.87
	Riparian vegetation	index	0.51	0.76	1		0.89

Home
Summary
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575 Carlton River, TAS
Condition: modified
Class: wave
Subclass: wave estuary

576 Pitt Water, TAS
Condition: extensively modified
Class: wave
Subclass: wave estuary

577 Port Arthur, TAS
Condition: not assessed
Class: tide
Subclass: other

578 Ralphs Bay, TAS
Condition: not assessed
Class: tide
Subclass: other

579 Derwent River, TAS
Condition: extensively modified
Class: tide
Subclass: other

580 D'Entrecasteaux Channel, TAS
Condition: not assessed
Class: tide
Subclass: other

581 Huon River, TAS
Condition: modified
Class: tide
Subclass: other

582 Esperance River, TAS
Condition: largely unmodified
Class: tide
Subclass: other

583 Cloudy Bay Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: wave estuary

584 Southport, TAS
Condition: largely unmodified
Class: wave
Subclass: wave estuary

585 Southport Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: wave estuary

586 Recherche Bay, TAS
Condition: not assessed
Class: tide
Subclass: other

1001 Big Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: other

1002 Sloop Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: other

1003 Grants Lagoon, TAS
Condition: modified
Class: wave
Subclass: wave estuary

1004 Duck Bay, TAS
Condition: modified
Class: wave
Subclass: wave estuary

1005 Montagu, TAS
Condition: modified
Class: tide
Subclass: tidal flat/creek

1006 Crayfish Creek, TAS
Condition: modified
Class: wave
Subclass: other

1022 Buxton River, TAS
Condition: modified
Class: river
Subclass: wave delta

1023 Stoney Lagoon, TAS
Condition: modified
Class: wave
Subclass: other

1024 Meredith River, TAS
Condition: modified
Class: river
Subclass: wave delta

1025 Bryans Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: strandplain

1042 Templestowe Lagoon, TAS
Condition: modified
Class: wave
Subclass: wave estuary

1043 Denison Rivulet, TAS
Condition: modified
Class: wave
Subclass: other

1044 Saltwater Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: other

1045 Freshwater Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: other

307	
South-West Coast	
Estuaries in 306	68.7
1014 Crookes Rivulet, TAS Condition: modified Class: tide Subclass: other	21.7
1015 Port Cygnet, TAS Condition: modified Class: tide Subclass: other	0.6
	0.5
	7.5
	0.7
	0.1
	0.0
	0.0
	1
	2
	1
	1
	1
	0.88
	0.98
	1
	0.76
	0.96
	0.84

Estuaries in 307

587 New River, TAS
Condition: near pristine
Class: wave
Subclass: wave estuary

588 Bathurst Harbour, TAS
Condition: near pristine
Class: tide
Subclass: other

589 Payne Bay, TAS
Condition: near pristine
Class: tide
Subclass: other

590 Giblin River, TAS
Condition: near pristine
Class: wave
Subclass: other

591 Lewis River, TAS
Condition: near pristine
Class: tide
Subclass: other

592 Mainwaring River, TAS
Condition: near pristine
Class: tide
Subclass: other

593 Wanderer River, TAS
Condition: near pristine
Class: wave
Subclass: other

594 Spero River, TAS
Condition: near pristine
Class: wave
Subclass: other

595 Macquarie Harbour, TAS
Condition: modified
Class: wave
Subclass: wave estuary

1007 Hibbs Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: other

1008 Freney Lagoon, TAS
Condition: near pristine
Class: wave
Subclass: other

1009 Louisa Creek, TAS
Condition: near pristine
Class: wave
Subclass: other

1010 Louisa River, TAS
Condition: near pristine
Class: wave
Subclass: other

1011 South Cape Rivulet, TAS
Condition: near pristine
Class: wave
Subclass: other

1012 Cockle Creek, TAS
Condition: near pristine
Class: wave
Subclass: other

1013 Catamaran River, TAS
Condition: near pristine
Class: wave
Subclass: other

1026 Mulcahy River, TAS
Condition: near pristine
Class: wave
Subclass: other

	Basin number		308	309		310	311
	Basin name	Units	Gordon River	King–Henty Rivers		Pieman River	Sandy Cape Coast
LAND USE	Nature conservation	%	84.7	12.0	**Estuaries in 309** 596 Henty River, TAS Condition: near pristine Class: wave Subclass: wave estuary 597 Little Henty River, TAS Condition: modified Class: river Subclass: wave delta 598 Pieman River, TAS Condition: largely unmodified Class: tide Subclass: other	18.6	0.3
	Other protected areas	%	10.4	1.3		7.1	83.2
	Minimal use	%	1.1	50.4		50.0	0.3
	Livestock grazing	%	0.0	0.4		0.3	1.2
	Forestry	%	3.8	35.2		23.1	14.5
	Dryland agriculture	%	0.0	0.2		0.1	0.5
	Irrigated agriculture	%	0.0	0.0		0.0	0.0
	Built environment	%	0.0	0.2		0.7	0.0
	Water	%	0.0	0.2		0.1	0.0
CATCHMENT CONDITION	Catchment land condition	index	1	1		1	1
	Catchment water condition	index	4	5		5	3
	Catchment biota condition	index	1	1		1	1
	Catchment condition – composite	index	2	3		2	1
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	1	0.95		0.85	0.97
	Environment index	index	0.86	0.82		0.82	0.91
	Catchment disturbance subindex	index	0.98	0.89		0.89	0.9
	Hydrological disturbance subindex	index	1	0.74		1	1
	Nutrient and suspended sediment load subindex	index	0.9	0.94		0.91	1
	Habitat subindex	index	0.75	0.79		0.66	0.86
	Riparian vegetation	index	0.77	1		0.97	0.76

	Basin number		314			315
	Basin name	Units	Smithton–Burnie Coast			Forth River
LAND USE	Nature conservation	%	2.4	**Estuaries in 314** 539 Welcome Inlet, TAS Condition: modified Class: tide Subclass: tidal flat/creek 540 Robbins Passage, TAS Condition: modified Class: tide Subclass: other 541 Mosquito Inlet, TAS Condition: largely unmodified Class: tide Subclass: other 542 West Inlet, TAS Condition: modified Class: tide Subclass: tidal flat/creek 543 East Inlet, TAS Condition: largely unmodified Class: wave Subclass: other 544 Black River, TAS Condition: near pristine Class: river Subclass: wave delta	545 Detention River, TAS Condition: modified Class: river Subclass: wave delta 546 Inglis River, TAS Condition: extensively modified Class: river Subclass: wave delta 547 Cam River, TAS Condition: extensively modified Class: wave Subclass: other 548 Emu River, TAS Condition: extensively modified Class: river Subclass: wave delta 549 Blythe River, TAS Condition: modified Class: river Subclass: wave delta 550 Leven River, TAS Condition: extensively modified Class: wave Subclass: wave estuary	32.2
	Other protected areas	%	2.1			0.2
	Minimal use	%	15.1			13.6
	Livestock grazing	%	18.8			12.7
	Forestry	%	32.0			32.3
	Dryland agriculture	%	22.0			6.4
	Irrigated agriculture	%	2.8			1.9
	Built environment	%	4.5			0.6
	Water	%	0.0			0.1
CATCHMENT CONDITION	Catchment land condition	index	3			2
	Catchment water condition	index	4			4
	Catchment biota condition	index	1			1
	Catchment condition – composite	index	3			2
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.99			1
	Environment index	index	0.68			0.64
	Catchment disturbance subindex	index	0.55			0.76
	Hydrological disturbance subindex	index	–			0.49
	Nutrient and suspended sediment load subindex	index	0.69			0.98
	Habitat subindex	index	0.99			0.56
	Riparian vegetation	index	0.99			1

	312 Arthur River	313 King Island
Estuaries in 311	0.7	6.3
599 Pedder River, TAS Condition: near pristine Class: wave Subclass: strandplain	6.4	2.3
	19.2	5.3
600 Nelson Bay River, TAS Condition: near pristine Class: wave Subclass: other	1.4	47.7
	69.9	1.2
1027 Lagoon River, TAS Condition: near pristine Class: wave Subclass: other	1.2	32.7
	0.1	0.0
	1.0	0.6
	0.2	0.2
1028 Curries River, TAS Condition: modified Class: wave Subclass: other	1	
	4	
	1	
	2	
	1	
	0.82	
	0.71	
	–	
	0.9	
	1	
	1	

Estuaries in 312

601 Arthur River, TAS
Condition: near pristine
Class: wave
Subclass: other

Estuaries in 313

862 Sea Elephant River, TAS
Condition: near pristine
Class: wave
Subclass: strandplain

864 Yarra Creek, TAS
Condition: modified
Class: wave
Subclass: other

865 Ettrick River, TAS
Condition: modified
Class: wave
Subclass: other

866 Seal River, TAS
Condition: modified
Class: wave
Subclass: wave estuary

1046 Yellow Rock River, TAS
Condition: modified
Class: wave
Subclass: other

	316 Mersey River	317 Rubicon River	318 Tamar River
Estuaries in 315	19.3	4.5	2.3
551 Forth River, TAS Condition: modified Class: tide Subclass: tide estuary	7.0	0.0	2.2
	9.4	14.1	25.4
	9.1	12.1	20.5
	28.2	37.0	23.9
	20.6	24.5	23.7
	5.3	5.9	0.9
	1.0	1.2	0.7
	0.2	0.5	0.3
	2	3	3
	5	3	4
	2	2	3
	3	3	4
	0.97	0.85	0.8
	0.63	0.63	0.6
	0.74	0.45	0.59
	0.43	–	0.42
	0.79	0.66	0.71
	0.67	1	0.77
	0.94	1	0.72

Estuaries in 316

552 Don River, TAS
Condition: extensively modified
Class: wave
Subclass: wave estuary

553 Mersey River, TAS
Condition: extensively modified
Class: wave
Subclass: wave estuary

554 Port Sorell, TAS
Condition: modified
Class: wave
Subclass: wave estuary

555 Tamar River, TAS
Condition: extensively modified
Class: tide
Subclass: tide estuary

	Basin number		319		401	402	403	404
	Basin name	Units	Piper–Ringarooma Rivers		Upper Murray River	Kiewa River	Ovens River	Broken River
LAND USE	Nature conservation	%	1.8	**Estuaries in 319**	28.7	17.1	16.9	2.6
	Other protected areas	%	2.1	556 Pipers River, TAS Condition: modified Class: wave Subclass: wave estuary	0.0	0.1	0.1	1.2
	Minimal use	%	19.0		9.3	8.6	5.5	3.7
	Livestock grazing	%	20.5		22.9	28.2	28.0	35.8
	Forestry	%	38.2	557 Little Forester River, TAS Condition: modified Class: river Subclass: wave delta	32.1	29.6	32.0	11.1
	Dryland agriculture	%	15.9		6.8	13.8	16.1	29.6
	Irrigated agriculture	%	1.9		0.1	0.7	0.8	15.3
	Built environment	%	0.3	558 Brid River, TAS Condition: modified Class: river Subclass: wave delta	0.1	0.9	0.5	0.6
	Water	%	0.1		0.1	0.0	0.0	0.2
CATCHMENT CONDITION	Catchment land condition	index	3	559 Tomahawk River, TAS Condition: modified Class: wave Subclass: wave estuary	3	4	3	4
	Catchment water condition	index	4		4	4	4	3
	Catchment biota condition	index	1		2	3	2	5
	Catchment condition – composite	index	3	560 Ringarooma River, TAS Condition: extensively modified Class: river Subclass: wave delta	4	4	4	4
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.79		0.79 (NSW) 1 (Vic)	0.94	0.98	0.91
	Environment index	index	0.69		0.71 (NSW) 0.74 (Vic)	0.75	0.75	0.59
	Catchment disturbance subindex	index	0.56		0.73 (NSW) 0.74 (Vic)	0.61	0.68	0.58
	Hydrological disturbance subindex	index	–		0.91 (NSW) 0.72 (Vic)	0.94	0.96	0.7
	Nutrient and suspended sediment load subindex	index	0.7		0.61 (NSW) 0.83 (Vic)	0.87	0.74	0.6
	Habitat subindex	index	0.98		0.68 (NSW) 0.71 (Vic)	0.72	0.7	0.51
	Riparian vegetation	index	0.97		0.62 (NSW) 0.75 (Vic)	0.51	0.66	0.36

	405	406	407	408	409	410	411	412	413	414	415	416
	Goulburn River	Campaspe River	Loddon River	Avoca River	Murray–Riverina	Murrumbidgee River	Lake George	Lachlan River	Benanee	Mallee	Wimmera – Avon Rivers	Border Rivers
	5.7	1.6	2.6	3.1	0.2	5.6	0.0	4.2	4.3	27.5	12.9	1.1
	0.2	0.1	0.4	1.4	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1
	8.1	5.0	3.3	1.4	0.7	5.4	19.2	2.0	3.9	1.2	1.0	17.9
	34.5	45.4	38.9	38.2	61.3	58.9	40.3	68.7	80.1	39.2	30.6	53.6
	22.6	6.5	8.7	2.8	6.4	3.6	2.2	1.5	2.0	6.5	2.6	7.6
	21.4	32.4	30.9	49.6	16.2	21.5	26.0	21.9	1.4	24.1	52.3	18.0
	6.9	8.2	13.3	3.2	13.7	3.6	0.0	0.9	0.2	0.8	0.1	1.5
	0.4	0.6	1.6	0.1	0.8	0.8	0.2	0.1	0.0	0.2	0.2	0.1
	0.2	0.3	0.1	0.1	0.6	0.5	12.1	0.8	8.1	0.2	0.1	0.0
	4	5	5	5	5	4	4	4	3	3	4	5
	4	4	3	3	5	4	4	4	2	2	3	4
	5	5	5	5	5	5	2	3	2	2	5	3
	5	5	5	4	5	5	4	4	2	3	4	5
	0.99	1	0.82	0.77	0.67	0.74	0.76	0.81	–	0.87 (SA)	0.86	0.74 (QLD) 0.88 (NSW)
	0.6	0.5	0.47	0.39	0.56	0.53 (NSW) 0.63 (ACT)	0.48	0.59		0.56 (SA)	0.5	0.57 (QLD) 0.52 (NSW)
	0.6	0.5	0.49	0.54	0.64	0.66 (NSW) 0.7 (ACT)	0.63	0.64		0.64 (SA)	0.57	0.67 (QLD) 0.67 (NSW)
	0.58	0.52	0.61	0.9	0.58	0.46 (NSW) 0.63 (ACT)	1	0.7		0.51 (SA)	0.55	0.66 (QLD) 0.63 (NSW)
	0.63	0.44	0.35	0	0.52	0.51 (NSW) 0.5 (ACT)	0.33	0.5		0.51 (SA)	0.37	0.37 (QLD) 0.31 (NSW)
	0.58	0.56	0.45	0.5	0.51	0.53 (NSW) 0.74 (ACT)	0.29	0.54		0.64 (SA)	0.53	0.69 (QLD) 0.55 (NSW)
	0.54	0.39	0.26	0.33	0.68	0.38 (NSW) 0.71 (ACT)	0.06	0.38		0.44 (SA)	0.41	0.73 (QLD) 0.41 (NSW)

	Basin number		417	418	419	420	421	422	423
	Basin name	Units	Moonie River	Gwydir River	Namoi River	Castlereagh River	Macquarie–Bogan Rivers	Condamine–Culgoa Rivers	Warrego River
LAND USE	Nature conservation	%	0.6	0.7	3.2	1.3	1.2	1.1	0.7
	Other protected areas	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Minimal use	%	15.3	14.1	4.4	3.5	2.5	8.4	9.2
	Livestock grazing	%	64.9	57.5	61.9	63.4	70.9	76.6	88.0
	Forestry	%	3.4	1.5	10.2	4.5	2.4	3.8	1.1
	Dryland agriculture	%	15.6	23.3	17.7	27.2	21.8	9.2	0.6
	Irrigated agriculture	%	0.2	2.7	2.3	0.0	0.8	0.4	0.0
	Built environment	%	0.0	0.1	0.1	0.1	0.2	0.1	0.0
	Water	%	0.0	0.0	0.3	0.0	0.3	0.3	0.4
CATCHMENT CONDITION	Catchment land condition	index	4	4	4	4	5	4	3
	Catchment water condition	index	2	5	5	4	5	2	2
	Catchment biota condition	index	3	2	3	5	4	3	2
	Catchment condition – composite	index	4	4	5	4	5	3	2
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.84	0.81	0.76	0.82	0.72	0.72 (QLD) 0.87 (NSW)	0.71 (QLD) 0.92 (NSW)
	Environment index	index	0.55 (QLD) 0.59 (NSW)	0.5	0.54	0.54	0.57	0.62 (QLD) 0.64 (NSW)	0.67 (QLD) 0.64 (NSW)
	Catchment disturbance subindex	index	0.67	0.66	0.65	0.64	0.64	0.64 (QLD) 0.65 (NSW)	0.63
	Hydrological disturbance subindex	index	0.37 (QLD)	0.59	0.65	0.67	0.62	0.81 (QLD) 0.75 (NSW)	0.9 (NSW) 0.9 (NSW)
	Nutrient and suspended sediment load subindex	index	0.48 (QLD) 0.58 (NSW)	0.34	0.37	0.42	0.49	0.42 (QLD) 0.56 (NSW)	0.59 (NSW) 0.59 (NSW)
	Habitat subindex	index	0.81 (QLD) 0.72 (NSW)	0.47	0.55	0.48	0.54	0.76 (QLD) 0.61 (NSW)	0.83 (QLD) 0.53 (NSW)
	Riparian vegetation	index	0.88 (QLD) 0.57 (NSW)	0.29	0.36	0.2	0.36	0.77 (QLD) 0.47 (NSW)	0.82 (QLD) 0.37 (NSW)

424	425	426		501		502
Paroo River	Darling Darling	Lower Murray River		Fleurieu Peninsula		Myponga River
3.2	0.9	6.3	**Estuaries in 426**	5.8	**Estuaries in 501**	0.0
0.0	0.0	1.6	524 The Coorong And Lower Lakes, SA Condition: extensively modified Class: wave Subclass: wave estuary	0.0	852 Inman River, SA Condition: extensively modified Class: wave Subclass: other	0.0
1.0	2.9	10.3		4.6		3.2
93.2	93.6	70.3		43.3		54.2
0.0	0.7	0.3		4.3	853 Hindmarsh River, SA Condition: modified Class: river Subclass: wave delta	0.6
0.1	0.5	8.6		39.2		40.6
0.1	0.1	0.6		1.4		1.3
0.0	0.0	0.2		1.1	854 Myponga River, SA Condition: extensively modified Class: wave Subclass: other	0.0
2.4	1.4	1.8		0.0		0.0
2	3	2		4		4
1	2	2		4		2
2	2	2		2		3
2	3	2		4		3
0.82 (NSW) 0.98 (QLD)	0.66	0.73 (NSW) 0.86 (SA)		1		0.94
0.64 (NSW) 0.7 (QLD)	0.61	0.52 (NSW) 0.56 (SA)		0.6		0.39
0.65 (NSW) 0.64 (QLD)	0.64	0.64		0.48		0.43
1	0.64	0.51		–		0.21
0.54 (NSW) 0.59 (QLD)	0.54	0.5		0.59		0.83
0.57 (NSW) 0.79 (QLD)	0.61	0.46 (NSW) 0.64 (SA)		0.81		0.28
0.19 (NSW) 0.73 (QLD)	0.47	0.44 (SA) 0.29 (NSW)		0.68		0.26

		Basin number	503		504	
		Basin name	Onkaparinga River		Torrens River	
LAND USE		Nature conservation	%	3.6		3.8	
		Other protected areas	%	0.0		0.0	
		Minimal use	%	9.2		9.0	
		Livestock grazing	%	37.1		26.3	
		Forestry	%	1.5		3.1	
		Dryland agriculture	%	25.7		8.3	
		Irrigated agriculture	%	10.4		2.2	
		Built environment	%	12.0		46.4	
		Water	%	0.1		0.6	
CATCHMENT CONDITION		Catchment land condition	index	4		4	
		Catchment water condition	index	5		5	
		Catchment biota condition	index	1		1	
		Catchment condition – composite	index	4		4	
RIVER CONDITION		Aquatic biota (macroinvertebrates) index	index	0.94		0.92	
		Environment index	index	0.48		0.49	
		Catchment disturbance subindex	index	0.29		0.29	
		Hydrological disturbance subindex	index	–		0.47	
		Nutrient and suspended sediment load subindex	index	0.57		0.72	
		Habitat subindex	index	0.65		0.57	
		Riparian vegetation	index	0.91		0.46	

Estuaries in 503

855 Onkaparinga River, SA
Condition: extensively modified
Class: river
Subclass: wave delta

Estuaries in 504

1047 Patawalonga Creek, SA
Condition: extensively modified
Class: wave
Subclass: other

		Basin number	507
		Basin name	Broughton River
LAND USE		Nature conservation	%	1.0
		Other protected areas	%	0.0
		Minimal use	%	3.0
		Livestock grazing	%	32.7
		Forestry	%	0.5
		Dryland agriculture	%	60.7
		Irrigated agriculture	%	0.0
		Built environment	%	0.6
		Water	%	1.4
CATCHMENT CONDITION		Catchment land condition	index	5
		Catchment water condition	index	3
		Catchment biota condition	index	3
		Catchment condition – composite	index	4
RIVER CONDITION		Aquatic biota (macroinvertebrates) index	index	0.95
		Environment index	index	0.56
		Catchment disturbance subindex	index	0.62
		Hydrological disturbance subindex	index	0.93
		Nutrient and suspended sediment load subindex	index	0.44
		Habitat subindex	index	0.45
		Riparian vegetation	index	0.08

Estuaries in 507

529 Second Creek, SA
Condition: extensively modified
Class: tide
Subclass: tidal flat/creek

530 Port Pirie, SA
Condition: extensively modified
Class: tide
Subclass: tidal flat/creek

531 Northern Spencer Gulf, SA
Condition: modified
Class: tide
Subclass: tide estuary

532 Franklin Harbour, SA
Condition: extensively modified
Class: tide
Subclass: other

533 Port Douglas/Coffin Bay, SA
Condition: modified
Class: tide
Subclass: other

859 First Creek, SA
Condition: extensively modified
Class: tide
Subclass: tidal flat/creek

860 Tod River, SA
Condition: extensively modified
Class: river
Subclass: tide delta

505 Gawler River		506 Wakefield River	
0.7	**Estuaries in 505** 525 Port River Barker Inlet System, SA Condition: extensively modified Class: tide Subclass: tidal flat/creek 856 Gawler River, SA Condition: extensively modified Class: tide Subclass: tidal flat/creek 857 Light River Delta, SA Condition: modified Class: river Subclass: tide delta 858 Port Broughton Estuary, SA Condition: extensively modified Class: tide Subclass: tidal flat/creek	0.1	**Estuaries in 506** 1039 Wakefield River, SA Condition: extensively modified Class: tide Subclass: tidal flat/creek **Estuaries in 508** 526 Port Davis Creek/ Broughton River Estuary, SA Condition: modified Class: tide Subclass: tidal flat/creek 527 Fisherman Creek, SA Condition: modified Class: tide Subclass: tidal flat/creek 528 Third Creek, SA Condition: modified Class: tide Subclass: tidal flat/creek
0.0		0.0	
1.7		0.9	
41.8		24.7	
2.1		0.0	
49.0		73.3	
2.0		0.5	
2.5		0.4	
0.3		0.1	
4		5	
4		2	
2		2	
4		3	
0.93		1	
0.53		0.48	
0.5		0.61	
0.65		–	
0.52		0.43	
0.49		0.42	
0.18		0.17	

508 Mambray Coast	509 Willochra Creek	510 Lake Torrens	511 Spencer Gulf	512 Eyre Peninsula	513 Kangaroo Island	
3.7	1.2	24.8	3.1	19.3	26.1	**Estuaries in 513** 842 Eleanor River, SA Condition: largely unmodified Class: wave Subclass: other 843 Chapman River, SA Condition: largely unmodified Class: wave Subclass: other 844 Stunsail Boom, SA Condition: largely unmodified Class: wave Subclass: other 846 Western River, SA Condition: largely unmodified Class: wave Subclass: other 847 Breakneck River, SA Condition: near pristine Class: wave Subclass: other 849 Middle River, SA Condition: largely unmodified Class: wave Subclass: other 850 Harriet River, SA Condition: largely unmodified Class: wave Subclass: other 851 Willson River, SA Condition: largely unmodified Class: wave Subclass: other 1038 South West River, SA Condition: largely unmodified Class: wave Subclass: other
0.0	0.0	0.0	0.0	0.0	0.0	
7.9	0.9	0.3	8.0	16.9	13.9	
82.9	82.9	74.7	55.0	42.0	20.3	
0.2	0.0	0.0	0.0	0.0	0.6	
2.9	15.0	0.1	27.1	20.5	38.8	
0.0	0.0	0.0	0.0	0.0	0.0	
0.6	0.0	0.0	5.9	0.5	0.1	
1.7	0.0	0.2	0.9	0.3	0.2	
3	4	1	3	3	3	
3	3	2	4	2	2	
3	3	2	3	2	3	
3	3	1	4	3	3	
1	0.93	0.98	0.82	0.7	0.93	
0.61	0.48	0.54	0.64	0.73	0.67	
0.57	0.58	0.62	0.61	0.71	0.68	
1	–	0.57	1	0.89	0.63	
0.48	0.49	0.41	0.54	0.68	0.55	
0.59	0.38	0.57	0.62	0.69	0.92	
0.25	0.04	0.16	0.37	0.5	0.95	

Home
Summary
Contents

	Basin number		601			602
	Basin name	Units	Esperance Coast			Albany Coast
LAND USE	Nature conservation	%	12.7	**Estuaries in 601**		23.4
	Other protected areas	%	0.0	637 Stokes Inlet, WA Condition: modified Class: wave Subclass: wave estuary	887 Jerdacuttup Lakes, WA Condition: modified Class: other Subclass: other	0.0
	Minimal use	%	23.9			8.0
	Livestock grazing	%	15.9	638 Culham Inlet, WA Condition: extensively modified Class: wave Subclass: wave estuary	1037 Saint Marys River, WA Condition: not assessed Class: wave Subclass: wave estuary	17.8
	Forestry	%	0.7			0.1
	Dryland agriculture	%	46.5			50.4
	Irrigated agriculture	%	0.0	639 Wellstead Estuary, WA Condition: modified Class: wave Subclass: wave estuary	883 Barker Inlet, WA Condition: modified Class: wave Subclass: wave estuary	0.0
	Built environment	%	0.1			0.1
	Water	%	0.1			0.2
CATCHMENT CONDITION	Catchment land condition	index	3	884 Torradup River, WA Condition: modified Class: wave Subclass: wave estuary		3
	Catchment water condition	index	3			3
	Catchment biota condition	index	5			5
	Catchment condition – composite	index	4			4
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.9	885 Oldfield Estuary, WA Condition: modified Class: wave Subclass: wave estuary		0.87
	Environment index	index	0.74			0.65
	Catchment disturbance subindex	index	0.79			0.74
	Hydrological disturbance subindex	index	1			–
	Nutrient and suspended sediment load subindex	index	0.55			0.49
	Habitat subindex	index	0.86			0.84
	Riparian vegetation	index	0.86			0.87

	Basin number		605		606	
	Basin name	Units	Frankland River		Shannon River	
LAND USE	Nature conservation	%	9.5	**Estuaries in 605**	51.6	**Estuaries in 606**
	Other protected areas	%	0.0	937 Franklands River, WA Condition: not assessed Class: Subclass:	0.0	647 Broke Inlet, WA Condition: near pristine Class: wave Subclass: wave estuary
	Minimal use	%	0.5		0.7	
	Livestock grazing	%	26.6		8.3	648 Warren River, WA Condition: largely unmodified Class: wave Subclass: wave estuary
	Forestry	%	8.0		35.7	
	Dryland agriculture	%	55.1		2.0	
	Irrigated agriculture	%	0.0		0.2	
	Built environment	%	0.2		0.2	649 Hardy Inlet, WA Condition: modified Class: wave Subclass: wave estuary
	Water	%	0.2		1.4	
CATCHMENT CONDITION	Catchment land condition	index	4		2	
	Catchment water condition	index	3		3	
	Catchment biota condition	index	5		3	
	Catchment condition – composite	index	4		2	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.63		1	
	Environment index	index	0.59		0.85	
	Catchment disturbance subindex	index	0.64		0.78	
	Hydrological disturbance subindex	index	–		–	
	Nutrient and suspended sediment load subindex	index	0.43		0.84	
	Habitat subindex	index	0.78		1	
	Riparian vegetation	index	0.93		1	

			603 Denmark River		604 Kent River	
Estuaries in 602			21.0	**Estuaries in 603**	22.3	**Estuaries in 604**
640 Beaufort Inlet, WA Condition: modified Class: wave Subclass: wave estuary	889 Dempster Inlet, WA Condition: modified Class: wave Subclass: wave estuary		0.0	896 Torbay Inlet, WA Condition: modified Class: wave Subclass: wave estuary	0.0	645 Irwin Inlet, WA Condition: largely unmodified Class: wave Subclass: wave estuary
641 Oyster Harbour, WA Condition: extensively modified Class: wave Subclass: wave estuary	890 Fitzgerald Inlet, WA Condition: largely unmodified Class: wave Subclass: wave estuary		3.2		5.7	
642 Princess Royal Harbour, WA Condition: modified Class: tide Subclass: other	891 Gordon Inlet, WA Condition: modified Class: wave Subclass: wave estuary		46.4	897 Gardener Lake, WA Condition: largely unmodified Class: river Subclass: wave delta	28.7	646 Walpole/Nornalup Inlet, WA Condition: largely unmodified Class: wave Subclass: wave estuary
643 Wilson Inlet, WA Condition: modified Class: wave Subclass: wave estuary	892 Cheyne Inlet, WA Condition: modified Class: wave Subclass: wave estuary		10.6		16.5	
644 Parry Inlet, WA Condition: largely unmodified Class: wave Subclass: wave estuary	893 Waychinicup Inlet, WA Condition: modified Class: tide Subclass: other		18.0		26.6	
888 Hamersley Inlet, WA Condition: modified Class: wave Subclass: wave estuary	894 Normans Inlet, WA Condition: modified Class: wave Subclass: other		0.0		0.0	
	895 Taylor Inlet, WA Condition: modified Class: wave Subclass: wave estuary		0.4		0.1	
			0.3		0.0	
			3		3	
			2		2	
			4		3	
			4		3	
			0.9		0.91	
			0.69		0.69	
			0.67		0.71	
			1		1	
			0.49		0.45	
			0.98		0.95	
			0.97		0.93	

607 Warren River	608 Donnelly River		609 Blackwood River	610 Busselton Coast	
16.6	16.2	**Estuaries in 608**	3.3	9.3	**Estuaries in 610**
0.0	0.0	898 Donnelly Inlet, WA Condition: largely unmodified Class: wave Subclass: wave estuary	0.0	0.0	650 Margaret River, WA Condition: modified Class: wave Subclass: wave estuary
1.5	1.0		1.1	2.3	
25.1	4.1		27.7	25.7	651 Vasse–Wonnerup Estuary, WA Condition: extensively modified Class: wave Subclass: wave estuary
44.7	66.9	899 Tobys Inlet, WA Condition: modified Class: wave Subclass: strandplain	14.2	25.2	
11.4	11.2		53.3	35.5	
0.4	0.3		0.1	0.5	
0.1	0.2		0.2	0.5	
0.0	0.0		0.2	1.1	
3	2		3	3	
3	3		3	3	
3	2		5	4	
3	3		4	4	
0.99	1		0.83	0.87	
0.62	0.71		0.59	0.62	
0.7	0.69		0.68	0.63	
–	1		–	–	
0.42	0.51		0.45	0.49	
0.88	1		0.69	0.84	
0.94	1		0.64	0.72	

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	Basin number		611		612	
	Basin name	Units	Preston River		Collie River	
LAND USE	Nature conservation	%	5.6	**Estuaries in 611** 939 Leschenault Inlet, WA Condition: extensively modified Class: Subclass:	17.6	**Estuaries in 612** 652 Leschenault Inlet, WA Condition: extensively modified Class: wave Subclass: wave estuary 653 Peel–Harvey Estuary, WA Condition: extensively modified Class: wave Subclass: wave estuary
	Other protected areas	%	0.0		0.0	
	Minimal use	%	3.1		5.3	
	Livestock grazing	%	19.7		21.9	
	Forestry	%	37.5		42.2	
	Dryland agriculture	%	26.7		10.7	
	Irrigated agriculture	%	1.9		0.8	
	Built environment	%	4.9		0.5	
	Water	%	0.5		1.0	
CATCHMENT CONDITION	Catchment land condition	index	4		3	
	Catchment water condition	index	3		4	
	Catchment biota condition	index	4		3	
	Catchment condition – composite	index	4		4	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.95		0.95	
	Environment index	index	0.58		0.55	
	Catchment disturbance subindex	index	0.59		0.7	
	Hydrological disturbance subindex	index	–		–	
	Nutrient and suspended sediment load subindex	index	0.44		0.35	
	Habitat subindex	index	0.78		0.72	
	Riparian vegetation	index	0.62		0.93	

	Basin number		617		618	619	701
	Basin name	Units	Moore–Hill Rivers		Yarra Yarra Lakes	Ninghan	Greenough River
LAND USE	Nature conservation	%	13.5	**Estuaries in 617** 900 Moore River Estuary, WA Condition: extensively modified Class: river Subclass: wave delta 901 Hill River, WA Condition: modified Class: wave Subclass: strandplain	0.2	15.6	3.6
	Other protected areas	%	0.0		0.0	0.0	0.0
	Minimal use	%	6.1		5.4	27.6	3.7
	Livestock grazing	%	32.6		82.2	51.4	49.7
	Forestry	%	1.2		0.6	0.0	0.0
	Dryland agriculture	%	46.1		10.5	4.4	42.7
	Irrigated agriculture	%	0.0		0.0	0.0	0.0
	Built environment	%	0.1		0.0	0.0	0.1
	Water	%	0.2		1.1	1.0	0.1
CATCHMENT CONDITION	Catchment land condition	index	3		3	1	3
	Catchment water condition	index	4		3	2	3
	Catchment biota condition	index	5		5	4	4
	Catchment condition – composite	index	4		4	2	4
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.78		–	–	0.83
	Environment index	index	0.37				0.53
	Catchment disturbance subindex	index	0.69				0.64
	Hydrological disturbance subindex	index	–				–
	Nutrient and suspended sediment load subindex	index	0.008				0.41
	Habitat subindex	index	0.71				0.59
	Riparian vegetation	index	0.74				0.42

613 Harvey River		614 Murray River (WA)		615 Avon River	616 Swan Coast
9.9	**Estuaries in 613** 938 Harvey Estuary, WA Condition: extensively modified Class: Subclass:	6.4	**Estuaries in 614** 654 Swan River, WA Condition: extensively modified Class: wave Subclass: wave estuary	6.6	14.8
0.0		0.0		0.0	0.0
1.1		2.7		22.8	0.9
21.5		25.6		27.6	29.1
31.5		26.6	655 Murchison River, WA Condition: modified Class: wave Subclass: wave estuary	0.9	25.1
28.1		35.2		41.6	12.8
3.5		0.1		0.0	0.4
3.8		3.2	656 Shark Bay, WA Condition: largely unmodified Class: tide Subclass: other	0.1	16.5
0.7		0.2		0.4	0.4
3		3	657 Gascoyne River, WA Condition: largely unmodified Class: river Subclass: wave delta	3	3
4		4		4	4
5		4		5	4
4		4		4	4
0.91		0.92	658 Giralia Bay, WA Condition: largely unmodified Class: tide Subclass: other	–	0.75
0.59		0.58			0.61
0.59		0.67	659 Yardie Creek, WA Condition: near pristine Class: tide Subclass: other		0.7
–		–			–
0.52		0.44	660 Ashburton River, WA Condition: largely unmodified Class: river Subclass: wave delta		0.46
0.68		0.68			0.72
0.65		0.74			0.8

	702 Murchison River	703 Wooramel River		704 Gascoyne River	705 Lyndon–Minilya Rivers	
Estuaries in 701 903 Irwin River, WA Condition: extensively modified Class: wave Subclass: other	3.2	11.5	**Estuaries in 703** 909 Wooramel River, WA Condition: largely unmodified Class: tide Subclass: other	1.2	3.1	**Estuaries in 705** 1040 Lake Macleod/Cardabia Crk/Lyndon/Minilya, WA Condition: near pristine Class: other Subclass: other
	0.2	0.0		0.6	0.0	
	5.5	0.4		3.2	5.4	
	89.0	87.3		94.8	89.3	
904 Greenough River, WA Condition: extensively modified Class: wave Subclass: strandplain	0.0	0.0		0.0	0.0	
	1.6	0.1		0.0	0.0	
	0.0	0.0		0.0	0.0	
	0.0	0.0		0.0	0.0	
906 Bowes River, WA Condition: modified Class: river Subclass: wave delta	0.5	0.6		0.2	2.1	
	2					
	2					
907 Oakajee River, WA Condition: modified Class: river Subclass: wave delta	2					
	2					
	0.88					
908 Hutt Lagoon, WA Condition: extensively modified Class: wave Subclass: wave estuary	0.61					
	0.63					
	1					
1031 Chapman River, WA Condition: not assessed Class: wave Subclass: other	0.38					
	0.72					
	0.87					

		Basin number		706	707		708	
		Basin name	Units	Ashburton River	Onslow Coast		Fortescue River	
LAND USE		Nature conservation	%	8.7	2.9	**Estuaries in 707**	6.2	**Estuaries in 708**
		Other protected areas	%	0.1	0.0	661 Cane River, WA Condition: largely unmodified Class: tide Subclass: tidal flat/creek	2.5	664 Fortescue River, WA Condition: largely unmodified Class: river Subclass: tide delta
		Minimal use	%	25.0	29.7		29.2	
		Livestock grazing	%	65.8	66.5		62.1	
		Forestry	%	0.0	0.0	662 Yammaderry Creek, WA Condition: largely unmodified Class: tide Subclass: tidal flat/creek	0.0	
		Dryland agriculture	%	0.0	0.0		0.0	
		Irrigated agriculture	%	0.0	0.0		0.0	
		Built environment	%	0.0	0.0		0.0	
		Water	%	0.5	0.8	663 Robe River, WA Condition: largely unmodified Class: river Subclass: tide delta	0.0	
CATCHMENT CONDITION		Catchment land condition	index					
		Catchment water condition	index					
		Catchment biota condition	index					
		Catchment condition – composite	index					
RIVER CONDITION		Aquatic biota (macroinvertebrates) index	index					
		Environment index	index					
		Catchment disturbance subindex	index					
		Hydrological disturbance subindex	index					
		Nutrient and suspended sediment load subindex	index					
		Habitat subindex	index					
		Riparian vegetation	index					

		Basin number		710	801	
		Basin name	Units	De Grey River	Cape Leveque Coast	
LAND USE		Nature conservation	%	0.0	1.3	**Estuaries in 801**
		Other protected areas	%	0.0	17.0	693 Baldwin Creek, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
		Minimal use	%	23.1	21.7	
		Livestock grazing	%	76.1	58.2	694 Beagle Bay, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
		Forestry	%	0.2	0.0	
		Dryland agriculture	%	0.0	1.2	695 Tappers Inlet, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
		Irrigated agriculture	%	0.0	0.0	
		Built environment	%	0.0	0.0	696 Kelk Creek, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
		Water	%	0.6	0.4	
CATCHMENT CONDITION		Catchment land condition	index			697 Lombadina Creek, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
		Catchment water condition	index			
		Catchment biota condition	index			698 Chile Creek, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
		Catchment condition – composite	index			
RIVER CONDITION		Aquatic biota (macroinvertebrates) index	index			699 King Sound (Goodenough To Cascade), WA Condition: near pristine Class: tide Subclass: tide estuary
		Environment index	index			
		Catchment disturbance subindex	index			700 Goodenough Bay, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
		Hydrological disturbance subindex	index			
		Nutrient and suspended sediment load subindex	index			701 Disaster Bay, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
		Habitat subindex	index			
		Riparian vegetation	index			702 Hoon Creek, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
						703 Fraser River, WA Condition: near pristine Class: tide Subclass: tidal flat/creek
						704 Fitzroy River, WA Condition: largely unmodified Class: river Subclass: tide delta
						705 Doctors Creek, WA Condition: near pristine Class: tide Subclass: tidal flat/creek

709
Port Hedland Coast
9.3
13.8
20.8
55.2
0.1
0.0
0.0
0.0
0.8

Estuaries in 709

665 Yanyare River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

666 Maitland River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

667 Hampton Harbour (Dampier), WA
Condition: modified
Class: tide
Subclass: other

668 Nickol River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

669 Port Robinson, WA
Condition: largely unmodified
Class: tide
Subclass: other

670 Harding River, WA
Condition: largely unmodified
Class: tide
Subclass: tide estuary

671 Jones River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

672 George River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

673 Little Sherlock River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

674 Sherlock River, WA
Condition: largely unmodified
Class: tide
Subclass: tide estuary

675 Peawah River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

676 Yule River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

677 Turner River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

678 Port Hedland Harbour, WA
Condition: modified
Class: tide
Subclass: other

679 Beebingarra Creek, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

680 Petermarer Creek, WA
Condition: largely unmodified
Class: river
Subclass: wave delta

681 Tabba Tabba Creek, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

682 Ridley River, WA
Condition: largely unmodified
Class: river
Subclass: tide delta

683 De Grey River, WA
Condition: largely unmodified
Class: tide
Subclass: tide estuary

684 Pardoo Creek, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

685 Banningarra Creek, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

686 Jaubert Creek, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

687 Mckelson Creek, WA
Condition: near pristine
Class: wave
Subclass: strandplain

802	803
Fitzroy River (WA)	Lennard River
0.4	6.9
0.0	0.0
13.0	8.7
86.1	81.4
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.5	3.1

Estuaries in 803

706 Point Torment Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

707 Point Torment Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

708 May River, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

709 Meda River, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

710 Robinson River, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

711 Saddle Hill Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

712 Saddle Hill Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

713 Saddle Hill Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

714 Cascade Bay, WA
Condition: near pristine
Class: tide
Subclass: other

Home
Summary
Contents

	Basin number		804
	Basin name	Units	Isdell River
LAND USE	Nature conservation	%	2.0
	Other protected areas	%	6.3
	Minimal use	%	54.9
	Livestock grazing	%	36.4
	Forestry	%	0.0
	Dryland agriculture	%	0.0
	Irrigated agriculture	%	0.0
	Built environment	%	0.0
	Water	%	0.1
CATCHMENT CONDITION	Catchment land condition	index	
	Catchment water condition	index	
	Catchment biota condition	index	
	Catchment condition – composite	index	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	
	Environment index	index	
	Catchment disturbance subindex	index	
	Hydrological disturbance subindex	index	
	Nutrient and suspended sediment load subindex	index	
	Habitat subindex	index	
	Riparian vegetation	index	

Estuaries in 804

715 Cone Bay, WA
Condition: near pristine
Class: tide
Subclass: other

716 Kammargoorh River, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

717 Jinunga River, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

718 Yuraddagi River, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

719 Coppermine Creek, WA
Condition: near pristine
Class: tide
Subclass: other

720 Myridi Bay, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

721 Talbot Bay, WA
Condition: near pristine
Class: tide
Subclass: other

722 Shoal Bay, WA
Condition: near pristine
Class: tide
Subclass: other

723 Secure Bay, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

724 Walcott Inlet, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

	Basin number		806
	Basin name	Units	King Edward River
LAND USE	Nature conservation	%	3.5
	Other protected areas	%	21.7
	Minimal use	%	27.6
	Livestock grazing	%	46.6
	Forestry	%	0.0
	Dryland agriculture	%	0.1
	Irrigated agriculture	%	0.0
	Built environment	%	0.0
	Water	%	0.2
CATCHMENT CONDITION	Catchment land condition	index	
	Catchment water condition	index	
	Catchment biota condition	index	
	Catchment condition – composite	index	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	
	Environment index	index	
	Catchment disturbance subindex	index	
	Hydrological disturbance subindex	index	
	Nutrient and suspended sediment load subindex	index	
	Habitat subindex	index	
	Riparian vegetation	index	

Estuaries in 806

753 Montague Sound Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

754 Mitchell River, WA
Condition: largely unmodified
Class: tide
Subclass: tide estuary

755 Lawley River, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

756 Mt Connor Creek, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

757 Rocky Cove, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

758 Wade Creek, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

759 Pauline Bay, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

760 Woppinbie Creek, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

761 King Edward River, WA
Condition: largely unmodified
Class: tide
Subclass: tide estuary

762 Mission Cove, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

763 Drysdale River, WA
Condition: modified
Class: tide
Subclass: tide estuary

764 Cape Londonderry Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

765 Cape Londonderry Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

766 Cape Londonderry Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

	805
	Prince Regent River
	34.9
	32.4
	24.1
	7.6
	0.0
	0.0
	0.0
	0.0
	0.2

Estuaries in 805

725 High Bluff Creek, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

726 Eagle Point, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

727 Doubtful Bay South, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

728 Doubtful Bay East, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

729 Sale River, WA
Condition: near pristine
Class: tide
Subclass: other

730 George Water, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

731 Wedge Hill Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

732 Prior Point Creek, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

733 Deception Bay, WA
Condition: near pristine
Class: tide
Subclass: other

734 Sampson Inlet, WA
Condition: near pristine
Class: tide
Subclass: other

735 Hanover Bay, WA
Condition: near pristine
Class: tide
Subclass: other

736 Prince Regent River, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

737 Mt Waterloo Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

738 Cape Torrens Embayment, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

739 Boongaree Island Creek, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

740 Unnamed East Of Roe, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

741 Roe River, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

742 Unnamed North Of Roe, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

743 Hunter River, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

744 Scott Straight Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

745 Scott Straight Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

746 Scott Straight Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

747 Scott Straight Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

748 Scott Straight Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

749 Mudge Bay, WA
Condition: near pristine
Class: tide
Subclass: other

750 Montague Sound Creeks, WA
Condition: near pristine
Class: tide
Subclass: other

751 Montague Sound Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

752 Montague Sound Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

	807	808
	Drysdale River	Pentecost River
	15.2	0.1
	29.1	15.7
	16.6	25.3
	39.1	58.4
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.5

767 Cape Londonderry Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

768 King George River, WA
Condition: near pristine
Class: tide
Subclass: other

769 Cape Whiskey Creek, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

770 Berkeley River, WA
Condition: near pristine
Class: tide
Subclass: tide estuary

771 Buckle Head Creek, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

Estuaries in 808

772 Thurburn Creek, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

773 Helby River, WA
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

774 Lyne River, WA
Condition: largely unmodified
Class: tide
Subclass: tide estuary

775 Thompson River, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

776 Ord River, WA
Condition: largely unmodified
Class: tide
Subclass: tide estuary

777 False Mouth Of Ord, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

778 Ningbing Range Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

779 Ningbing Range Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

780 Ningbing Range Creeks, WA
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

941 Cambridge Gulf West Arm, WA
Condition: not assessed
Class:
Subclass:

	Basin number		809	810
	Basin name	Units	Ord River	Keep River
LAND USE	Nature conservation	%	6.8	10.1
	Other protected areas	%	1.7	0.0
	Minimal use	%	20.7	9.5
	Livestock grazing	%	70.1	73.5
	Forestry	%	0.0	0.0
	Dryland agriculture	%	0.0	0.0
	Irrigated agriculture	%	0.1	0.0
	Built environment	%	0.0	0.1
	Water	%	0.5	6.7
CATCHMENT CONDITION	Catchment land condition	index	2	2
	Catchment water condition	index	2	1
	Catchment biota condition	index	1	1
	Catchment condition – composite	index	2	1
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.95 (WA)	0.72 (WA)
	Environment index	index	–	0.71 (NT) 0.8 (WA)
	Catchment disturbance subindex	index	0.65 (NT) 0.73 (WA)	0.7 (NT) 0.69 (WA)
	Hydrological disturbance subindex	index	–	1
	Nutrient and suspended sediment load subindex	index	–	–
	Habitat subindex	index	0.52 (WA)	0.61 (NT) 0.84 (WA)
	Riparian vegetation	index	0.51 (WA)	0.44 (NT) 0.78 (WA)

Estuaries in 810

82 Nt001, NT
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

83 Keep River, NT
Condition: near pristine
Class: tide
Subclass: tide estuary

	Basin number		815
	Basin name	Units	Finniss River
LAND USE	Nature conservation	%	14.0
	Other protected areas	%	16.5
	Minimal use	%	19.9
	Livestock grazing	%	34.2
	Forestry	%	0.0
	Dryland agriculture	%	2.3
	Irrigated agriculture	%	0.0
	Built environment	%	6.5
	Water	%	6.5
CATCHMENT CONDITION	Catchment land condition	index	2
	Catchment water condition	index	2
	Catchment biota condition	index	1
	Catchment condition – composite	index	2
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.93
	Environment index	index	–
	Catchment disturbance subindex	index	0.78
	Hydrological disturbance subindex	index	–
	Nutrient and suspended sediment load subindex	index	–
	Habitat subindex	index	0.97
	Riparian vegetation	index	0.98

Estuaries in 815

93 Daly River, NT
Condition: near pristine
Class: tide
Subclass: tide estuary

94 Finniss River, NT
Condition: largely unmodified
Class: river
Subclass: wave delta

95 Nt014, NT
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

96 Bynoe Harbour, NT
Condition: near pristine
Class: tide
Subclass: other

97 Corrawara Creek, NT
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

98 Darwin Harbour, NT
Condition: largely unmodified
Class: tide
Subclass: other

99 Woods Inlet, NT
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

100 West Arm, NT
Condition: near pristine
Class: tide
Subclass: other

101 Middle Arm, NT
Condition: largely unmodified
Class: tide
Subclass: other

102 East Arm, NT
Condition: modified
Class: tide
Subclass: other

103 Reichardt Creek, NT
Condition: modified
Class: tide
Subclass: tidal flat/creek

104 Micket Creek, NT
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

811 Victoria River			812 Fitzmaurice River	813 Moyle River	814 Daly River
16.5	**Estuaries in 811**		0.0	0.0	8.7
2.5	84 Forsyth Creek, NT Condition: near pristine Class: tide Subclass: tide estuary	89 Port Keats, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	56.6	98.6	18.1
4.0			0.0	1.2	9.8
76.2	85 Victoria River, NT Condition: near pristine Class: tide Subclass: tide estuary	90 Nt009, NT Condition: near pristine Class: tide Subclass: tide estuary	39.4	0.0	63.2
0.0			0.0	0.0	0.0
0.0			0.0	0.0	0.1
0.0	86 Fitzmaurice River, NT Condition: near pristine Class: tide Subclass: tide estuary	91 Moyle River, NT Condition: near pristine Class: river Subclass: wave delta	0.0	0.0	0.0
0.0			0.0	0.0	0.0
0.8			3.8	0.1	0.1
1	87 New Moon Inlet, NT Condition: near pristine Class: tide Subclass: tide estuary	92 Little Moyle Inlet, NT Condition: near pristine Class: wave Subclass: strandplain	2	2	2
1			1	1	2
1			2	1	1
1	88 Nt007, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	838 Buffalo Creek, NT Condition: modified Class: tide Subclass: tidal flat/creek	2	1	2
0.88			–	–	0.93
0.7		1032 King Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	0.9	0.92	0.85
0.69			0.83	0.98	0.75
1			1	1	1
–			–	–	–
0.58			0.96	0.86	0.95
0.41			0.95	0.81	0.93

816 Bathurst and Melville Islands				
0.0	**Estuaries in 816**			
98.7	202 Kilu-Impini Creek, NT Condition: near pristine Class: wave Subclass: wave estuary	208 Johnston River, NT Condition: near pristine Class: tide Subclass: tide estuary	214 De Vere Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	
0.0	203 Mirikau-Yunga Creek, NT Condition: near pristine Class: tide Subclass: tide estuary	209 Nt128, NT Condition: near pristine Class: tide Subclass: tide estuary	215 Tunganapu Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	
0.0				
0.6	204 Curtis Haven, NT Condition: near pristine Class: tide Subclass: tide estuary	210 Dongau Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	216 Perakery Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	
0.0				
0.0	205 Andranangoo Creek, NT Condition: near pristine Class: river Subclass: wave delta	211 Nt130, NT Condition: near pristine Class: wave Subclass: strandplain	217 Port Hurd, NT Condition: near pristine Class: tide Subclass: tide estuary	
0.0				
0.5	206 Jessie River, NT Condition: near pristine Class: tide Subclass: tide estuary	212 Saunders Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	218 Cullala Creek, NT Condition: near pristine Class: tide Subclass: tide estuary	
	207 Robinson Inlet, NT Condition: near pristine Class: wave Subclass: wave estuary	213 Bonkalii Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek		

105 Hope Inlet, NT
Condition: largely unmodified
Class: tide
Subclass: tide estuary

106 Leaders Creek, NT
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

107 Adelaide River, NT
Condition: largely unmodified
Class: tide
Subclass: tide estuary

108 Tommycut Creek, NT
Condition: extensively modified
Class: river
Subclass: tide delta

109 Sampan Creek, NT
Condition: extensively modified
Class: river
Subclass: tide delta

1041 Reynolds River, NT
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

	Basin number		817	818	819		820
	Basin name	Units	Adelaide River	Mary River (WA)	Wildman River		South Alligator River
LAND USE	Nature conservation	%	15.1	28.4	67.4	**Estuaries in 819**	91.0
LAND USE	Other protected areas	%	2.3	4.3	0.0	110 Wildman River, NT Condition: near pristine Class: river Subclass: tide delta	8.7
LAND USE	Minimal use	%	12.6	7.8	12.8		0.0
LAND USE	Livestock grazing	%	61.7	57.5	18.9	111 West Alligator River, NT Condition: near pristine Class: tide Subclass: tide estuary	0.3
LAND USE	Forestry	%	0.0	0.0	0.0		0.0
LAND USE	Dryland agriculture	%	0.4	0.7	0.1		0.0
LAND USE	Irrigated agriculture	%	0.0	0.0	0.0		0.0
LAND USE	Built environment	%	6.8	0.0	0.0	112 South Alligator River, NT Condition: near pristine Class: tide Subclass: tide estuary	0.0
LAND USE	Water	%	1.1	1.2	0.8		0.0
CATCHMENT CONDITION	Catchment land condition	index	2	1	1		1
CATCHMENT CONDITION	Catchment water condition	index	2	2	1		1
CATCHMENT CONDITION	Catchment biota condition	index	1	1	1	113 East Alligator, NT Condition: near pristine Class: tide Subclass: tide estuary	1
CATCHMENT CONDITION	Catchment condition – composite	index	2	1	1		1
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	0.94	–	–		–
RIVER CONDITION	Environment index	index	0.79	0.83	0.91	114 Murgenella Creek, NT Condition: near pristine Class: tide Subclass: tide estuary	0.91
RIVER CONDITION	Catchment disturbance subindex	index	0.66	0.73	0.86		0.97
RIVER CONDITION	Hydrological disturbance subindex	index	1	1	1		1
RIVER CONDITION	Nutrient and suspended sediment load subindex	index	–	–	–	115 Saltwater Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	–
RIVER CONDITION	Habitat subindex	index	0.88	0.91	0.95		0.85
RIVER CONDITION	Riparian vegetation	index	0.84	0.87	0.93		0.79

	Basin number		823		824	
	Basin name	Units	Liverpool River		Blyth River	
LAND USE	Nature conservation	%	0.0	**Estuaries in 823**	0.0	**Estuaries in 824**
LAND USE	Other protected areas	%	100.0	136 Nt055, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	99.9	139 Anamayirra Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
LAND USE	Minimal use	%	0.0		0.0	
LAND USE	Livestock grazing	%	0.0		0.0	140 Blyth River, NT Condition: near pristine Class: tide Subclass: tide estuary
LAND USE	Forestry	%	0.0	137 Liverpool River, NT Condition: near pristine Class: tide Subclass: tide estuary	0.0	
LAND USE	Dryland agriculture	%	0.0		0.0	
LAND USE	Irrigated agriculture	%	0.0		0.0	141 Ngandadauda Creek, NT Condition: near pristine Class: river Subclass: wave delta
LAND USE	Built environment	%	0.0	138 Gudgerama Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	
LAND USE	Water	%	0.0		0.0	142 Djigagila Creek, NT Condition: near pristine Class: tide Subclass: other
CATCHMENT CONDITION	Catchment land condition	index				
CATCHMENT CONDITION	Catchment water condition	index				143 Glyde River, NT Condition: near pristine Class: river Subclass: tide delta
CATCHMENT CONDITION	Catchment biota condition	index				
CATCHMENT CONDITION	Catchment condition – composite	index				144 Woolen River, NT Condition: near pristine Class: tide Subclass: tide estuary
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index				
RIVER CONDITION	Environment index	index				
RIVER CONDITION	Catchment disturbance subindex	index				
RIVER CONDITION	Hydrological disturbance subindex	index				
RIVER CONDITION	Nutrient and suspended sediment load subindex	index				
RIVER CONDITION	Habitat subindex	index				
RIVER CONDITION	Riparian vegetation	index				

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821 East Alligator River				822 Goomadeer River	
26.0	**Estuaries in 821**			0.0	**Estuaries in 822**
72.2	116 Minimini Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	122 Shamrock Bay, NT Condition: near pristine Class: tide Subclass: other	128 Raffles Bay, NT Condition: near pristine Class: tide Subclass: other	99.8	133 Wurugoij Creek, NT Condition: near pristine Class: wave Subclass: strandplain
0.6	117 Ilamaryi River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	123 Popham Bay, NT Condition: near pristine Class: tide Subclass: other	129 Marligur Creek, NT Condition: near pristine Class: river Subclass: tide delta	0.1	134 Majari Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
0.2	118 Nt037, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	124 Blue Mud Bay, NT Condition: near pristine Class: tide Subclass: other	130 King River, NT Condition: near pristine Class: tide Subclass: tide estuary	0.0	135 Nungbalgarri Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
0.0	119 Nt038, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	125 Trepang Bay, NT Condition: near pristine Class: tide Subclass: other	131 All Night Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	
0.0	120 Nt039, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	126 Port Essington, NT Condition: near pristine Class: tide Subclass: other	132 Goomadeer River, NT Condition: near pristine Class: river Subclass: tide delta	0.0	
0.8	121 Silvio Bay, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	127 Port Bremer, NT Condition: near pristine Class: tide Subclass: tide estuary		0.1	
1					
1					
1					
1					
–					
0.76					
0.97					
1					
–					
0.59					
0.42					

	825 Goyder River	826 Buckingham River		
145 Hutchinson Strait, NT Condition: near pristine Class: tide Subclass: other	0.0	0.0	**Estuaries in 826**	
146 Buckingham River, NT Condition: near pristine Class: tide Subclass: tide estuary	100.0	99.2	149 Slippery Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	156 Barungbirinung River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
147 Kurala River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	0.1	150 Darwarunga River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	157 Melville Bay, NT Condition: largely unmodified Class: tide Subclass: other
148 Arnhem Bay, NT Condition: near pristine Class: tide Subclass: other	0.0	0.0	151 Habgood River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	158 Giddy River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
	0.0	0.0	152 Baralminar River, NT Condition: near pristine Class: tide Subclass: tide estuary	159 Latram River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
	0.0	0.0	153 Goromuru River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	160 Nt079, NT Condition: near pristine Class: wave Subclass: strandplain
	0.0	0.0	154 Cato River, NT Condition: near pristine Class: river Subclass: tide delta	161 Nt080, NT Condition: near pristine Class: wave Subclass: strandplain
	0.0	0.0	155 Peter John River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	162 Port Bradshaw, NT Condition: near pristine Class: wave Subclass: wave estuary
	0.0	0.1		

	Basin number		901		902	
	Basin name	Units	Koolatong River		Walker River	
LAND USE	Nature conservation	%	0.0	**Estuaries in 901**	0.0	**Estuaries in 902**
	Other protected areas	%	99.6	163 Nt082, NT Condition: near pristine Class: wave Subclass: strandplain	99.9	168 Walker River, NT Condition: near pristine Class: river Subclass: tide delta
	Minimal use	%	0.1		0.0	
	Livestock grazing	%	0.0	164 Trial Bay, NT Condition: near pristine Class: tide Subclass: other	0.0	169 Anguruki Creek, NT Condition: near pristine Class: wave Subclass: wave estuary
	Forestry	%	0.0		0.0	
	Dryland agriculture	%	0.0	165 Koolatong River, NT Condition: near pristine Class: river Subclass: tide delta	0.0	170 Hart River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
	Irrigated agriculture	%	0.0		0.0	
	Built environment	%	0.0	166 Little Lagoon, NT Condition: near pristine Class: wave Subclass: wave estuary	0.0	171 Muntak Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
	Water	%	0.0		0.0	
CATCHMENT CONDITION	Catchment land condition	index				172 Rose River, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
	Catchment water condition	index				
	Catchment biota condition	index				
	Catchment condition – composite	index				173 Miyangkala Creek, NT Condition: near pristine Class: river Subclass: tide delta
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index				
	Environment index	index				
	Catchment disturbance subindex	index				
	Hydrological disturbance subindex	index				
	Nutrient and suspended sediment load subindex	index				
	Habitat subindex	index				
	Riparian vegetation	index				

	Basin number		907	908		909	
	Basin name	Units	McArthur River	Robinson River		Calvert River	
LAND USE	Nature conservation	%	0.3	0.0	**Estuaries in 908**	0.0	**Estuaries in 909**
	Other protected areas	%	7.6	2.1	186 Wearyan River, NT Condition: near pristine Class: river Subclass: tide delta	11.9	192 Nt111, NT Condition: near pristine Class: wave Subclass: strandplain
	Minimal use	%	2.4	0.9		0.9	
	Livestock grazing	%	87.8	92.9	187 Nt106, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	85.2	193 Nt112, NT Condition: near pristine Class: wave Subclass: strandplain
	Forestry	%	0.0	0.0		0.0	
	Dryland agriculture	%	0.0	0.0	188 Fat Fellows Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	194 Nt113, NT Condition: near pristine Class: wave Subclass: strandplain
	Irrigated agriculture	%	0.0	0.0		0.0	
	Built environment	%	0.0	0.0	189 Robinson River, NT Condition: near pristine Class: river Subclass: wave delta	0.0	195 Nt114, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
	Water	%	1.9	4.1		2.0	
CATCHMENT CONDITION	Catchment land condition	index			190 Shark Creek, NT Condition: near pristine Class: wave Subclass: strandplain		196 Nt115, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
	Catchment water condition	index					
	Catchment biota condition	index					
	Catchment condition – composite	index					
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index			191 Seven Emu Creek, NT Condition: near pristine Class: wave Subclass: strandplain		197 Calvert River, NT Condition: near pristine Class: river Subclass: wave delta
	Environment index	index					
	Catchment disturbance subindex	index					
	Hydrological disturbance subindex	index					
	Nutrient and suspended sediment load subindex	index					
	Habitat subindex	index					
	Riparian vegetation	index					

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903 Roper River		904 Towns River		905 Limmen Bight River	906 Rosie River	
0.2	**Estuaries in 903**	0.0	**Estuaries in 904**	0.0	0.0	**Estuaries in 906**
29.5	174 Nt093, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	34.1	176 Nayampi Creek, NT Condition: near pristine Class: river Subclass: tide delta	10.2	16.1	181 Rosie Creek, NT Condition: near pristine Class: river Subclass: tide delta
2.1		0.3		1.9	0.0	
68.2	175 Roper River, NT Condition: near pristine Class: tide Subclass: tide estuary	64.9	177 Nt096, NT Condition: near pristine Class: tide Subclass: tidal flat/creek	87.2	81.1	182 Bing Bong Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
0.0		0.0		0.0	0.0	
0.0		0.0		0.0	0.0	
0.0		0.0		0.0	0.0	183 Mule Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
0.0		0.0	178 Towns River, NT Condition: near pristine Class: river Subclass: tide delta	0.0	0.0	
0.1		0.7		0.7	2.7	
			179 Spillen Creek, NT Condition: near pristine Class: tide Subclass: tidal flat/creek			184 Mcarthur River, NT Condition: near pristine Class: river Subclass: tide delta
			180 Limmen Bight River, NT Condition: near pristine Class: river Subclass: tide delta			185 Nt104, NT Condition: near pristine Class: tide Subclass: tidal flat/creek

910 Settlement Creek	
0.0	**Estuaries in 910**
3.5	198 Nt117, NT Condition: near pristine Class: wave Subclass: strandplain
0.1	
93.9	199 Nt118, NT Condition: near pristine Class: tide Subclass: tidal flat/creek
0.0	
0.0	200 Dudwell Creek, NT Condition: near pristine Class: river Subclass: wave delta
0.0	
0.0	
2.5	201 Apsley Strait, NT Condition: near pristine Class: tide Subclass: other
	223 Massacre Inlet, QLD Condition: near pristine Class: river Subclass: tide delta
	224 Q006, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	225 Lagoon Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	226 Q008, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	227 Eight Mile Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	228 Q010, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	229 Cliffdale Creek, QLD Condition: near pristine Class: wave Subclass: strandplain
	230 Passmore Creek, QLD Condition: near pristine Class: river Subclass: tide delta
	231 Q013, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	232 Syrell Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
	233 Moonlight Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek

219 Q001, QLD Condition: near pristine Class: wave Subclass: strandplain	
220 Gum Creek, QLD Condition: near pristine Class: wave Subclass: strandplain	
221 Q003, QLD Condition: near pristine Class: wave Subclass: strandplain	
222 Tully Inlet, QLD Condition: near pristine Class: river Subclass: wave delta	

	Basin number		911
	Basin name	Units	Mornington Island
LAND USE	Nature conservation	%	0.0
	Other protected areas	%	0.8
	Minimal use	%	0.0
	Livestock grazing	%	86.3
	Forestry	%	0.0
	Dryland agriculture	%	0.0
	Irrigated agriculture	%	0.0
	Built environment	%	0.3
	Water	%	11.7
CATCHMENT CONDITION	Catchment land condition	index	
	Catchment water condition	index	
	Catchment biota condition	index	
	Catchment condition – composite	index	
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index	
	Environment index	index	
	Catchment disturbance subindex	index	
	Hydrological disturbance subindex	index	
	Nutrient and suspended sediment load subindex	index	
	Habitat subindex	index	
	Riparian vegetation	index	

Estuaries in 911

234 Horse Place Creek, QLD
Condition: near pristine
Class: wave
Subclass: strandplain

235 Q017, QLD
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

236 Boyorunga Inlet, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

237 Beeber Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

238 Kungunmeah Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

239 Toongoowahgun Inlet, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

240 Walbor Inlet, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

241 Ngulwonmeah River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

242 Elizabeth River, QLD
Condition: near pristine
Class: river
Subclass: tide delta

243 Dalmumeah Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

244 Towbulbulan River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

245 Sandalwood River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

	Basin number		914		915	916	917
	Basin name	Units	Morning Inlet		Flinders River	Norman River	Gilbert River
LAND USE	Nature conservation	%	0.0		0.3	0.0	2.0
	Other protected areas	%	0.0		0.0	0.0	0.6
	Minimal use	%	0.0		3.7	2.2	4.6
	Livestock grazing	%	78.7		95.5	96.4	88.3
	Forestry	%	0.0		0.0	0.0	0.0
	Dryland agriculture	%	0.0		0.2	0.2	3.1
	Irrigated agriculture	%	0.0		0.0	0.0	0.0
	Built environment	%	0.0		0.0	0.0	0.0
	Water	%	21.3		0.4	1.2	1.4
CATCHMENT CONDITION	Catchment land condition	index					
	Catchment water condition	index					
	Catchment biota condition	index					
	Catchment condition – composite	index					
RIVER CONDITION	Aquatic biota (macroinvertebrates) index	index					
	Environment index	index					
	Catchment disturbance subindex	index					
	Hydrological disturbance subindex	index					
	Nutrient and suspended sediment load subindex	index					
	Habitat subindex	index					
	Riparian vegetation	index					

Estuaries in 914

267 Q049, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

268 Morning Inlet, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

269 Spring Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

270 Flinders River/Bynoe River, QLD
Condition: near pristine
Class: river
Subclass: tide delta

271 Norman River, QLD
Condition: largely unmodified
Class: river
Subclass: tide delta

272 Brannigan Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

		912 Nicholson River		913 Leichhardt River	
		5.4	**Estuaries in 912**	0.0	**Estuaries in 913**
246 Mckenzie Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	252 Q034, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	22.8	257 Q039, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	262 Leichhardt River, QLD Condition: near pristine Class: river Subclass: tide delta
247 Q029, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	253 John'S Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.6	258 Q040, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	4.3	263 Q045, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
248 Q030, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	254 Channon Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	69.1	259 Pascoe Inlet, QLD Condition: near pristine Class: river Subclass: tide delta	94.5	264 Disaster Inlet, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
249 Q031, QLD Condition: near pristine Class: wave Subclass: strandplain	255 Q037, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	260 Williams Inlet, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.3	265 Q047, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
250 Marless Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	256 Gin Arm Creek, QLD Condition: near pristine Class: river Subclass: tide delta	0.0	261 Albert River, QLD Condition: near pristine Class: river Subclass: tide delta	0.0	266 Q048, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
251 Q033, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek		0.0		0.1	
		2.0		0.9	

	918 Staaten River		919 Mitchell River (Qld)	
Estuaries in 917	19.2	**Estuaries in 918**	1.3	**Estuaries in 919**
273 Accident Inlet, QLD Condition: near pristine Class: river Subclass: wave delta	0.0	279 Q062, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	3.3	283 Horse Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek
274 Smithburne River, QLD Condition: near pristine Class: river Subclass: tide delta	0.1	280 Staaten River, QLD Condition: near pristine Class: river Subclass: tide delta	1.9	284 Topsy Creek, QLD Condition: near pristine Class: river Subclass: wave delta
275 Duck Creek, QLD Condition: near pristine Class: river Subclass: wave delta	79.3	281 Salt Arm Creek, QLD Condition: near pristine Class: wave Subclass: strandplain	89.1	285 Mitchell River, QLD Condition: largely unmodified Class: river Subclass: tide delta
276 Snake Creek, QLD Condition: near pristine Class: river Subclass: tide delta	0.0	282 Nassau River, QLD Condition: largely unmodified Class: river Subclass: wave delta	1.2	
277 Gilbert River, QLD Condition: near pristine Class: river Subclass: tide delta	0.7		2.5	
278 Q061, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0		0.1	
	0.0		0.0	
	0.7		0.5	
			3	
			2	
			3	
			3	
			1	
			0.82	
			0.64	
			1	
			–	
			0.94	
			0.93	

		Basin number	920
		Basin name	Coleman River
LAND USE		Units	
	Nature conservation	%	0.0
	Other protected areas	%	35.2
	Minimal use	%	0.1
	Livestock grazing	%	64.6
	Forestry	%	0.0
	Dryland agriculture	%	0.0
	Irrigated agriculture	%	0.0
	Built environment	%	0.0
	Water	%	0.1
CATCHMENT CONDITION			
	Catchment land condition	index	
	Catchment water condition	index	
	Catchment biota condition	index	
	Catchment condition – composite	index	
RIVER CONDITION			
	Aquatic biota (macroinvertebrates) index	index	
	Environment index	index	
	Catchment disturbance subindex	index	
	Hydrological disturbance subindex	index	
	Nutrient and suspended sediment load subindex	index	
	Habitat subindex	index	
	Riparian vegetation	index	

Estuaries in 920

286 Malaman Creek, QLD
Condition: near pristine
Class: wave
Subclass: strandplain

287 Chapman River, QLD
Condition: near pristine
Class: wave
Subclass: strandplain

288 Moonkan Creek, QLD
Condition: near pristine
Class: wave
Subclass: strandplain

289 Edward River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

290 Hersey Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

291 Kendall River, QLD
Condition: near pristine
Class: river
Subclass: wave delta

292 Kirke River, QLD
Condition: near pristine
Class: wave
Subclass: wave estuary

293 Love River, QLD
Condition: near pristine
Class: wave
Subclass: wave estuary

294 Archer Bay, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

		Basin number	924
		Basin name	Embley River
LAND USE		Units	
	Nature conservation	%	0.0
	Other protected areas	%	31.1
	Minimal use	%	2.1
	Livestock grazing	%	62.8
	Forestry	%	0.0
	Dryland agriculture	%	0.0
	Irrigated agriculture	%	0.0
	Built environment	%	0.1
	Water	%	3.8
CATCHMENT CONDITION			
	Catchment land condition	index	
	Catchment water condition	index	
	Catchment biota condition	index	
	Catchment condition – composite	index	
RIVER CONDITION			
	Aquatic biota (macroinvertebrates) index	index	
	Environment index	index	
	Catchment disturbance subindex	index	
	Hydrological disturbance subindex	index	
	Nutrient and suspended sediment load subindex	index	
	Habitat subindex	index	
	Riparian vegetation	index	

Estuaries in 924

298 Andoom Creek, QLD
Condition: largely unmodified
Class: tide
Subclass: tidal flat/creek

299 Pine River Bay, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

300 Pennefather River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

301 Janie Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

302 Port Musgrave, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

303 Wenlock River, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

304 Ducie River, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

305 Namaleta Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

306 Skardon River, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

307 Jackson River, QLD
Condition: near pristine
Class: river
Subclass: wave delta

308 Macdonald River, QLD
Condition: near pristine
Class: river
Subclass: wave delta

309 Doughboy River, QLD
Condition: near pristine
Class: wave
Subclass: strandplain

921 Holroyd River	922 Archer River	923 Watson River
0.4	32.6	1.5
1.7	0.5	0.0
0.6	4.5	0.6
97.1	60.0	97.0
0.0	1.5	0.0
0.0	0.1	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.2	0.9	0.9

Estuaries in 923

295 Norman Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

296 Embley River, QLD
Condition: largely unmodified
Class: tide
Subclass: tide estuary

297 Mission River, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

	925 Wenlock River	926 Ducie River	927 Jardine River
310 Q093, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.0	0.0	53.0
	19.7	67.4	44.4
311 Crystal Creek, QLD Condition: near pristine Class: tide Subclass: tidal flat/creek	0.5	0.6	1.8
	78.7	30.9	0.8
312 Jardine River, QLD Condition: near pristine Class: river Subclass: wave delta	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	1.2	1.1	0.0

Estuaries in 927

313 Cowal Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

314 Kennedy Inlet, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

315 Escape River, QLD
Condition: near pristine
Class: tide
Subclass: tide estuary

316 Logan Jack Creek, QLD
Condition: near pristine
Class: tide
Subclass: tidal flat/creek

928 Torres Strait Islands	929 Groote Eylandt
0.0	0.0
51.4	95.5
6.1	3.7
39.6	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.2	0.0
2.3	0.0

Estuaries in 929

167 Angurugubira Lake, NT
Condition: near pristine
Class: wave
Subclass: wave estuary

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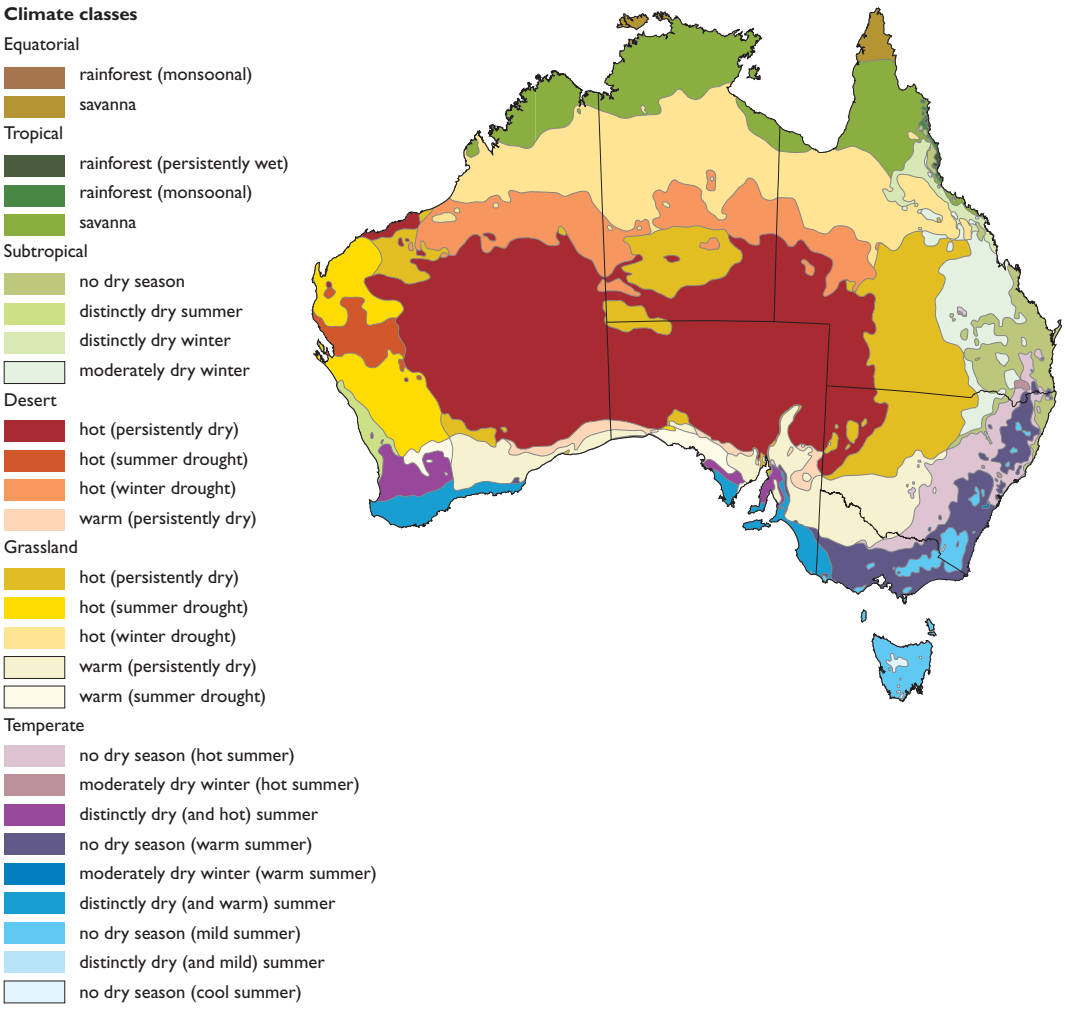
APPENDIX 4. CONTEXTUAL INFORMATION FROM OTHER AUDIT ASSESSMENTS

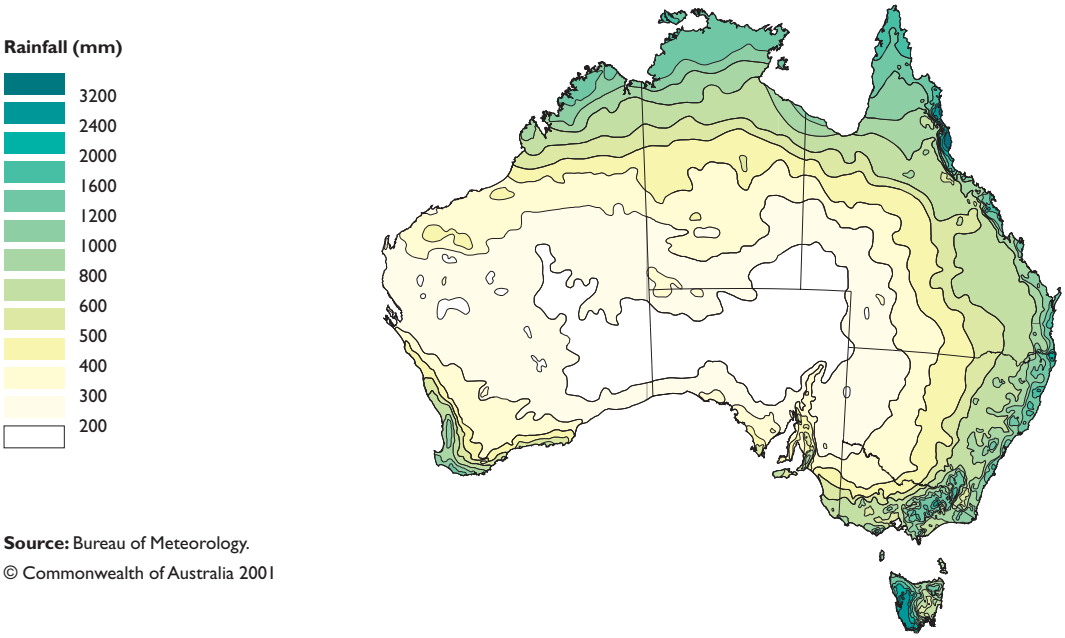
The Audit has conducted assessments into dryland salinity, water resources, rangelands, vegetation, and agricultural producting and sustainability. The following maps show outcomes from these assessments and provide valuable co ntextual information to the catchment, rivers and estuaries assessments.

Figure A1 Australia's climate types (Koppen classification) (NLWRA 2001b).



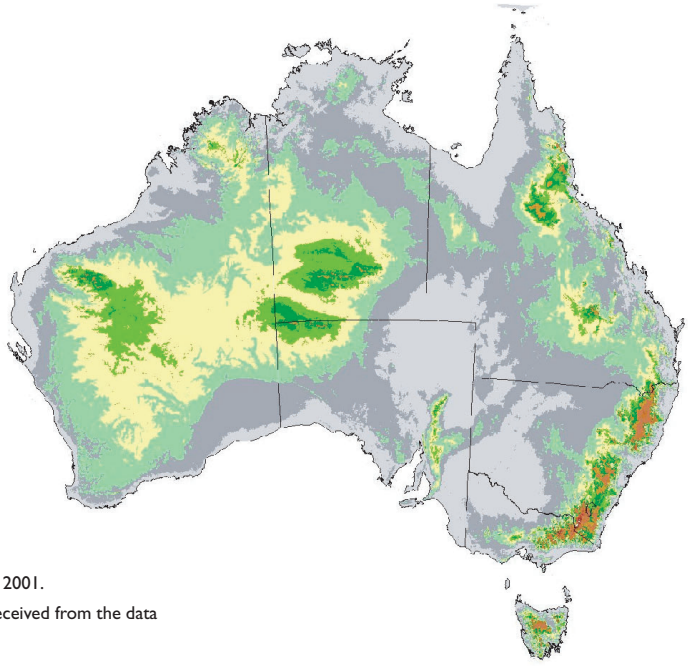
Source: Bureau of Meteorology.

Figure A2 Mean annual rainfall for Australia (NLWRA 2001b).



Source: Bureau of Meteorology.

Figure A3 Topographic map of Australia (grey is lowest and red is highest elevation) (NLWRA 2001b).

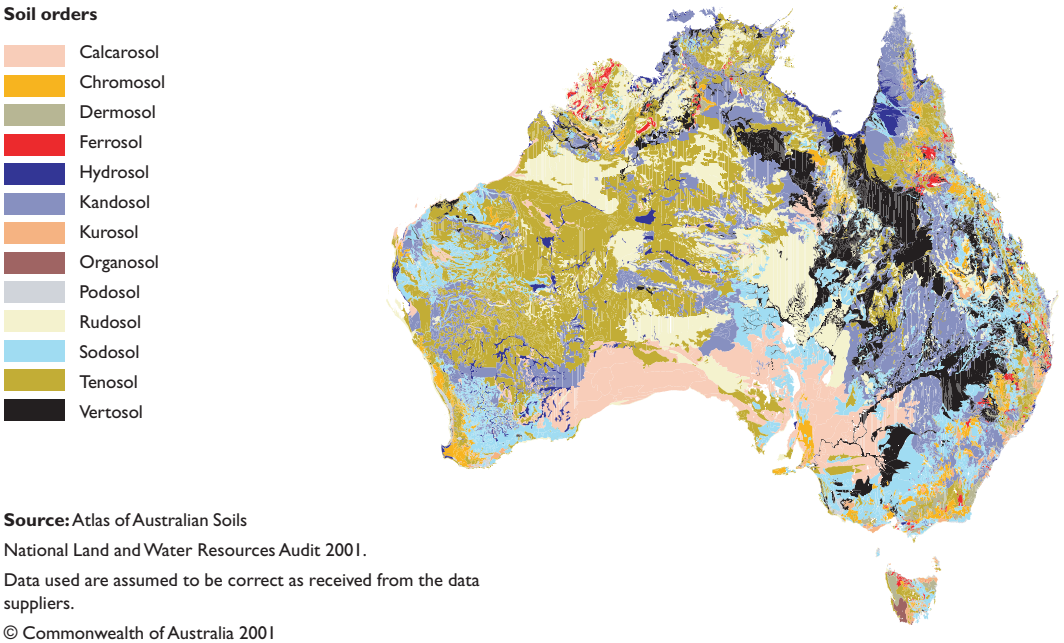


Source: AUSLIG.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure A4 Australia's soil orders according to the Australian Soil Classification (NLWRA 2001b).

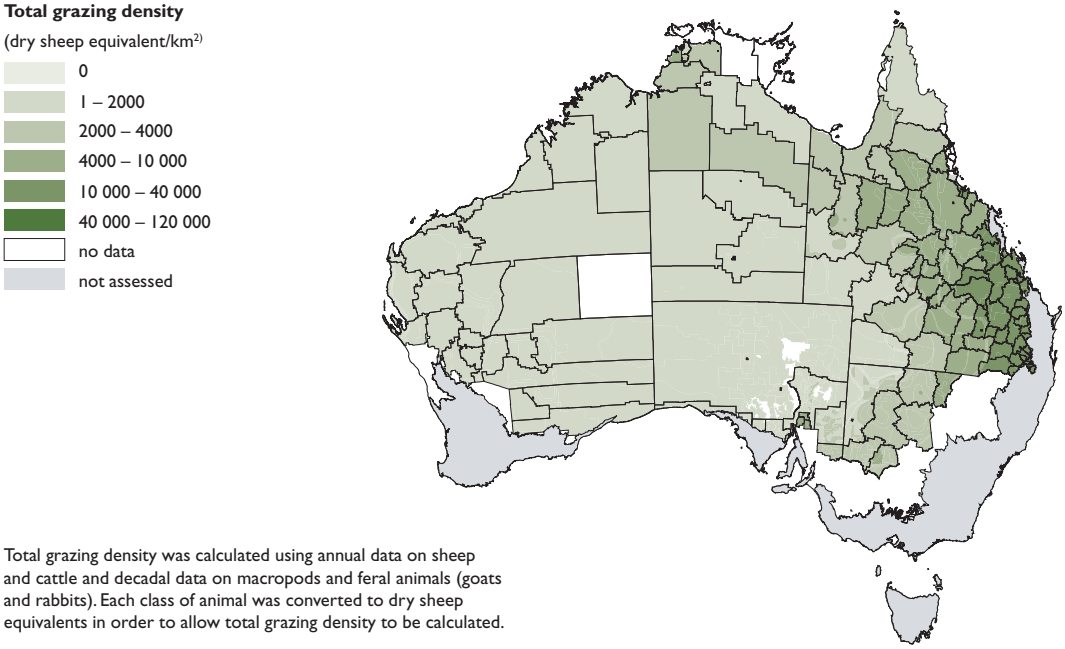


Source: Atlas of Australian Soils

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure A5 Total grazing density for Australia's rangelands by statistical local area (1990s) (NLWRA 2001d).



Total grazing density was calculated using annual data on sheep and cattle and decadal data on macropods and feral animals (goats and rabbits). Each class of animal was converted to dry sheep equivalents in order to allow total grazing density to be calculated.

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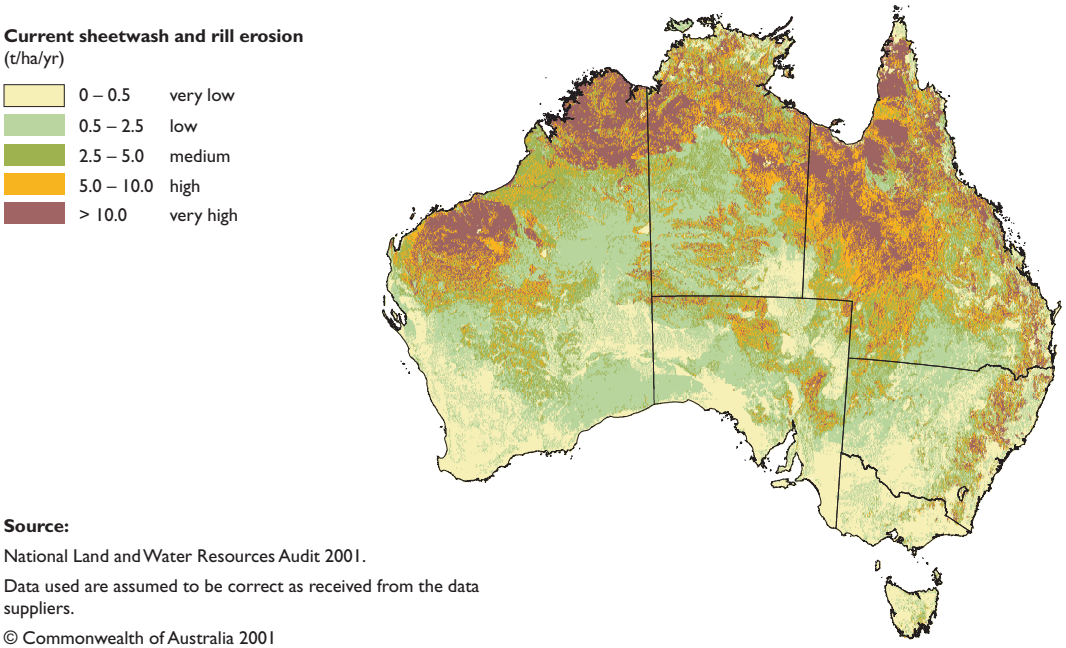
Figure A6 Mean annual sheetwash and rill erosion rate (NLWRA 2001b).

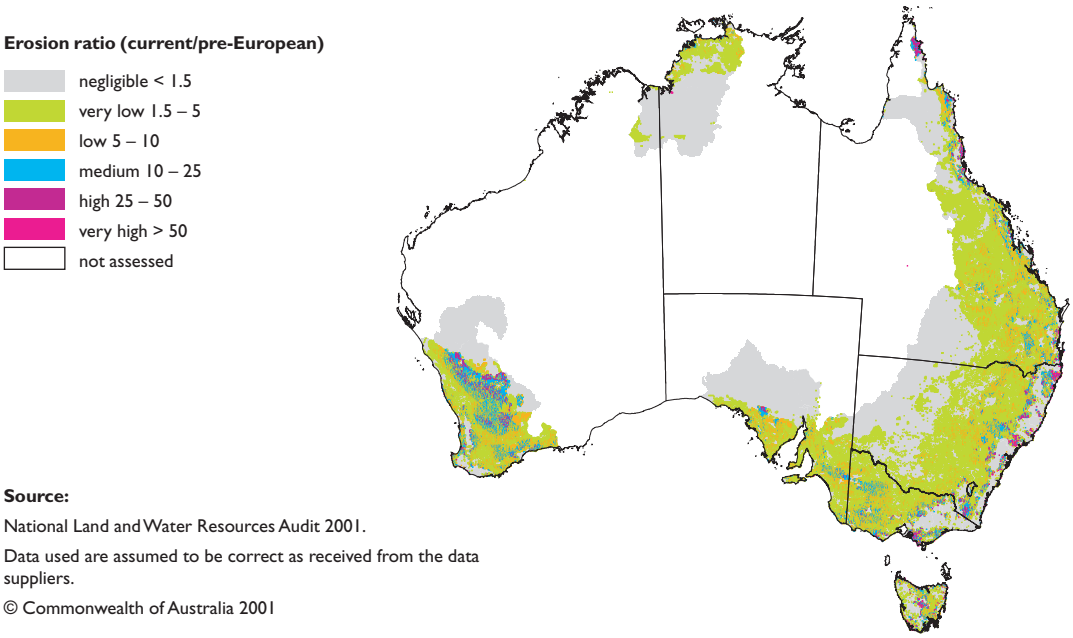


Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure A7 Present to pre-European sheetwash and rill erosion ratio (NLWRA 2001b).



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

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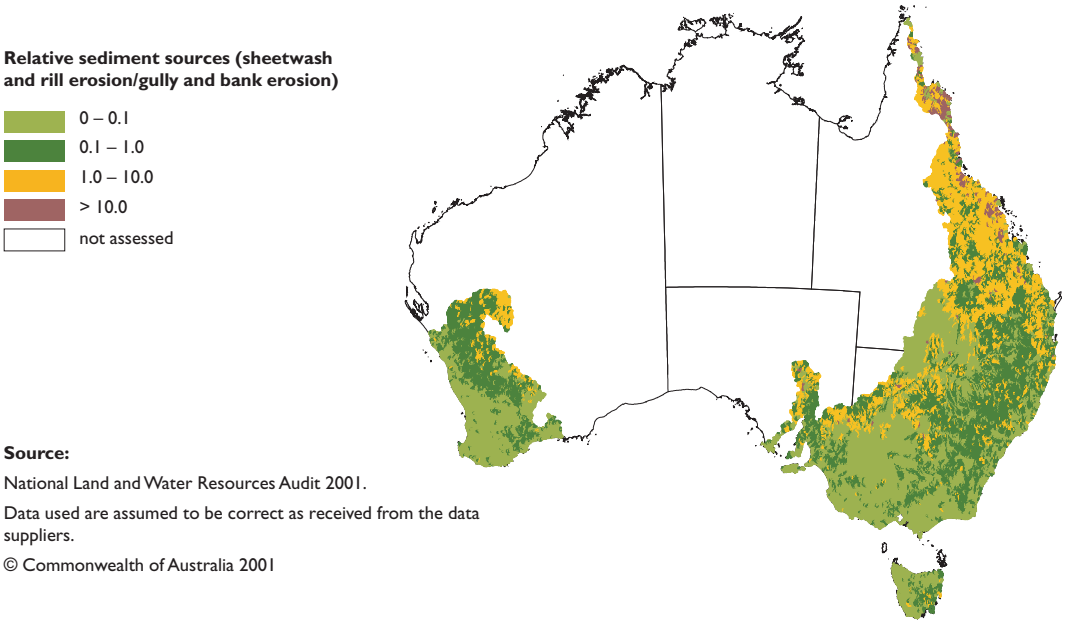
Figure A8 Ratio of hillslope to channel (gully and streambank) sediment sources by river link subcatchments (NLWRA 2001b).

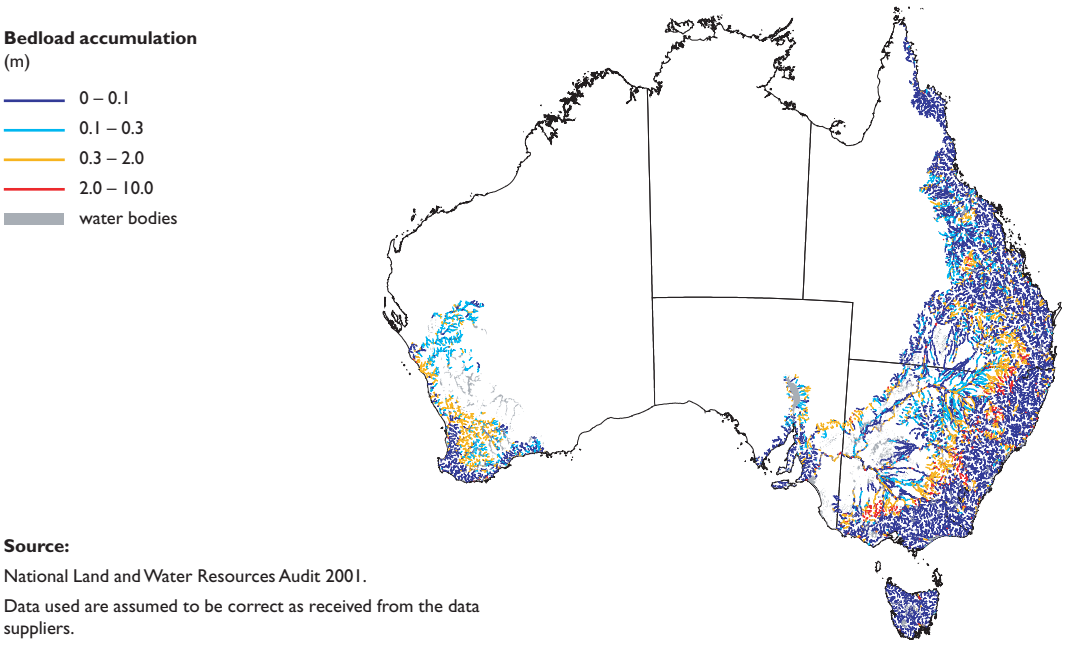


Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure A9 River bed sediment accumulation (NLWRA 2001b).

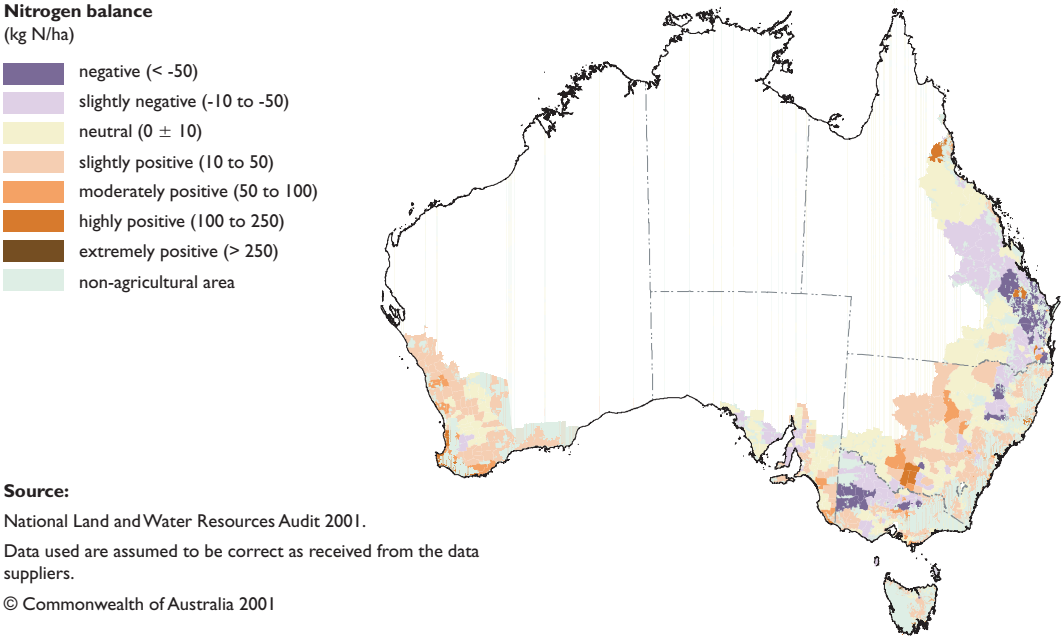


Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure A10 Farm gate nitrogen balance (kg N/ha) for all land uses combined (averaged 1992–1996) (NLWRA 2001b).

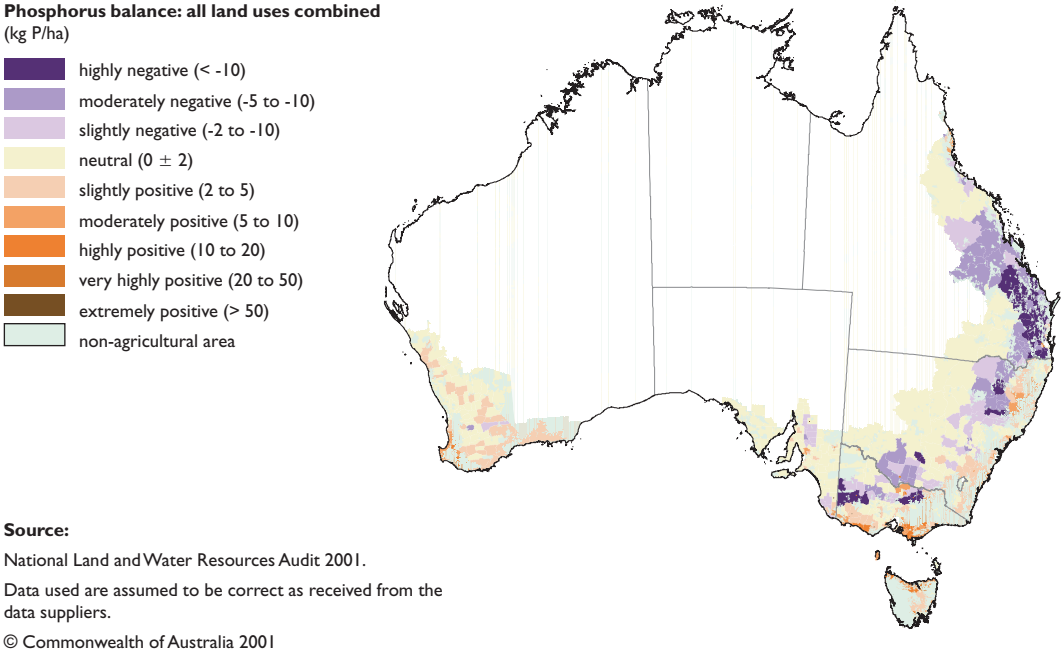


Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure A11 Farm gate phosphorus balance (kg P/ha) with all land used combined (averaged 1992–1996) (NLWRA 2001b).



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

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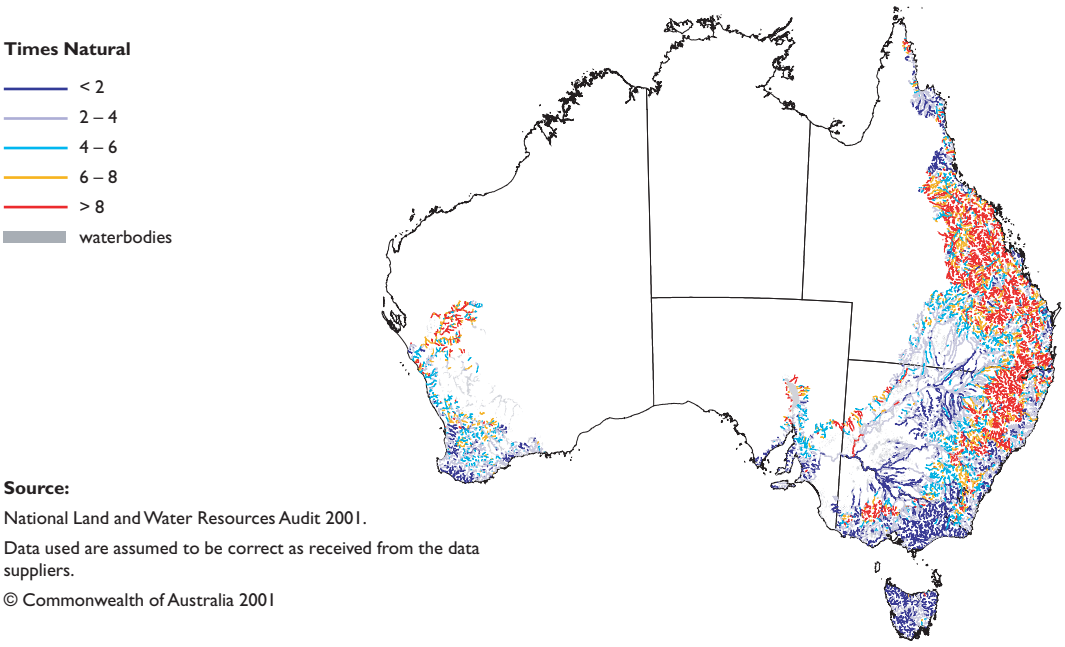
Figure A12 Relative increase in average annual total phosphorus loads by river network (NLWRA 2001b).

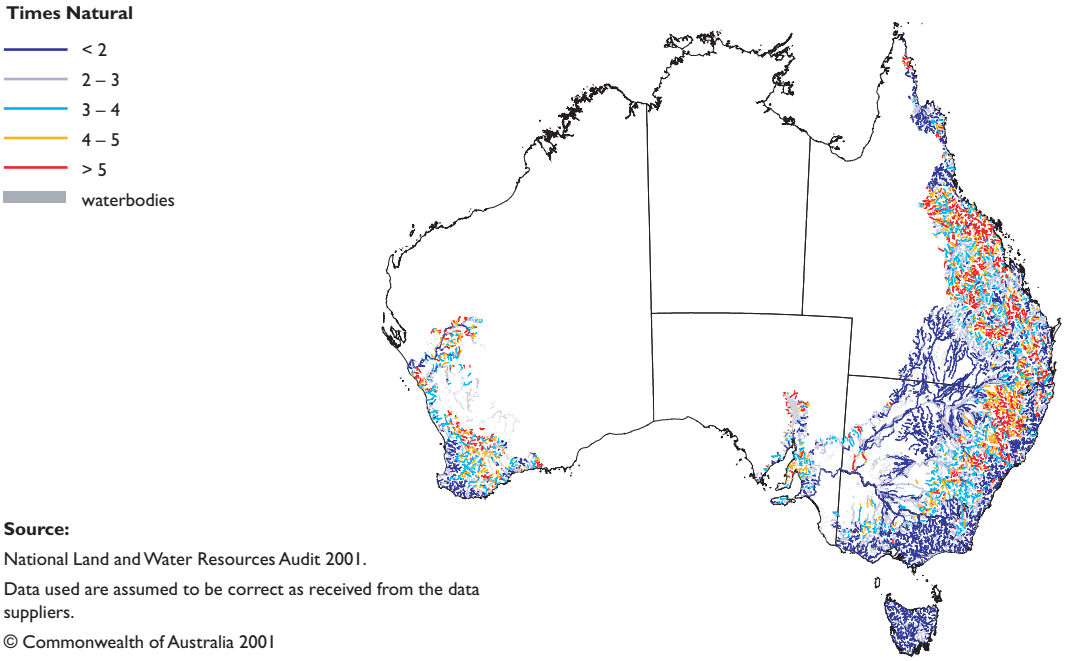


Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure A13 Relative increase in average annual total nitrogen load by river network (NLWRA 2001b).



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

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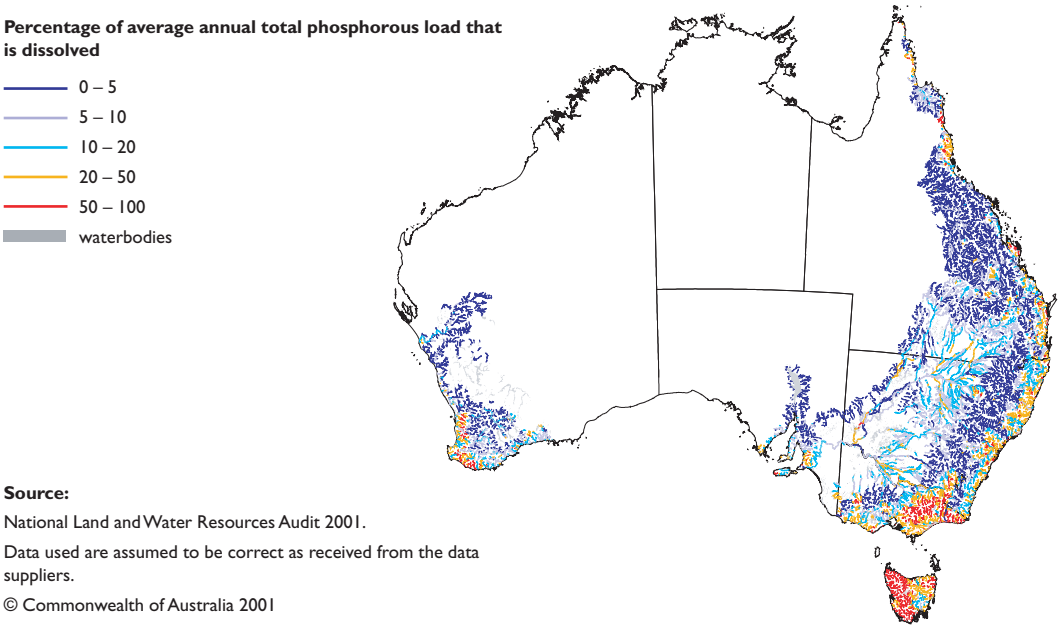
Figure A14 Percentage of average annual total phosphorus load that is dissolved by river network (NLWRA 2001b).

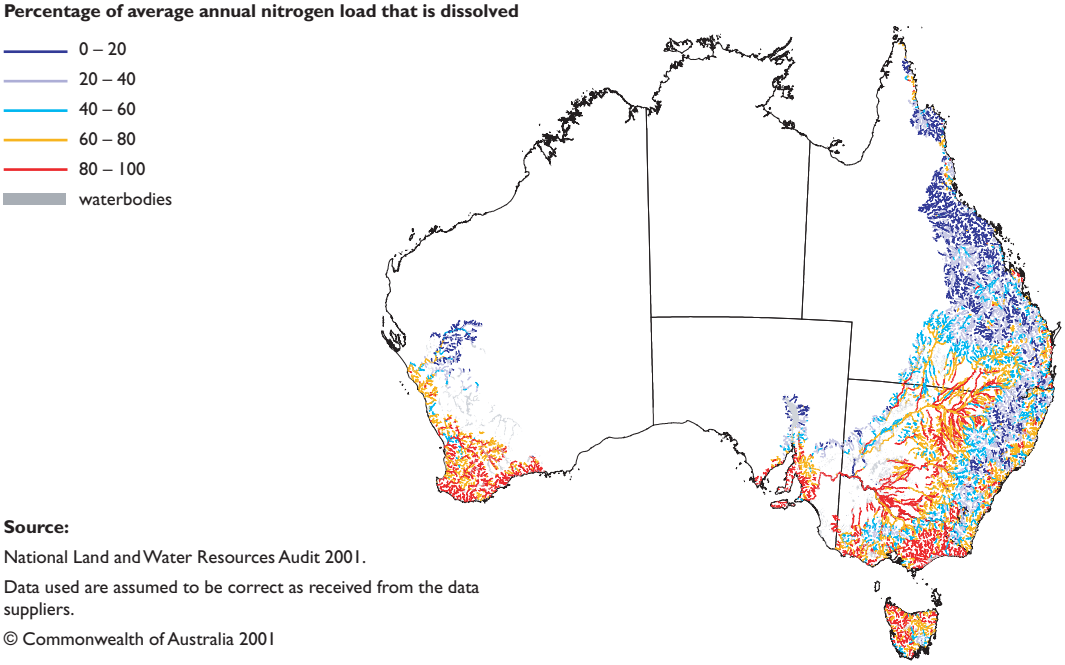


Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure A15 Percentage of average annual total nitrogen loads that is dissolved by river network (NLWRA 2001b).



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

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Figure A16 Areas of high hazard or risk of salinity 2000 (NLWRA 2001e).

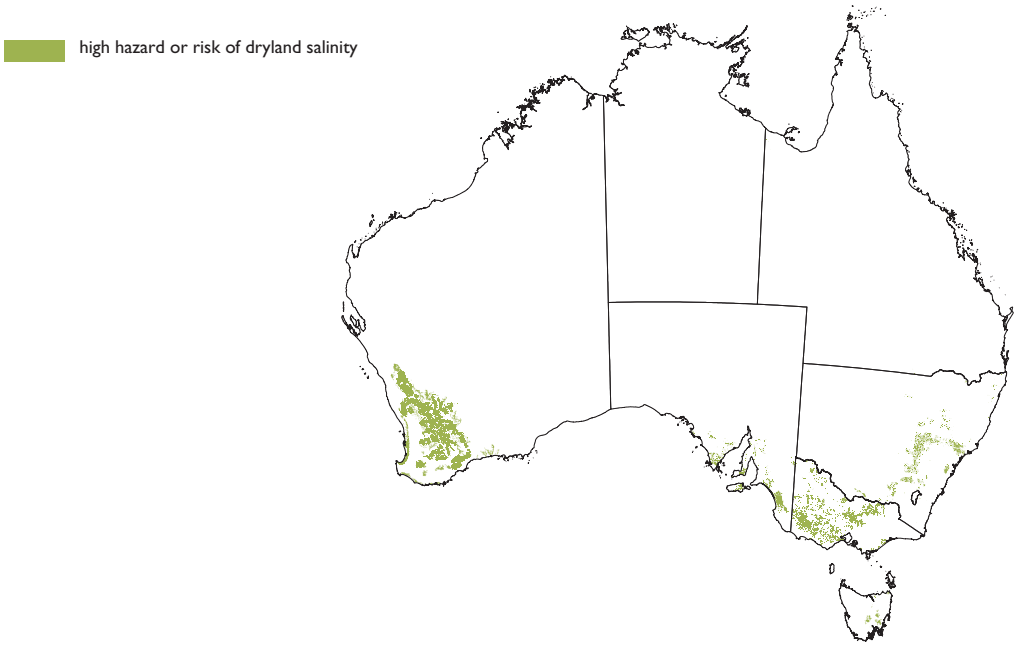
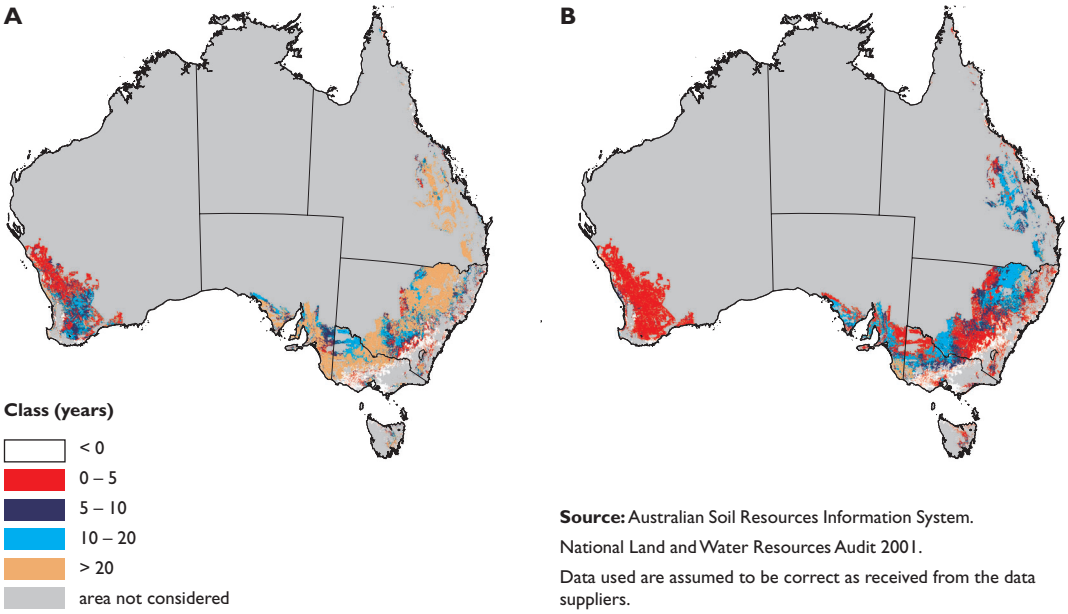


Figure A17 Modelled estimated years for Australia's agricultural soils (pH > 4.8) to reach pH_{Ca} 4.8 at minimum (A) and maximum (B) rates of acid addition, and in the absence of lime applications (NLWRA 2001b).



Source: Australian Soil Resources Information System.
National Land and Water Resources Audit 2001.
Data used are assumed to be correct as received from the data suppliers.

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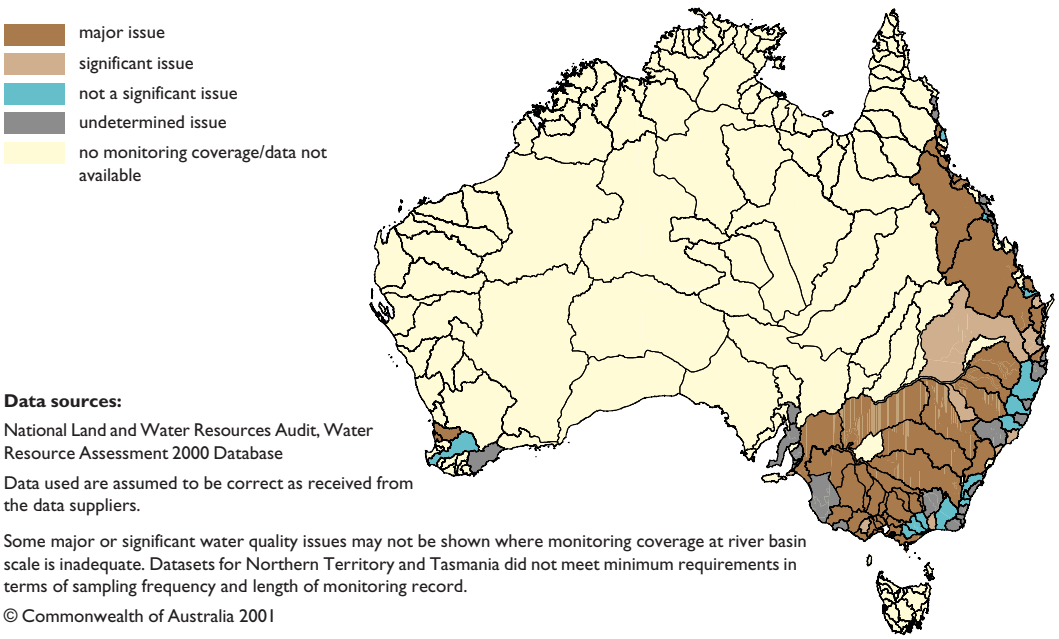
Figure A18 Surface water quality 2000. Exceedance of turbidity guidelines (NLWRA 2001f).



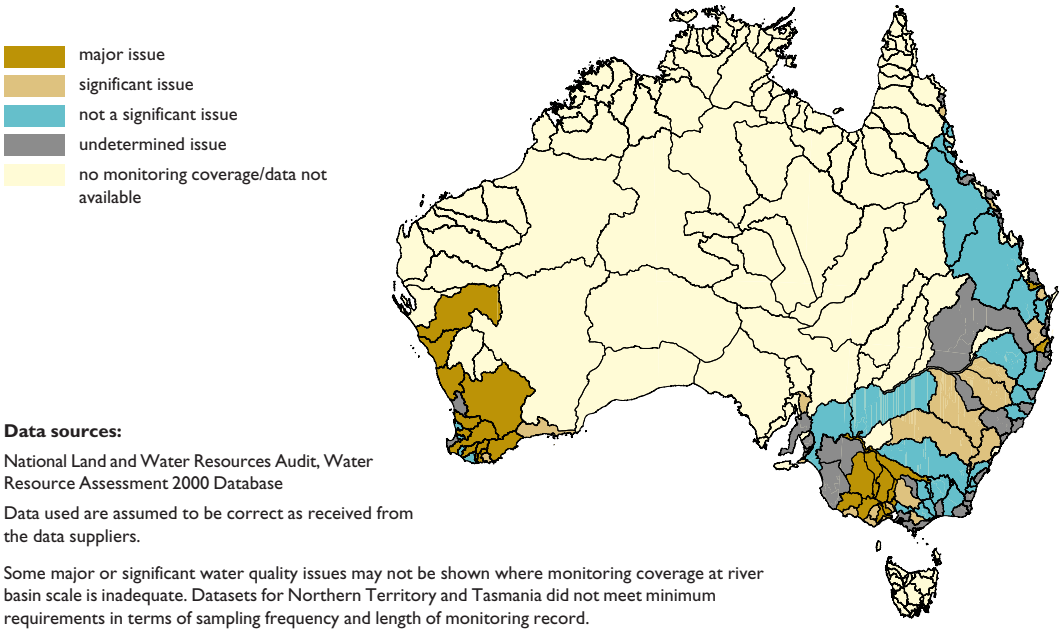
Data sources:

National Land and Water Resources Audit, Water Resource Assessment 2000 Database

Data used are assumed to be correct as received from the data suppliers.

Some major or significant water quality issues may not be shown where monitoring coverage at river basin scale is inadequate. Datasets for Northern Territory and Tasmania did not meet minimum requirements in terms of sampling frequency and length of monitoring record.

Figure A19 Surface water quality 2000. Exceedance of salinity guidelines (NLWRA 2001f).



Data sources:

National Land and Water Resources Audit, Water Resource Assessment 2000 Database

Data used are assumed to be correct as received from the data suppliers.

Some major or significant water quality issues may not be shown where monitoring coverage at river basin scale is inadequate. Datasets for Northern Territory and Tasmania did not meet minimum requirements in terms of sampling frequency and length of monitoring record.

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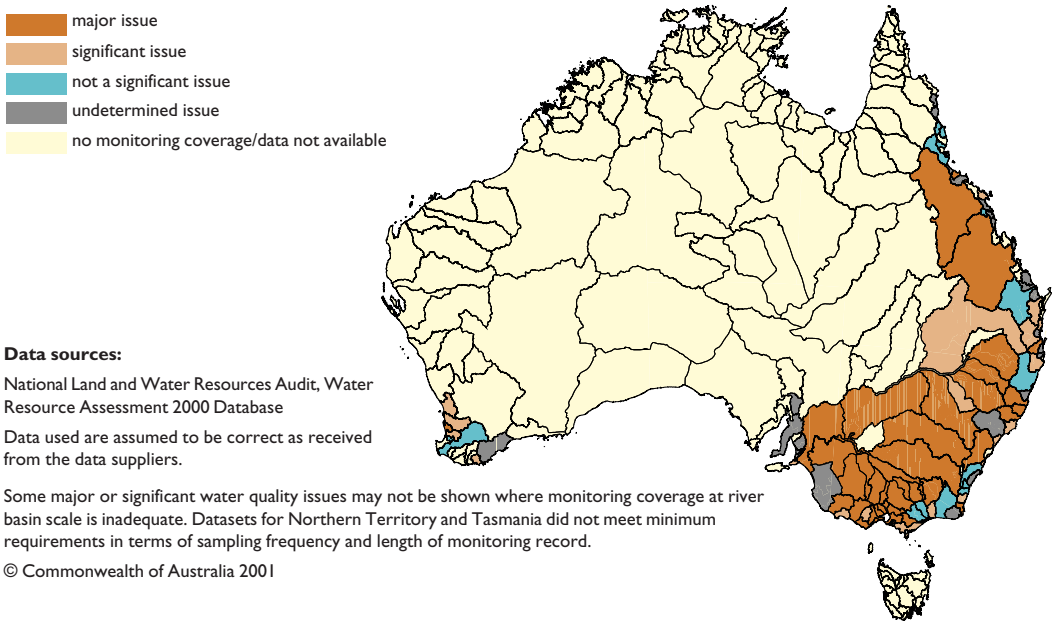
Figure A20 Surface water quality 2000. Exceedance of total phosphorus guidelines (NLWRA 2001f).



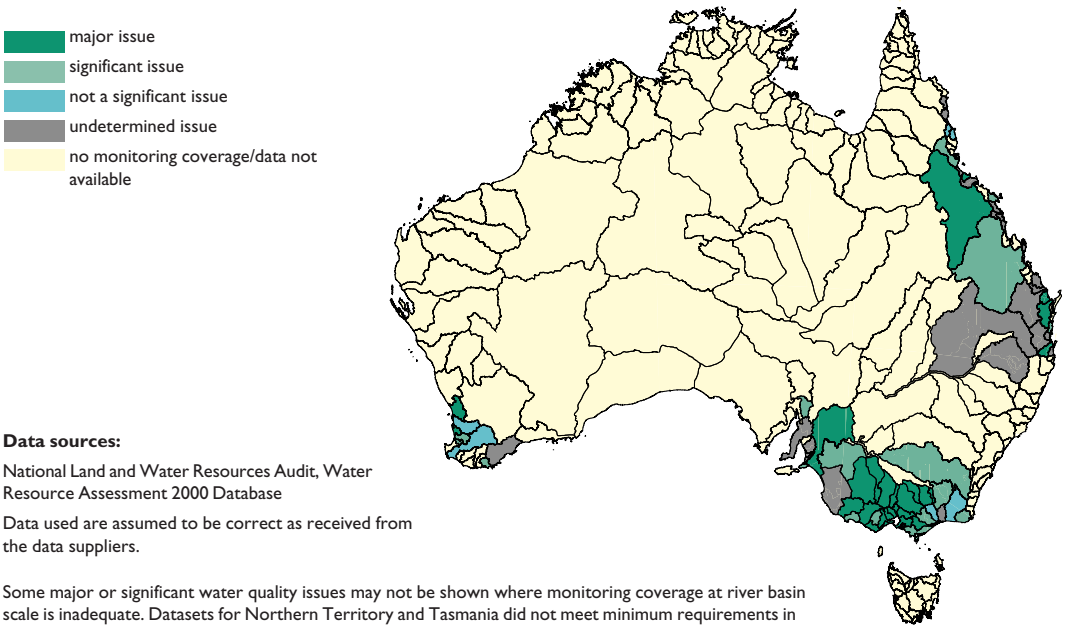
Data sources:

National Land and Water Resources Audit, Water Resource Assessment 2000 Database

Data used are assumed to be correct as received from the data suppliers.

Some major or significant water quality issues may not be shown where monitoring coverage at river basin scale is inadequate. Datasets for Northern Territory and Tasmania did not meet minimum requirements in terms of sampling frequency and length of monitoring record.

Figure A21 Surface water quality 2000. Exceedance of total nitrogen guidelines (NLWRA 2001f).



Data sources:

National Land and Water Resources Audit, Water Resource Assessment 2000 Database

Data used are assumed to be correct as received from the data suppliers.

Some major or significant water quality issues may not be shown where monitoring coverage at river basin scale is inadequate. Datasets for Northern Territory and Tasmania did not meet minimum requirements in terms of sampling frequency and length of monitoring record.

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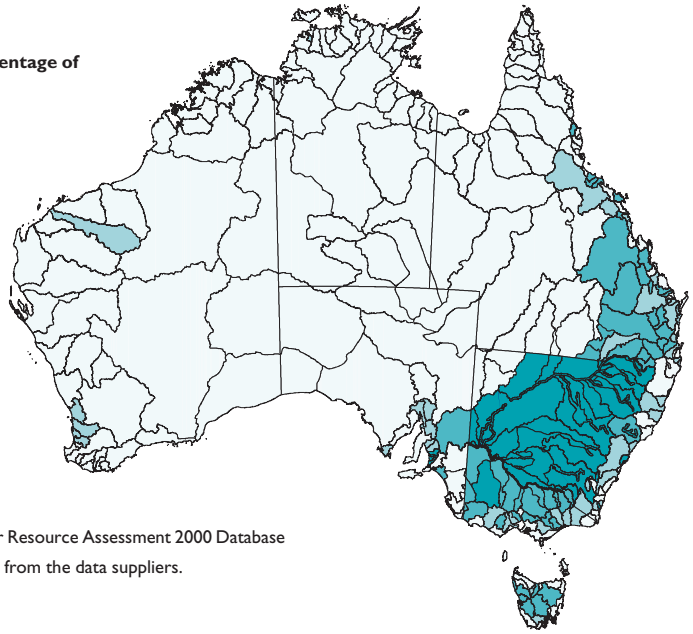
Figure A22 Surface water management areas. Level of surface water resource commitment (2000) (NLWRA 2001f).

Development category: diversion as a percentage of sustainable flow regime.

- greater than 100%
- between 70% and 100%
- between 30% and 70%
- less than 30%



Data sources:

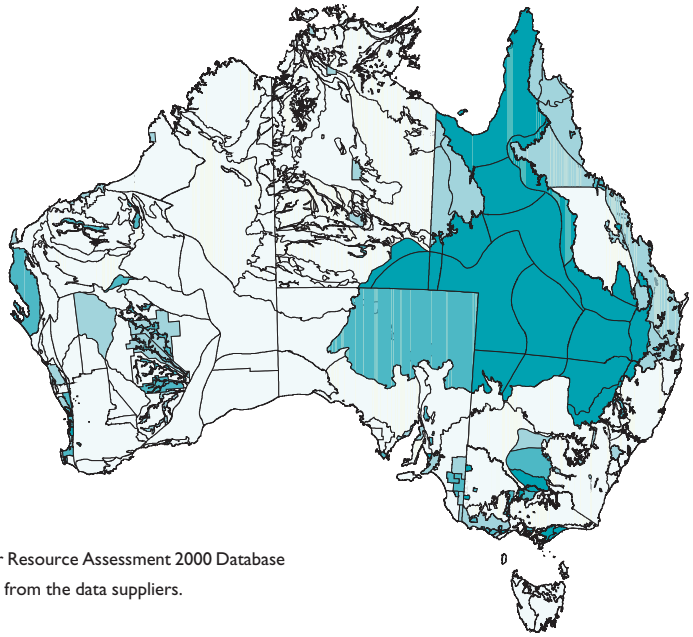
National Land and Water Resources Audit, Water Resource Assessment 2000 Database

Data used are assumed to be correct as received from the data suppliers.

Figure A23 Groundwater province abstraction development categorisation (2000) (NLWRA 2001f).

Abstraction development category: abstraction as a percentage of sustainable yield

- less than 30%
- between 30% and 70%
- between 70% and 100%
- greater than 100%



Data sources:

National Land and Water Resources Audit, Water Resource Assessment 2000 Database

Data used are assumed to be correct as received from the data suppliers.

GLOSSARY

Abstraction
Permanent removal of water from a stream channel.

Algal bloom
Proliferation of one or more phytoplankton species to high densities under favourable environmental conditions.

Alluvial
Relating to material deposited by running water.

Anaerobic
Environmental conditions where free oxygen is absent.

Aquatic ecosystem/system
Any body of water including lakes, streams, wetlands, reservoirs or estuaries and associated living organisms and non-living components functioning as a natural system.

Aquifer
A geological formation, group of formations, or part of a formation that stores and/or allows movement of groundwater.

Bank
The relatively steep part of a river channel, generally thought of as being above the usual water level.

Bank full
The carrying capacity of a stream just prior to its spilling onto the adjacent area.

Bed load
The solids that are carried within the bed of a river, excluding those carried in suspension or solution; they range from the heavier particles, which are moved by saltation (leaping movement), to the largest, which are moved by traction. The bed load has two sources: hillside material washed into a stream and material produced by erosion of river banks.

Bed, river
That part of a river channel usually covered with water when the river is flowing.

Bedrock
The natural, more or less undisturbed country/parent rock.

Benthic zone
The bottom or bed of a water body.

Biota
Refers to all plant and animal life in an area.

Biodiversity
Variety of life forms including the different plants, animals and microorganisms, the genes they contain and the ecosystems they form. Biodiversity is usually considered at three levels: genetic, species and ecosystem.

Biophysical
Relating to biological and physical processes.

Braided
Refers to streams that divide into an interlacing network of several branching and reuniting channels separated from each other by islands or channel bars.

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Catchment
An area that drains all the precipitation that falls on it to a single point. Or the area of land drained by a stream or stream system. It can be simple, dealing with the water of one watercourse, or complex, having a number of internal subcatchments contributing to the whole. *Catchment* should not to be confused with watershed.

Condition
The state of a system that is defined relative to some ideal benchmark.

Connectivity, lateral
A river's connection with the floodplain and the movement of water, biota and material across the floodplain. Levees disrupt lateral connectivity.

Connectivity, longtitudinal
The upstream–downstream connectivity that is important for the migration and breeding of many fish species. Built structures disrupt longtitudinal connectivity.

Dam
An impediment, natural or artificial to the general flow of a stream, usually built for storage.

Deposition
The settling out or laying down of suspended, in-solution or other water-borne materials by a lessening of the velocity of the water or changes in water chemistry.

Detention basin
A basin (constructed or natural wetland) that temporarily detains surface run-off or flood waters.

Detritus
Organic marterial such as leaves and twigs.

Dike, bund, bund wall
An embankment for controlling water; any impoundment structure that completely spans navigable water.

Disturbance
A force that causes changes in habitat or community structure and composition such as natural events or human activities.

Diversion
Any natural or artificial method or means by which a part or whole of a river flow is taken from its natural course.

Drainage area
The country drained by a stream system. See *catchment*, *drainage basin*.

Drainage basin
See *catchment* or *river basin*.

Drainage division
Drainage divisions are broad regions of the Australian continent defined by aggregation of adjoining river basins with comparable climate or geography or shared discharge points.

Dredging
A mechanical operation that may use heavy machinery to remove river material to improve the channel or as part of a mining operation.

Driver, biophysical or process
Biophysical elements or processes that determine the patterns and fluxes of biota, material and energy within ecosystems. Changes to these elements or processes 'drive' the ecosystem to a different condition.

Dry sheep equivalent
A standard unit frequently used to compare the feed requirements of different classes of stock or to assess the carrying capacity and potential productivity of a given farm or area of grazing land. It is based on the amount of feed required by a two year old, 45 kg Merino sheep (wether or non-lactating, non-pregnant ewe) to maintain its weight.

Ecological sustainability
Maintenance of ecosystem and species stability over human time scales.

Ecosystem
Community of organisms that may include humans, interacting with one another. Incorporating the physical, chemical and biological processes inherent in that interaction and the environment in which they live.

Ecosystem health
A term used to describe desired ecosystem conditions. the perception of health will vary depending on goals (i.e. production versus biodiversity).

Embankment
The artificial bank built along a river to protect adjacent land from flood waters. Also called *levee* or *dike*.

Endemic
Species that is unique or confined to a specific locality.

Environmental water provisions
Water allocated to support the ecological functioning of aquatic and other dependent habitats based on environmental, social and economic considerations, including existing user rights.

Environmental water requirements
Descriptions of the flow regimes (e.g. volume, timing, seasonality, duration) needed to sustain the ecological values of aquatic ecosystems including their processes and biological diversity.

Estuary/coastal waterway
For the Audit assessment, estuaries and coastal waterways are broadly described as a semi-enclosed coastal water body where salt from the open sea mixes with freshwater draining from the land or where marine and fluvial sediments occur together.

Eutrophication
Process of enrichment of nutrients, especially nitrogen and phosphorous.

Extensive land use zone
The area of Australia that does not contain intensive land use. Broadly referred to as the rangelands.

Fish ladder, passage
Inclined waterway, commonly an artificial channel with stepped pools installed at a dam to allow passage of migratory fish over or around an obstruction.

Flushing rate
Time required for a volume of water equivalent to the estuary volume to mix with the ocean or the reservoir volume to be discharged.

Fluvial
Relating to or occurring in a river.

Flood plain
The flat area usually toward the lower end of a river system where periodic flooding has deposited river-borne materials.

Flow duration
Percentage of time within a given period when different flows occur.

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Gauging station
Location where measurements of stream flow are made.

Geomorphic
Pertaining to form or shape of the landscape and the processes that affect the Earth's surface.

Geomorphology
Science of describing and interpreting landform and processes of landscape formation.

Groundwater
Water stored underground in rock fractures and pores.

Groyne
A structure built from the bank of a river in a transverse direction to the current. Its function is to assist in keeping the eroding current away from an affected bank and in so doing to promote deposition of silt and other material along the bank in its vicinity.

Gully
A narrow channel worn in a hillside or on sloping ground by the action of water and particularly by accelerated erosion. It is usually dry except after rain.

Habitat
A specific type of place within an ecosystem occupied by an organism, population or community that contains both living and non-living components with specific biological, chemical and physical characteristics including life requirements (e.g. food, shelter and water).

Hydrologic regime
Water movement in a given area. It is a function of input from precipitation, surface and groundwater and output from evaporation into the atmosphere or transpiration from plants.

Impoundment
A natural or artificial body of water that is confined by a structure such as a dam.

Inshore marine
In or on marine water, but close to the shore.

Intensive land use zone
The area of Australia where intensive land use practices such as irrigated agriculture occur.

Intertidal
The zone of shore between the high water mark and low water mark.

Integrated catchment management
A management process that takes account of all aspects of a catchment. Although defined slightly differently in each State, the goal of integrated catchment management (or total catchment management) is usually to ensure the sustainable development of natural resource-based industries, the protection of land, water and vegetation resources and the conservation of natural and cultural heritage on a river or groundwater catchment basis.

Inverse estuary
Type of estuary where evaporation exceeds freshwater inflow plus precipitation.

Landtype
Unit on the Earth's surface of a characteristic geomorphic surface type and a particular lithilogical composition, identifiable on a scale of hecatares.

Levee
Natural or artificial ridge or embankment to prevent flooding or restrict movement of water.

Littoral drift
River mouths at coastlines suffer a gradual and continual change due to wind and wave action which may cause deposition across the mouth. Usually the principal source of bar material.

Macro-invertebrate
An animal without a backbone and large enough to be seen without magnification.

Macrophyte
A plant that can be seen without magnification.

Mean flow, average discharge, average daily flow, average annual flow
Average discharge at a given stream location.

Natural flow
Discharge that occurs naturally through climate and geomorphology without regulation and diversion or other modification.

Outfall
Outlet of a water body, drain or culvert.

Oxbow
Bend or meander in a stream that becomes detached from the stream channel. Also known as 'billabong'.

Protective management
Management activities focussed on maintaining natural resources in good condition as opposed to those that seek to rehabilitate condition.

Rehabilitation, remediation
Action to return a landform, vegetation, or water body to as near as original condition as practical. Implies making land and water resources useful again after disturbance.

Remote sensing
Acquisition of information on an object by satellite, aerial photography and radar.

Retention
Portion of the gross storm rainfall that is intercepted, stored or delayed in wetlands or constructed basins to allow nutrients and sediment loads to settle out.

Riffles
Shallow reaches with low flow characterised by small hydraulic jumps over rough bed material, causing small ripples, waves and eddies, without breaking surface tension.

Rill erosion
Erosion resulting from movement of soil by a network of small, shallow channels.

River basin
Catchment areas of major rivers draining to the sea; named after these rivers. The 245 river basins as defined by the former Australian Water Resources Council. These form sub-basins of the drainage divisions.

River reach
A group of river segments with similar biophysical characteristics.

Run-off
The difference in quantity between precipitation and the combination of evaporation and transpiration. The resulting water that supplies rivers and lakes after evaporation and transpiration have occurred. Includes water that soaks into the earth and is available as groundwater. Surface run-off does not include groundwater.

Seasonal amplitude
Measure of the difference between seasonally high and low flows.

Seasonal period
The return time between certain flow conditions.

Sediment carrying capacity
: The capacity of a stream to transport sediment both as bed load and in suspension. It is related to flow gradient, velocity and volume.

Sedimentary environment
: Refers to a characteristic suite of sediment types defined by mineralogical composition and grain size that are deposited within specific landform and energetic environments. Also known as 'sedimentary facies'.

Sheet erosion
: Erosion of soil from across a surface by uniform action of rain or flowing water.

Supratidal
: The zone of shore between the mean high water mark and the astronomical high water (spring tide) mark.

Watershed
: The boundary of a catchment, the dividing line between two catchments. Often erroneously used instead of *catchment*.

Waterway
: A general term for any stream, river or watercourse, either flowing or dry. Also includes artificial cuts, canals and channels.

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NATIONAL LAND AND WATER RESOURCES AUDIT

Who is the Audit responsible to?

The Minister for Agriculture, Fisheries and Forestry – Australia has overall responsibility for the Audit as a program of the Natural Heritage Trust. The Audit reports through the Minister for Agriculture, Fisheries and Forestry to the Natural Heritage Board which also includes the Minister for the Environment and Heritage.

How is the Audit managed?

An Advisory Council manages the implementation of the Audit. Dr Roy Green, with a background in research, science policy and management chairs the Advisory Council. Members of the Advisory Council and the organisations they represent in February 2002 are: Warwick Watkins (L&WA), Bernie Wonder (AFFA), Stephen Hunter (EA), John Radcliffe (CSIRO), Peter Sutherland (SCARM), Jon Womersley (SCC), Roger Wickes (SCARM) and Colin Creighton (Audit).

What is the role of the Audit Management Unit?

The Audit Management Unit's role has evolved over its five-year life. Phases of activity include:

Phase 1. Strategic planning and work plan formulation—specifying (in partnership with Commonwealth, States and Territories, industry and community) the activities and outputs of the Audit—completed in 1998–1999.

Phase 2. Project management—letting contracts, negotiating partnerships and then managing all the component projects and consultancies that will deliver Audit outputs—a major component of Unit activities from 1998–1999 onwards.

Phase 3. Reporting—combining outputs from projects in each theme to detail Audit findings and formulate recommendations—an increasingly important task in 2000–2001 and the early part of 2001–2002.

Phase 4. Integration and implementation—combining theme outputs in a final report, working towards the implementation of recommendations across government, industry and community, and the application of information products as tools to improve natural resource management—the major focus for 2001–2002.

Phase 5. Developing long term arrangements for continuing Audit-type activities—developing and advocating a strategic approach for the continuation of Audit-type activities—complete in 2001–2002.

The Audit Management Unit has been maintained over the Audit's period of operations as a small multidisciplinary team. This team as at February 2002 comprises Colin Creighton, Warwick McDonald, Maria Cofinas, Jim Tait, Rochelle Lawson, Sylvia Graham and Drusilla Patkin.

How are Audit activities undertaken?

As work plans were agreed by clients and approved by the Advisory Council, component projects in these work plans were contracted out. Contracting involves negotiation by the Audit to develop partnerships with key clients or a competitive tender process.

Facts and figures

• Total Audit worth, including all partnerships	in excess of $52 m
• Audit allocation from Natural Heritage Trust	$34.19 m
• % funds allocated to contracts	~ 92%
• Total number of contracts	149

Natural Heritage Trust

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A Commonwealth Government Initiative

National Land & Water Resources Audit

A program of the Natural Heritage Trust

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