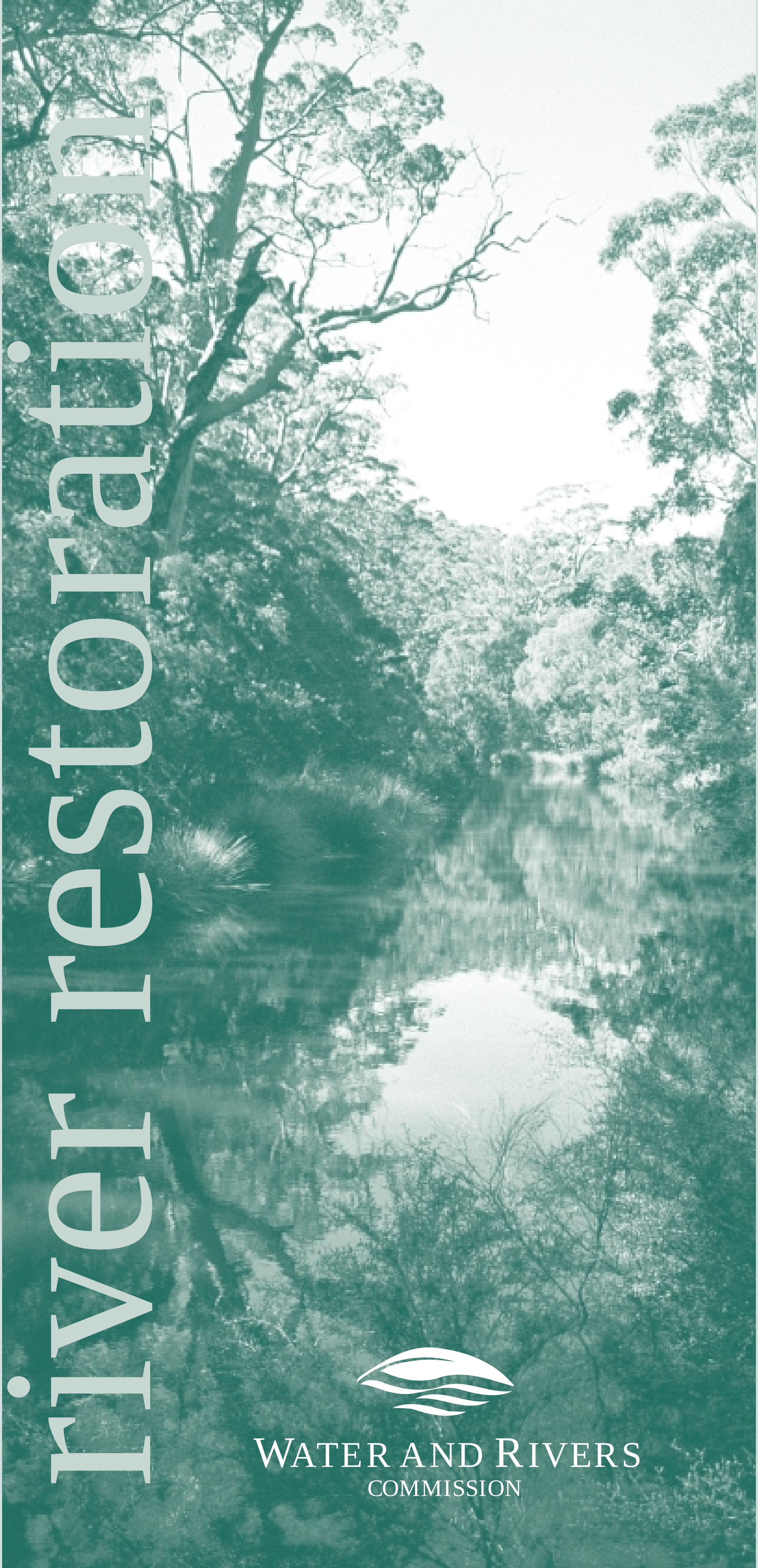

river restoration

THE GOVERNMENT OF WESTERN AUSTRALIA

Determining foreshore reserves

WATER AND RIVERS COMMISSION

November 2001
Report No. RR 16

Determining Foreshore Reserves

Prepared by
Chris Manning

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Foreword

Many Western Australian rivers are becoming degraded as a result of human activity within and along waterways and through the off-site effects of catchment land uses. The erosion of foreshores and invasion of weeds and feral animals are some of the more pressing problems. Water quality in our rivers is declining with many carrying excessive loads of nutrients and sediment and in some cases contaminated with synthetic chemicals and other pollutants. Many rivers in the south-west region are also becoming increasingly saline.

The Water and Rivers Commission is responsible for coordinating the management of the State's waterways. Given that Western Australia has some 208 major rivers with a combined length of over 25 000 km, management can only be achieved through the development of partnerships between business, landowners, community groups, local governments and the Western Australian and Commonwealth Governments.

The Water and Rivers Commission is the lead agency for the Waterways WA Program, which is aimed at the protection and enhancement of Western Australia's waterways through support for on-ground action. One of these support functions is the development of river restoration literature that will assist local government, community groups and landholders to restore, protect and manage waterways.

This document is part of an ongoing series of river restoration literature aimed at providing a guide to the nature, rehabilitation and long-term management of waterways in Western Australia. It is intended that the series will undergo continuous development and review. As part of this process, any feedback on the series is welcomed and may be directed to the Catchment Management Branch of the Water and Rivers Commission.

Contents

Figures

Introduction

Protection and management of foreshore areas is essential for maintaining healthy waterways and wetlands. Protected foreshores preserve aquatic, littoral and terrestrial habitat for native flora and fauna while providing amenity and maintaining scenic quality and landscape values. They also reduce the impacts of erosion, sedimentation and nutrient influx in waterways.

Traditionally, foreshore protection and management policies have relied on a standard or pre-determined figure, such as 30 metres for rivers (WAPC DC 2.3) and 50 metres for estuaries (WAPC DC 6.1) (Western Australian Planning Commission 1999). Foreshore policy development in Western Australia has heralded new thinking in foreshore protection and management by introducing the use of biophysical criteria for defining foreshore reserves.

What is a foreshore?

A foreshore is the land that adjoins or directly influences a waterway. More specifically, it is the area of transition between the edge of the waterway and the furthest extent of riparian vegetation, flood prone land, and riverine landform or simply the adjacent upland. However in practice, where human activities have affected creek, river and estuary foreshores, the foreshore area may be the land between the waterway and that being actively used by humans (Water and Rivers Commission 1999, *Statewide Foreshore Policy – Policy Update No. 2*). A foreshore may be considered part of a waterway protection precinct.

Why should we protect and manage foreshores?

The water quality of waterways is influenced by the health of the catchment and adjacent fringing vegetation. Typically, native riparian vegetation consists of an understorey of groundcover species, a middle storey of shrubs and taller sedges and an upper storey of trees and shrubs. Healthy native riparian vegetation filters nutrients from run off and helps to bind soils, thus reducing erosion. Overhanging vegetation provides shade to the waterway, which reduces water temperatures and improves water quality. Fallen logs and branches provide stream habitat while also helping to dictate stream flow.

Fallen material, including leaf litter, provides a detrital food source for invertebrates, which in turn drives the food chain of the waterway. Vegetation may also help in the conveyance of floodwaters along the waterway. A healthy foreshore area is usually mostly free of erosion, weeds, feral animals, livestock and litter. A properly managed foreshore will improve property values and provide recreational amenity.

What are biophysical criteria?

Biophysical criteria are the physical and biological features of a waterway, as illustrated in Figure 1. They are the factors to be considered in defining the foreshore reserve. Application of these criteria will yield an area of influence for the waterway. This is the land area affected by the waterway, which in turn affects the health of the waterway.

Biophysical criteria:

- Vegetation: fringing and upland remnant vegetation associated with, or influencing, the waterway.
- Hydrology: flood prone land and areas subject to waterway channel changes.
- Soil type: soil types that define the extent of foreshore vegetation.
- Erosion: soils types prone to erosion.
- Geology: geological features that influence the waterway.
- Topography: landscape features including slope, shape and composition of landforms that influence, or are influenced by the waterway.
- Function: the foreshore function, ie. flood protection, recreation or habitat conservation.
- Habitat: habitats such as river pools, woody debris, riffles and riparian vegetation.
- Climate: climatic variations and resultant changes in water levels.
- Land use: areas that may be harmed by increased land use pressure.
- Heritage: archaeological and ethnographic sites.

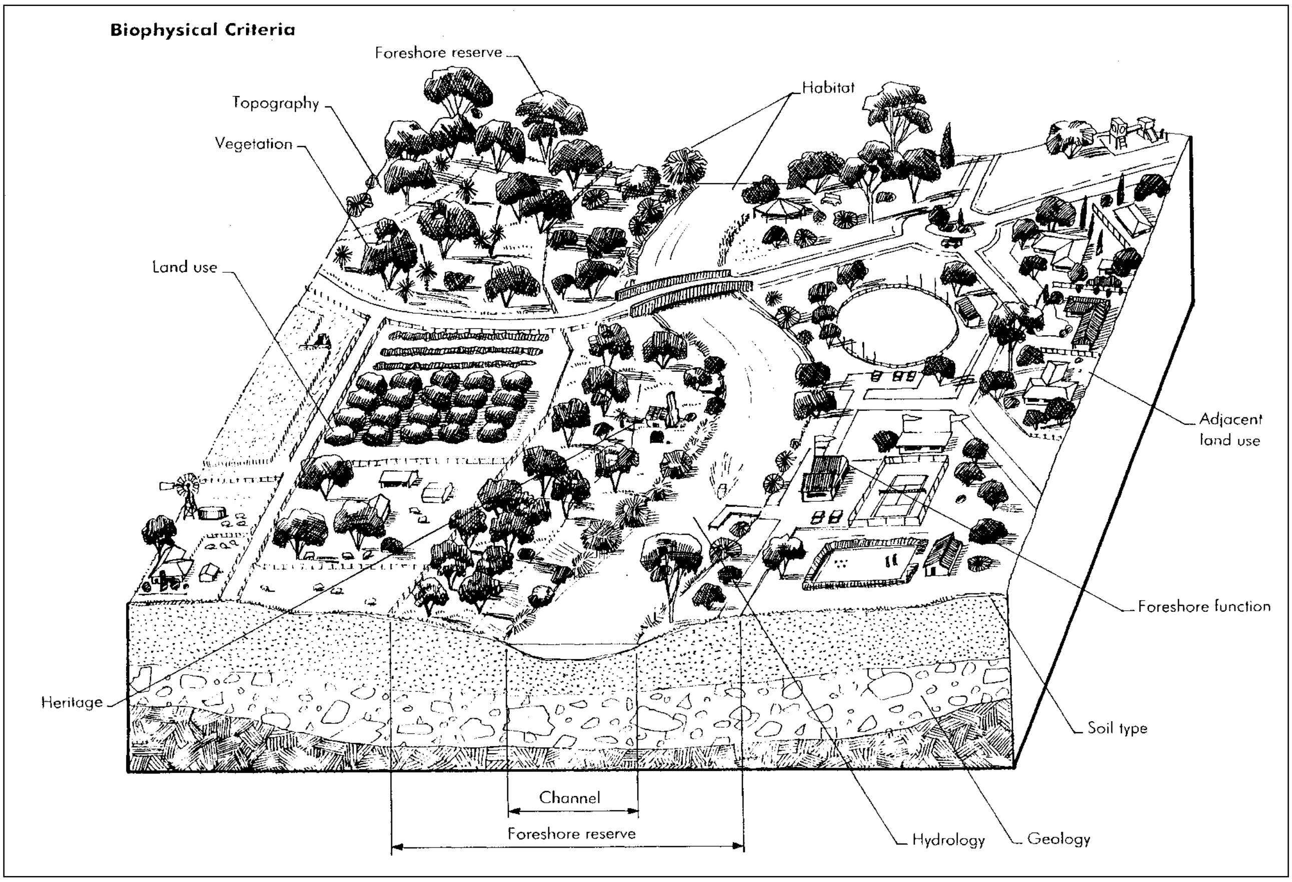

Figure 1. Representation of the biophysical criteria of a waterway.

Identifying the biophysical factors of a waterway

Identification of the biophysical criteria of a waterway yields a foreshore reserve that is reflective of these biophysical factors. The Water and Rivers Commission (the Commission) recommends that an annotated map showing the extent of the proposed foreshore reserve and a brief report outlining the rationale and justification for the delineation of the foreshore is prepared. This report may be used to streamline the approval process for any associated development proposal.

Identification of a foreshore reserve using biophysical criteria is described in four steps, outlined below.

Step 1: Background information and preliminary investigations

To begin with you should seek to:

1. understand the waterway, its issues and regional conservation significance, including consideration of any social or political issues in the area if relevant;
2. acquire aerial photos to assist in the delineation of the riparian corridor and the assessment of plant communities, river form and adjacent land uses;
3. obtain maps where relevant, showing the extent of the floodway and floodplains, landform, cadastral boundaries, soil, geology and plant community information for the river and adjacent land (these maps are available through the use of digital geographical information systems mapping, from the Department of Land Administration, Department of Planning and Infrastructure and the Commission's floodplain mapping section); and
4. identify reports relevant to the river and region, which may cover floodplain mapping, flora and fauna surveys, or ethnographic and cultural significance.

Degraded foreshore in suburban waterway. [Photo: L. Pen]

Step 2: Identification of the biophysical criteria

Defining foreshore reserves using biophysical criteria involves a combination of desktop analysis and field inspection. Analysis of the photos, maps and reports collected in Step 1 yields a foreshore reserve for the river while also identifying areas for field inspection. The following factors should be assessed:

- *The extent of the riparian vegetation.*

  Identify adjoining riparian vegetation and associated dryland vegetation. A buffer of riparian or upland vegetation is important for habitat and wildlife corridors as well as for nutrient stripping and erosion control. The extent of the riparian vegetation can be determined with the use of aerial photos and by conducting vegetation surveys.

- *Soil types that typically support riparian vegetation.*

  These soil types are helpful in identifying areas where riparian vegetation may once have existed or in identifying plant species suitable for revegetation. Make use of aerial photos, soil maps and site inspections.

- *The extent of the floodway and floodplain.*

  Locate land susceptible to flooding, primarily the floodway and floodplain, using topographic maps, aerial photos, floodplain mapping (available from the Commission) or site inspections. Floodplain mapping may include information on the level of prospective flooding, such as the 1 in 100 year flood level. Plant species and communities may also help in identifying these areas.

- *Soil types that are prone to erosion.*

  Soils that are typically loose, gravelly and loamy in texture are more susceptible to erosion. Sloping sites have greater potential for erosion. Soils with low permeability have higher surface run off, which increases superficial erosion, while the opposite applies for soils with relatively high permeability. Identify these areas using soil maps, land capability maps, aerial photos and site inspections.

- *Landforms important to watercourse function.*

  These include drainage lines, steep slopes, ridges, cliff faces, low-lying or seasonally inundated lands and sand dunes. These areas may be subject to bank subsidence, stock trampling, scouring, undercutting and other forms of erosion. Identify these landforms using contour maps, aerial photos and site inspections.

- *Valuable habitat areas.*

  Identify aquatic habitats such as pools, riffles, billabongs, marshes and waterfalls, and terrestrial habitats such as mudflats, samphire marshes, trees, fallen logs, sedgelands, vegetated corridors and overhangs. It is recommended that any rare, endangered or locally significant species that may rely on the watercourse and adjacent lands for survival are identified. Make use of aerial photos, flora and fauna surveys and site inspections. The Department of Conservation and Land Management's (CALM) records may also be of use.

- *Adjacent land use pressures that may affect the foreshore area.*

  The impact of land use on foreshores should be considered. Land uses with less impact (such as rural-residential) may permit narrower foreshore reserves than land uses having higher impact (such as rural, industrial and high-density residential development). The location of existing or future infrastructure such as roads, powerlines and sewerage should be identified, along with any existing or proposed firebreaks, buildings and fencing. The need for public access and recreation nodes should also be identified. Determine adjacent land use from town planning schemes, structure plans, and outline development plans, subdivision proposals, aerial photos and site inspections. This information may be obtained through your local shire office.

- *Archaeological and ethnographic sites adjacent to the waterway.*

  Identify sites of cultural, archaeological or religious significance and any sites of historical association. These sites should be included in the foreshore reserve where possible. Identification of sites of Aboriginal significance should involve consultation with the Department of Indigenous Affairs and local Aboriginal elders. Make use of existing reports and engage in community consultation.

Step 3: Are there any other factors you should consider?

There may be other local or regional issues that need consideration in finalising the foreshore reserve alignment. Some examples include:

- presence of contiguous wetlands which maintain links between waterways;
- presence of existing policies of decision making or advisory bodies;
- maintaining visual and residential amenity;
- threats to public amenity and/or health from mosquitos or other pests;
- future purpose and vesting options for the reserve;
- maintenance and enhancement of the ecological function of waterways and catchments; and
- identification of management needs of the foreshore reserve.

Negotiating the proposed foreshore boundary alignment

Negotiation of the proposed foreshore alignment is essential for determining an adequate foreshore reserve. Negotiation helps yield a foreshore reserve that satisfies as far as possible, all parties' interests and represents an agreed optimal position. Negotiation may involve the Commission, other government agencies, local government, the proponent and other interested parties.

Potential risks and consequences of an inadequate foreshore alignment

The delineation of an inadequate foreshore reserve may result in certain risks and consequences stemming from long term population and environmental changes, such as:

- increasing demand for water and water based recreation resulting from population growth;
- climatic changes associated with global warming (both climatic and hydrological);
- rising water tables causing waterlogging that results in an increase in the potential for flooding;
- rising salinity resulting in a loss of water quality and fringing vegetation;
- flood potential resulting from upstream alterations, such as levee banks or channel clearing; and
- flood potential resulting from adjacent land use pressure, such as land clearing and urban development.

Step 4: Finalisation of the alignment and presentation of information

The areas identified by earlier steps may now be overlayed on a map or sketch of the waterway (see Figure 2). The outer edge of these areas defines the foreshore reserve. Consideration of the purpose or function (e.g. recreation, conservation, flood

Foreshore reserve delineated by a footpath. [Photo: L. Pen] protection or public access) of the foreshore reserve will determine which factors to assign greater weighting.

Developers also need to be aware that the Commission will normally require some form of physical demarcation between a foreshore reserve and land to be developed for other purposes. The form of the demarcation may be a road, dual use path, fence etc.

The resultant foreshore alignment recognises the dynamic biophysical processes of the river or estuarine system as a whole, including its coastal interface and catchment area. It recognises, from a regional perspective, the issues of adjacent land use pressure, social impacts and recreational pressures. The alignment also reflects an analysis of the risks and consequences of an inadequate foreshore reserve.

The final negotiated foreshore alignment represents an agreed position between all interested parties, while noting that your ideal outcome will not always be possible. The process outlined in this document identifies the ideal foreshore reserve from a biophysical perspective and recognises that the final delineation is often the best that can be achieved under the prevailing circumstances. Where this is much less than ideal, the consequences and issues will have been identified, allowing for the future management of the foreshore reserve.

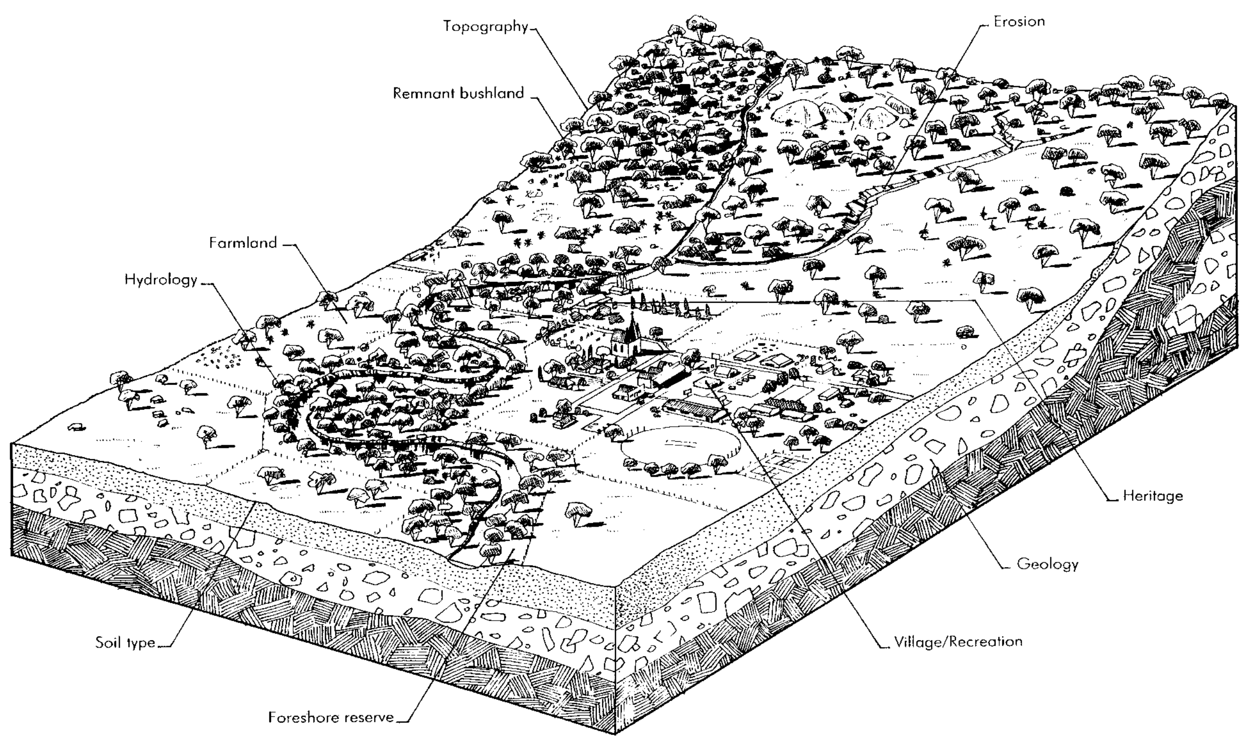

Figure 2. Stylised diagram of a river denoting the foreshore reserve delineation.

Biophysical Criteria – A check list for application

Presented below is a checklist of the tasks required to properly assess any foreshore area using biophysical criteria to determine the foreshore reserve.

Step 1: Background information and preliminary investigations

- ❑ Understand the waterway, its significance and the management issues.
- ❑ Obtain aerial photos to assess vegetation complexes, river form, function and adjacent land uses.
- ❑ Obtain maps showing the extent of floodway and floodplains, topographical features, cadastral boundaries, soils, underlying geology and vegetation complexes.
- ❑ Obtain any relevant reports on the river and region. This may include floodplain mapping, development proposals and flora and fauna survey reports.
- ❑ Plan a site visit once you are confident you have the necessary background information.
- ❑ Negotiate and communicate with relevant stakeholders as required.

Step 2: Identifying the biophysical criteria of the waterway

- ❑ Identify the extent of the riparian vegetation.
- ❑ Identify soils that support riparian vegetation.
- ❑ Locate the floodway and floodplain – 1 in 100 yr flood levels, peak flow and river hydrology.
- ❑ Identify any soil types prone to erosion.
- ❑ Identify landforms, including any drainage lines that may be important to watercourse function.
- ❑ Identify valuable habitat areas.
- ❑ Identify adjacent land use pressures with potential to affect the foreshore.
- ❑ Investigate and identify any other factors influencing decisions on foreshore widths, such as Aboriginal sites, other heritage sites, and residential and recreational amenity.
- ❑ Negotiate and communicate with relevant stakeholders as required.

Step 3: Are there any other factors you need to consider?

- ❑ Identification of other issues to be considered.
- ❑ Analyse any risks and consequences resulting from the proposed foreshore alignment.

Step 4: Finalisation of the alignment and presentation of information

- ❑ Annotated diagram showing the foreshore delineation.
- ❑ Rationale for the delineation in the form of a brief report.

Case Study 1 – The Hill River

The Hill River is situated approximately 200 km south of Geraldton, in a region of high conservation significance as exhibited by an extensive reserve system in its upper reaches (see Figure 3). This case study outlines the process for determining the foreshore reserve for this river system, taking into account the areas of high conservation value and low existing land use pressures. The process involved extensive negotiations with stakeholders.

The Hill River reaches the coast as an estuary that is well vegetated in comparison with other rivers in the region. In addition, the upper reaches of the river are in relatively good condition due to the State Government's commitment to reserving land in the Mt Lesueur National Park and Beekeepers Nature Reserve, through which the Hill River flows. Most other rivers in the region are somewhat degraded, necessitating the need to manage the Hill River to preserve its representative and now unique values, as well as protecting and enhancing the investment made by government in local conservation reserves.

Determining the foreshore reserve

The proposed development on the Hill River required definition of an appropriate foreshore reserve to ensure adequate protection of the river ecosystem, and to identify development limits for adjacent lands. The proponent engaged the services of a consultant who used the biophysical criteria method to identify an appropriate foreshore reserve.

Step 1: Background information and preliminary investigations

All relevant background information for the Hill River and its region was obtained prior to conducting the site visit. In addition to this, the following information was gathered:

- Aerial photos of the proposal area.
- Maps of the proposed subdivision development, showing the proposed foreshore reserve.
- A floodplain mapping report defining the extent of the floodplain, floodway and the flood fringe as well as determining the 1 in 100 years flood level for the Hill River (JDA Consultant Hydrologists 2000). The report found the maximum width of the floodway to be 550 metres at one point, but the average width of the floodway was less than 250 metres. This work was based on 2 metre contours, but in the more critical areas (where the proposed development was close to the river) the use of 1 metre contours was necessary to determine the extent of the floodway.
- A report titled *Delineation of the Foreshore Reserve for a section of the Hill River (Between Indian Ocean Drive and the Estuary)* by Alan Tingay and Associates (1999). This contained the proposed boundary alignment that needed to be assessed and reviewed.

Step 2: Identifying the biophysical criteria of the waterway

- *Identify the extent of the riparian vegetation.*

  Riparian vegetation was identified by analysis of the aerial photos and areas of interest were identified for site inspection. Appraisal of these areas led to an adjustment being made to the draft delineation of the foreshore boundary prepared by the consultant. For example, the initial boundary delineation failed to include vegetation found on flood prone land on the northern side of the estuary.

- *Locate the floodway and floodplain – 1 in 100 yr flood levels, flow (peak) rates and river hydrology.*

  Floodplain and flood prone land was identified using aerial photography. This identified the extent of wetland vegetation which by definition, only grows in damp flood prone areas. The *Hill River Floodplain Mapping* report (JDA Consultant Hydrologists 2000), identified the extent of the floodway and projected a 1 in 100 year flood level. This information, together with field inspections yielded the extent of the floodway and floodplain.

- *Identify any soil types prone to erosion.*

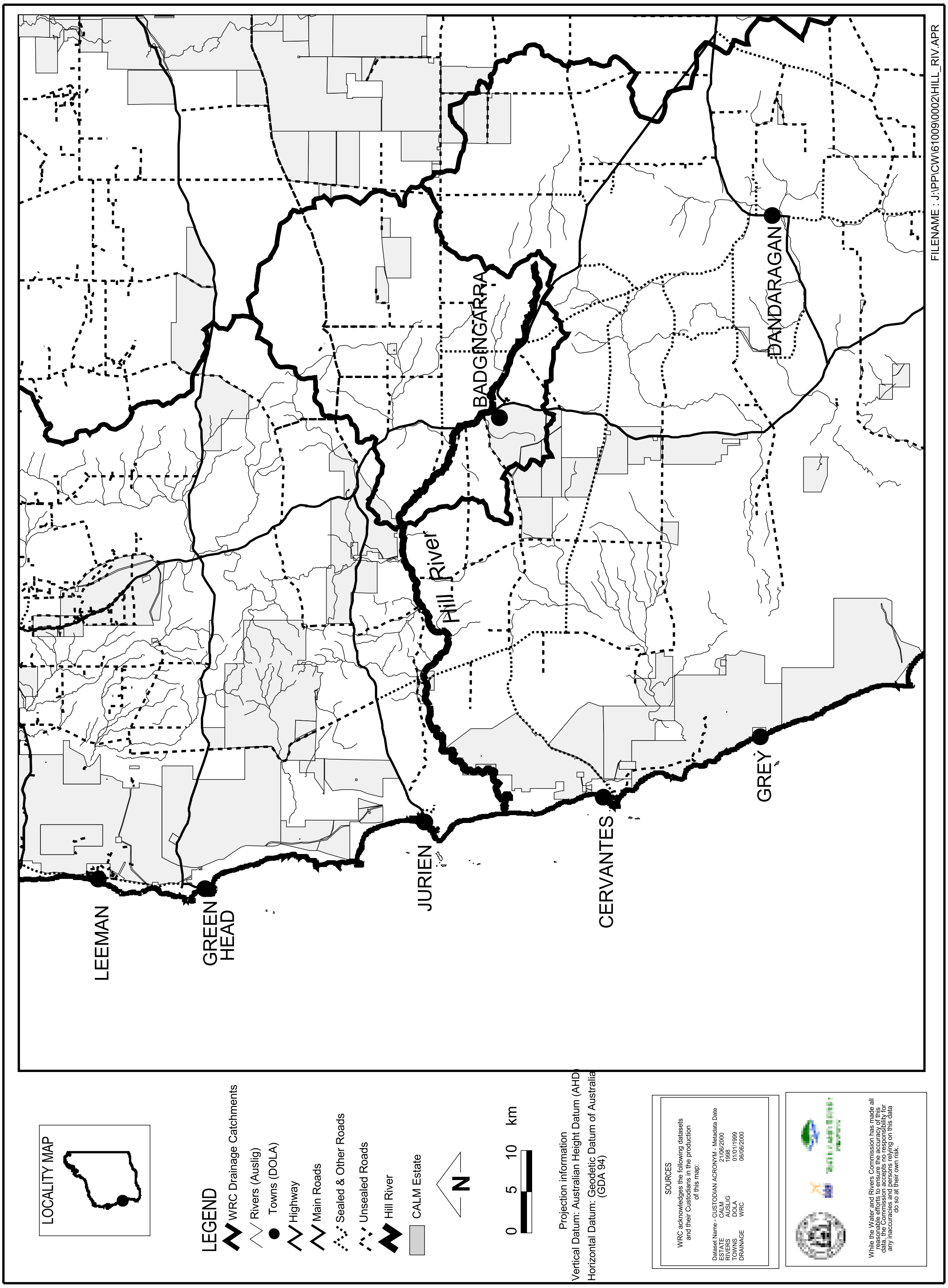

Figure 3. The Hill River region.

The draft alignment was adequate to protect the foreshore given the good coverage of protective native vegetation.

- *Identify landforms important to watercourse function.*

  The examination of aerial photos and field inspections identified drainage lines, sand dunes and associated vegetation to be included in an extended foreshore area in order to buffer the area from sedimentation and related impacts.

- *Identify valuable habitat areas.*

  The original foreshore alignment was considered adequate to protect valuable habitat areas. Habitats of riparian vegetation were well represented, providing habitat for fauna and especially for those that may be displaced by the adjacent proposed development. The River Red Gum (*Eucalyptus camaldulensis*) that occurs along the foreshore was considered the only significant habitat type in the area and was included in the foreshore reserve to ensure its protection (Sparks & Howard 2001 *pers. comm*).

- *Identify adjacent land use pressures with potential to harm the foreshore.*

  The impact of adjacent land use pressures on the proposed foreshore area was not investigated thoroughly due to the lack of specific information on the development initially. Management strategies dealing with stormwater, septic systems, feral animals, introduced species, domestic pets and the influx of pollutants from diffuse sources into the river had not been addressed. More information was sought from the proponent to determine the best alignment of the foreshore boundary.

- *Investigate and identify any other factors influencing decisions on foreshore widths, such as Aboriginal sites, heritage sites, and residential and recreational amenity.*

  The proposed foreshore alignment was considered adequate to protect cultural values and recreational amenity. Consultants were engaged to determine archaeological or ethnographic sites within the proposed subdivision and foreshore areas. This report and subsequent consultations with the Department of Indigenous Affairs, concluded that there were no sites of significance within the study area. However, the consultants requested a minimum foreshore reserve of 30 metres to protect its natural character. This request is satisfied by the proposed foreshore alignment.

Step 3: Are there any other factors you need to consider?

The Water and Rivers Commission (the Commission), Department of Conservation and Land Management (CALM), Department of Environmental Protection (DEP) and the Department of Planning and Infrastructure (DPI) considered it vital that the investment made by the State Government in creating a reserve system upstream of the proposal area should be enhanced. Creation of adequate foreshore reserves, with similar biophysical characteristics as the existing reserves along the reaches of the Hill River would achieve a continuously linked system of reserves. This reserve system minimises the impacts of ecosystem fragmentation and preserves the conservation efforts initiated upstream in the Mt Lesueur National Park and Beekeepers Nature Reserve.

Negotiating and communicating with stakeholders

Negotiation of the proposed foreshore boundary alignment involved the Commission, the proponent, CALM, DEP, DPI and the Shire of Dandaragan. These negotiations largely involved the realignment of the foreshore to include landscape elements not included in the initial draft. This realignment resulted from Commission officers assessing the initial proposed alignment and deciding that some factors had not been addressed satisfactorily. Interested parties discussed the contentious points and a negotiated position was arrived at, after consideration of new information provided by the proponent, the Commission and other stakeholders. Where insufficient information was available, Commission officers applied the precautionary principle in determining an adequate foreshore boundary.

Step 4: Finalisation of the alignment and presentation of information

The biophysical factors identified were overlayed onto a map (see Figure 4) to yield a foreshore boundary alignment, which was similar to the draft alignment proposed by the proponent, with some important adjustments. The revised alignment included flood prone land, sand dunes and associated vegetation, and tributary drainage lines. The foreshore reserve on the Hill River was created primarily to preserve conservation values, due to the extensive reserve systems upstream and the local and regional significance of the river.

The resultant boundary alignment is a negotiated outcome between the Commission and the proponent. It recognises the biophysical processes of the Hill River and accounts for the issues considered important by relevant stakeholders. The boundary alignment recognises the river system is dynamic and more relevant information may be available in the future. In response to the changing nature of river systems and information, the Commission has undertaken to consider the possibility of renegotiating the foreshore boundary alignment in the future.

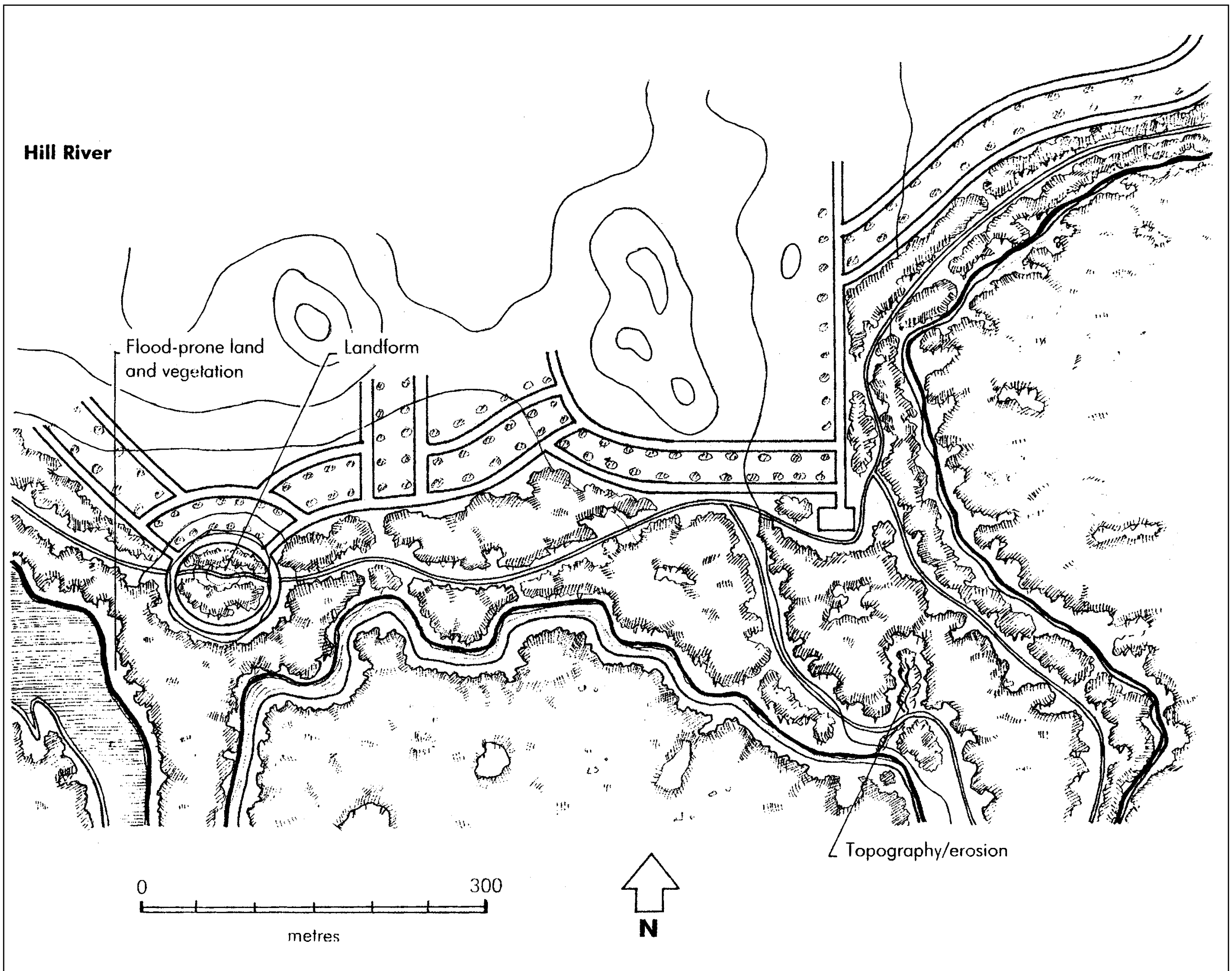

Figure 4. Annotated map showing extent of the foreshore reservation for the Hill River.

Case Study 2 – The lower Collie and Brunswick rivers

The lower reaches of the Collie and Brunswick rivers near the Leschenault Inlet are under increasing pressure from adjacent land uses, such as the large-scale urban developments at Australind and Eaton, special rural subdivisions and an increasing number of individual residential properties (see Figure 5). This has led to the Leschenault Inlet Management Authority (LIMA) becoming more pro-active in foreshore reservation. LIMA commissioned a report in 1993, defining adequate foreshore boundaries for the lower reaches of the Collie and Brunswick rivers (Woodcock 1994).

Determining the foreshore reserve

Step 1: Background information and preliminary investigations

LIMA prepared the *Collie and Brunswick Rivers Foreshore Study* (Woodcock 1994), a report outlining the process and rationale used for determining foreshore boundaries for these rivers. The report describes the studies performed, existing reports and on site investigations. The study identifies reports, aerial photos and personal communications for the management of vegetation, habitats, fauna, flooding, erosion, water quality, existing reserves and land use. This provides an overview of the significance of these river systems to the region.

Step 2: Identifying the biophysical criteria of the waterway

- *Identify the extent of the riparian vegetation.*

  A comprehensive vegetation survey of the region was undertaken in 1992. The report described six major categories of fringing vegetation (Pen 1993). A simplified version of Pen's classification was used to determine the foreshore boundary for the Collie and Brunswick Rivers study area (Woodcock 1994). The foreshore boundary was aligned to include these vegetation elements.

- *Locate the floodway and floodplain – 1 in 100 yr flood levels, flow (peak) rates and river hydrology.*

  The Water Authority of Western Australia developed floodplain maps of the lower Collie and Brunswick rivers. This information was used to determine a foreshore reserve that protected areas of flood prone land and provided for infrastructure protection.

- *Identify any soil types prone to erosion.*

  Areas of severe erosion damage in the study area were identified by Pen (1993). Erosion resulted from a thinning of fringing vegetation, the susceptibility of local soils to erosion, steep slopes and livestock trampling. The alignment of the foreshore reserve took into account the natural erosion processes of the river and aimed to protect areas susceptible to erosion, such as meander bends with high banks.

- *Identify landforms important to watercourse function.*

  Topographical features in the study area included steep slopes, gorges and low lying or flood prone land. These areas are important to the function of waterways and also provide landscape amenity. These areas have been included within the foreshore reserve.

- *Identify valuable habitat areas.*

  A fauna study was conducted in the Kemerton area in 1985 and the results were used to identify similar fauna habitat areas in the study area. The foreshore alignment protects habitat areas important for the survival of native fauna, such as dense low forest of *Melaleuca priessiana* and *Acacia saligna,* and the open woodlands of *Eucalyptus rudis*. The alignment also protects the wetland habitats of amphibians and reptiles found in the area.

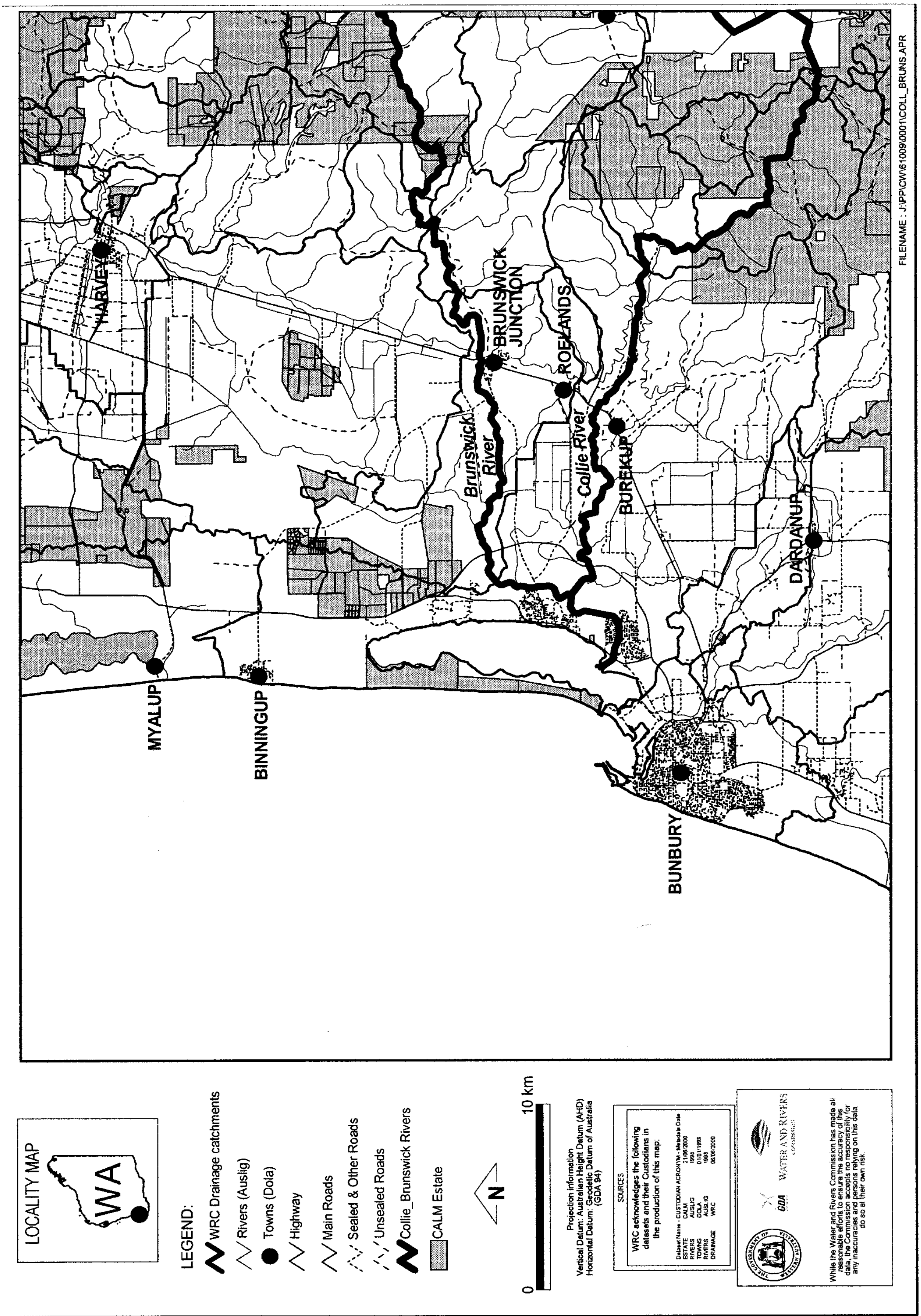

Figure 5. The Leschenault Inlet region.

- *Identify adjacent land use pressures with potential to harm the foreshore.*

  The study area is subject to land use pressure from the adjacent residential areas of Australind and Eaton. The *Bunbury Region Plan, Policy Statement* (State Planning Commission 1987) provides the framework for land use development in the region. It identifies social and economic factors guiding land use and development while recognising the need for responsible environmental management practice. The foreshore alignment reflects the provisions of the Bunbury Region Plan, by identifying areas of Regional Open Space, Possible Reserves Zone and Rural Landscape Amenity Areas. The alignment also allows for future urban development, by planning for increases in population and infrastructure, such as bridges / utility crossings, drainage and public open space for community recreation rather than conservation purposes.

- *Investigate and identify any other factors, such as Aboriginal sites, heritage sites, and residential and recreational amenity.*

  The *Pelican Point Bunbury Public Environmental Review* (LeProvost Environmental Consultants 1991) found six relatively minor Aboriginal archaeological and ethnographic sites and no sites of European historical significance within the study area. The alignment of the foreshore boundary was drawn to reflect the presence of these sites.

Step 3: Are there any other factors you should consider?

The report identified several other issues, which were considered in determining the foreshore boundary for the Collie and Brunswick River study area. These issues were:

- mosquito breeding areas;
- existing reserve areas;
- existing recreation nodes;
- water quality for recreation purposes; and
- climatic change.

The foreshore boundary was aligned to reflect an understanding of these issues.

Analyse any risks and consequences resulting from the proposed foreshore alignment

The final foreshore alignment attempts to alleviate the potential for harm to the waterway environment, housing and infrastructure and human life resulting from the following factors:

- mosquito breeding areas and the potential for Ross River virus;
- damage to property, infrastructure and human life resulting from flooding;
- maintaining and enhancing the region's (rivers and foreshores) recreational potential;
- maintenance of water quality for recreational purposes;
- alleviating fire risk by providing firebreaks; and
- maintenance of visual and landscape amenity.

Negotiating and communicating with stakeholders

An advisory committee was formed to facilitate the negotiation of the foreshore alignment. The committee included the LIMA, Department of Planning and Urban Development, Department of Conservation and Land Management (CALM), Department of Land Administration (DOLA), the Shires of Dardanup and Harvey, the Waterways Commission and the Water Authority. The committee recognised and discussed relevant issues and while complete agreement, especially at draft stages, was not achieved, the negotiated consensus did alleviate most concerns. The report was also released for public comment and the submissions received were considered in finalising the foreshore alignment.

Step 4: Finalisation of the alignment and presentation of information

The biophysical factors identified were overlayed on a map of the waterway (see Figure 6 over), yielding a foreshore reserve which is reflective of the biophysical criteria of the Collie – Brunswick River study area.

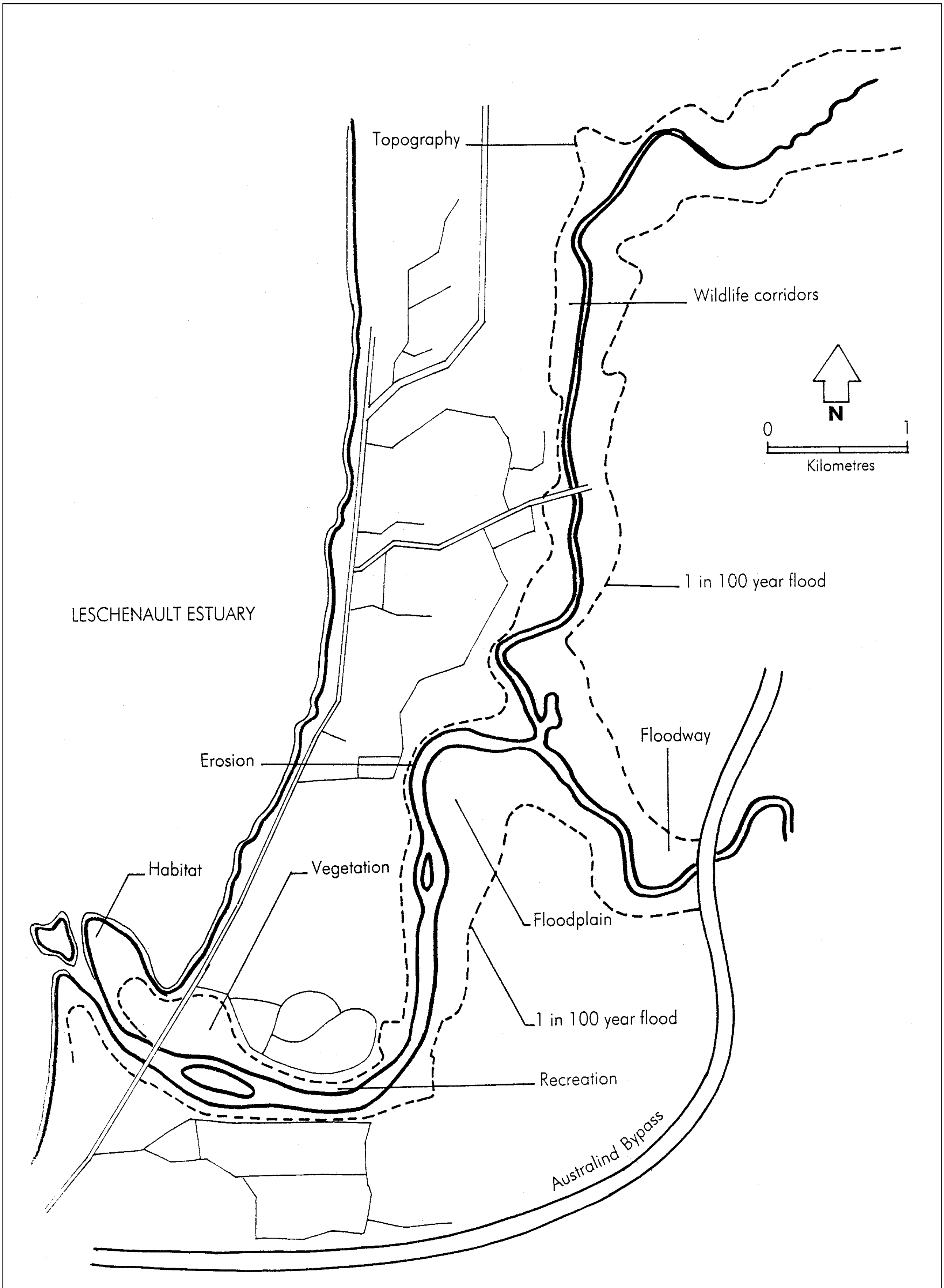

Figure 6. Annotated map showing the extent of the foreshore reservation for the study area on the Collie - Brunswick River.

Glossary

1 in 100- year floodplain The 100-year flood level is generally defined as a contour through the floodplain to which this flood will rise (see Flood – 100-year).

Fauna Animal life of a particular area or period of time.

Floodplain The portion of a river valley next to the river channel that is or has been periodically covered with water during flooding.

Flood prone land All land subject to flooding including the floodway, flood fringe and floodplain.

Flood–100-year Refers to a severe flood that has a statistical probability of occurring once in 100 years. The flood has a 1% chance of occurring on any given year; on average it will occur once in every 100 years.

Flood fringe The area of the floodplain, outside the floodway, which is affected by flooding. This area is generally covered by still or very slow moving waters during the 100-year flood.

Floodway The river channel and portion of the floodplain which forms the main flow path of flood waters once the main channel has overflowed.

Flora Plant life of a particular area or period of time.

Foreshore The area of transition between the waterbody and the furthest extent of riparian vegetation, flood prone land, and riverine landform.

Habitat The environment or place where a plant or animal grows or lives (includes soil, climate, other organisms and communities).

Precautionary principle Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

a) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

b) an assessment of the risk-weighted consequences.

Riparian vegetation Vegetation growing along the banks of rivers, streams and wetlands, extending laterally away from the riverbank and ending at the extent of the floodplain. Also includes the brackish upstream reaches of an estuary.

Riparian zone The zone along or surrounding a water body where the vegetation and natural ecosystems benefit from and are influenced by the passage and storage of water.

Waterways All streams, creeks, rivers, estuaries, coastal lagoons, inlets and harbours.

Waterways environment The waters and foreshores of a waterway and its natural components, both physical and biological, its ecological processes and its cultural components such as scenic, recreational and historic values.

Waterway protection precinct The area of critical importance in protecting the waterway ecosystem and includes the waterway and adjoining foreshore.

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