

MURCHISON-GASCOYNE REGION

OVERVIEW

The Murchison-Gascoyne region is defined in this report, as AWRC Basins 701 to 705 inclusive. The Gascoyne River is the longest river in Western Australia and extends for a length of approximately 800 km from the coast at Carnarvon, inland to the east. The Murchison River located further south at Kalbarri is the second longest river in the State. The Gascoyne and Murchison rivers are also the largest by volume in the region (fifth and ninth largest in the State), with mean annual flows of 680 and 150 gigalitres respectively.

The region has a climate varying from Mediterranean with cool, wet winters and hot, dry summers in the south, to arid with hot summers and mild winters in the northern and inland areas. Inland climatic conditions are typically more extreme than experienced on the coast. Annual rainfall typically varies between 200 and 500 mm, with the highest monthly average rainfall occurring between May and July. Northern areas of the region can also be subject to tropical cyclones that typically occur between January and March, bringing summer rainfall.

The Murchison region is predominantly covered by the Yilgarn Block, consisting primarily of gneisses and granites, with the sedimentary Perth Basin located to the west consisting of sandstone, siltstone and shale. The sedimentary Carnarvon Block lies to the north of the Perth Basin and covers much of the Gascoyne. The Carnarvon Basin generally slopes gently to the coast

Gascoyne River near Carnarvon



and is characterised by low relief, open drainage and gently undulating sand plains (Water and Rivers Commission, 1998).

The Murchison region has been extensively cleared for agriculture, with grain crops contributing significantly to the economy. Clearing has resulted in increased stream salinity, with few fresh streams remaining in the Greenough and Murchison basins. Further north, the Gascoyne region is largely uncleared, although vegetation has been affected by extensive grazing. Horticultural activity occurs in areas adjacent to the Gascoyne River and near Carnarvon. Numerous mine sites have been established in the region, including mineral sands operations in the coastal areas of the Murchison region and salt production in the Gascoyne region.

RESOURCES

Rivers

There is generally poor knowledge of the state of rivers in the region, including knowledge of water resources. Allocation levels are low, as there are limited fresh water resources available and, as such, groundwater is widely used. Water quality and contamination are generally unknown throughout the region. Erosion and sedimentation levels are generally high and are continuing to increase.

Where known, the condition of fringing vegetation is poor and is deteriorating. The Gascoyne, Wooramel, Murchison rivers and many of the smaller rivers to the south of the Murchison are in poor condition. There is little remnant vegetation remaining in the region; however, where it exists there is very high biodiversity.

Flooding is a significant issue for the Irwin, Greenough and Gascoyne rivers. There is a need to anticipate requirements for flood warning advice on towns and infrastructure throughout the region, particularly with major public use of flood-prone roads. There is also community demand for flood mitigation measures for the Gascoyne and Greenough Rivers.

There is increasing pressure from urban development on the riverine systems – for example, the Chapman River at Geraldton. Current and proposed industrial and

mining developments also have the potential to impact on water resources – for example, Oakajee industrial development north of Geraldton.

Groundwater

Groundwater is a very important resource in the region as the public water supply relies mostly on groundwater resources and it is also used for irrigation in the Carnarvon region. Most of the groundwater supplied to the region is sourced from the Carnarvon Basin (Allen, 1997). There is a high quantity of groundwater in the southern half of the region, with high allocation levels for the Gingin north, Arrowsmith, Jurien and Carnarvon groundwater areas. Water quality is generally high and contamination is generally low, where known.

There are high resource demands and pressures on the Lower Gascoyne Basin. There is also community desire for large horticultural precincts based on undeveloped groundwater resources in the Carnarvon and Geraldton areas. Increasing tourism development in the Exmouth/Cape Range/Coral Bay area and aquaculture in the Northampton block also has the potential to increase groundwater demands. Industrial developments, such as Oakajee, and mining activities at Eneabba, Shark Bay and Lake McLeod all require groundwater. Proposed industrial and mining developments are likely to exert further pressures on groundwater resources.

Estuaries

There is generally poor knowledge of the state of the twelve recognised estuaries, especially in the Gascoyne region. All of the estuaries in the Murchison region have been modified, some severely, such as the Irwin, Greenough and Chapman River estuaries. In the Gascoyne region the estuaries are largely unmodified, including the near-pristine Lake MacLeod and Yardie Creek estuaries.

Nutrient levels are low in the Murchison estuary at Kalbarri and high in the Chapman estuary at Geraldton. Contamination is also generally unknown; however, contamination levels are moderate for the Greenough, Chapman and Murchison estuaries and are likely to increase with increasing urbanisation along the coast.

Loss of estuarine fringing vegetation is generally moderate in the Murchison region; however, it is in better condition than on the rivers. Erosion and sedimentation levels are generally high, as the estuaries receive significant sediment inputs from the contributing rivers.

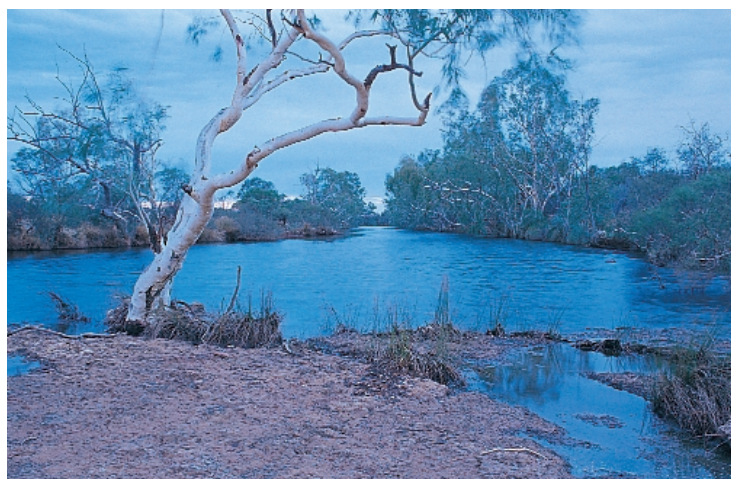
Wetlands

There are a number of important wetlands in the region, which are summarised in Table 12. Lake MacLeod, north of Carnarvon, is a coastal lake that is episodically inundated by fresh water and supports Australia's largest inland community of mangroves and associated fauna (Australian Nature Conservation Agency, 1996). The lake is also used for commercial salt production, and is under pressure from current activities and proposed expansions.

The Cape Range National Park near Exmouth contains the Cape Range Subterranean Waterways, significant for its stygofauna. The system is under pressure from nutrient enrichment, water abstraction and townsite development (Australian Nature Conservation Agency, 1996).

Two wetland systems are included in the internationally recognised Shark Bay World Heritage Area, Hamelin Pool and Shark Bay East. Hamelin Pool supports extensive microbialite (subtidal stromatolite and intertidal thrombolite) formations, which are the most abundant and diverse examples of growing marine microbialites in the world. Hamelin Pool is visited by

Dalgely River near Gascoyne Junction





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an increasing number of tourists and there is the potential for areas of microbialites to become damaged if tourist activity is not managed carefully. Shark Bay East is under pressure from fishing and boating activities (Australian Nature Conservation Agency, 1996).

The Lower Reaches of the Murchison River is significant for the permanent river pools set in a long, narrow, steep-sided gorge. Potential impacts include siltation of river pools due to over-grazing in the catchment, water pollution in the estuary from urban sources and excessive human disturbance from large numbers of tourists at the gorge pools (Australian Nature Conservation Agency, 1996).

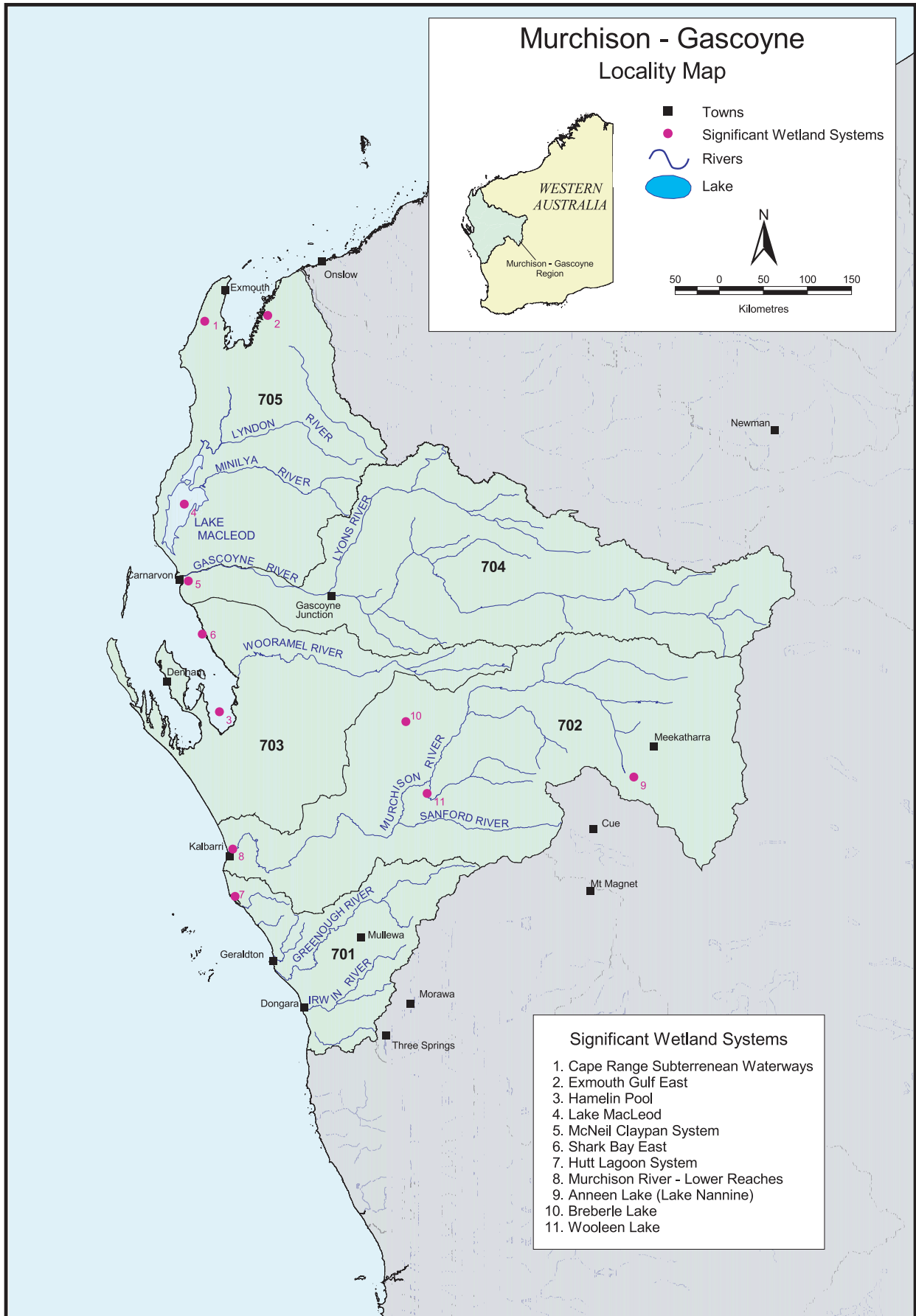
Table 12: Summary of significant wetlands of the Murchison-Gascoyne region

Wetlands	Ramsar	Directory of Important Wetlands in Australia	Register of National Estate	Other
Cape Range Subterranean Waterways		CAR001WA	✓	
Exmouth Gulf East		CAR002WA		
Hamelin Pool		CAR003WA	✓	WHA ¹
Lake MacLeod		CAR004WA	✓	
McNeill Claypan System		CAR005WA		
Shark Bay East		CAR006WA	✓	WHA ¹
Hutt Lagoon System		GS001WA		
Murchison River (Lower Reaches)		GS003WA	✓	
Anneen Lake (Lake Nannine)		MUR001WA		
Breberle Lake		MUR002WA		
Wooleen Lake		MUR006WA		

1. World Heritage Area (Shark Bay)

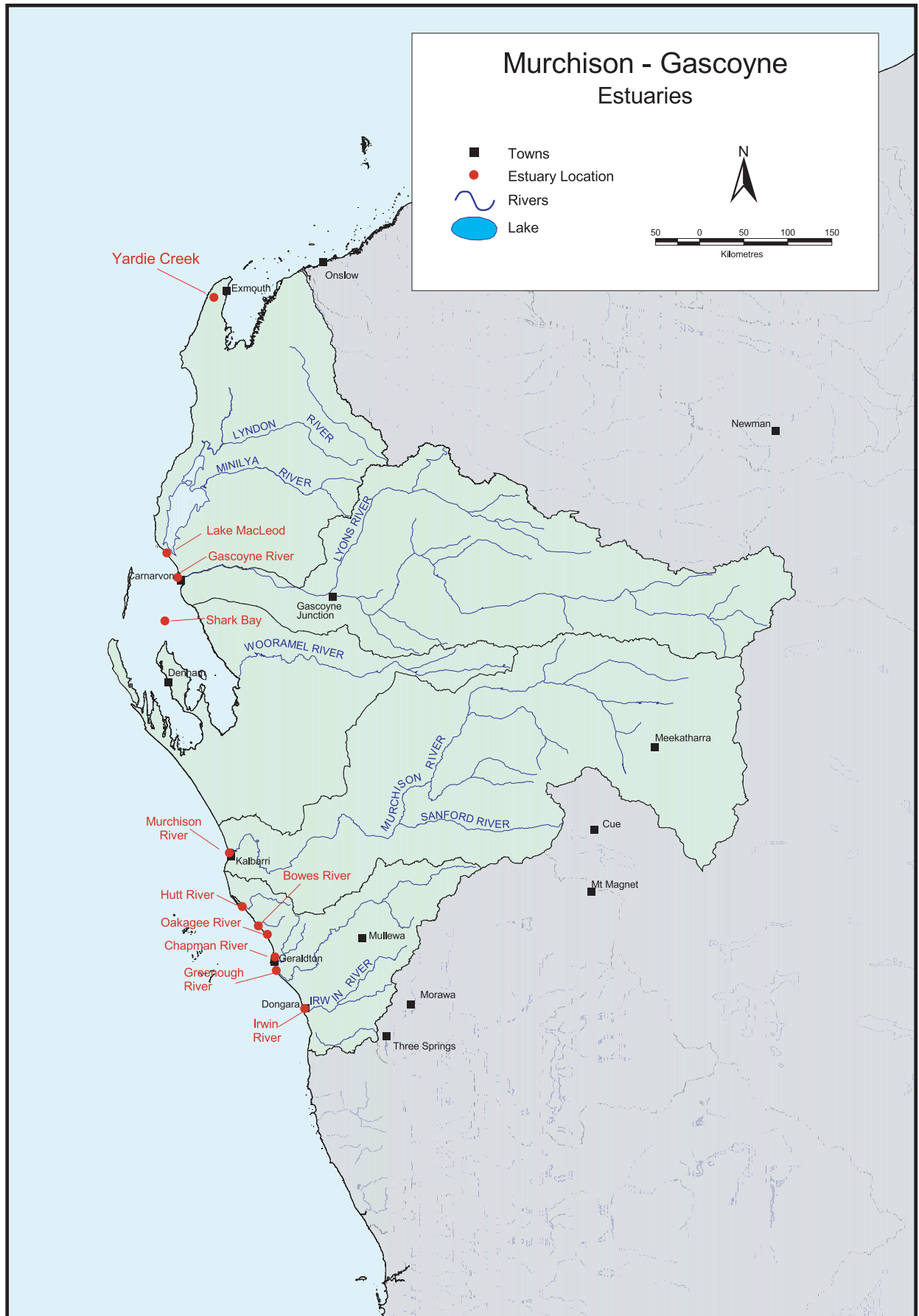
Freshwater is obtained from bores located in the Gascoyne River. However the pumps need to be removed during periods of river flow

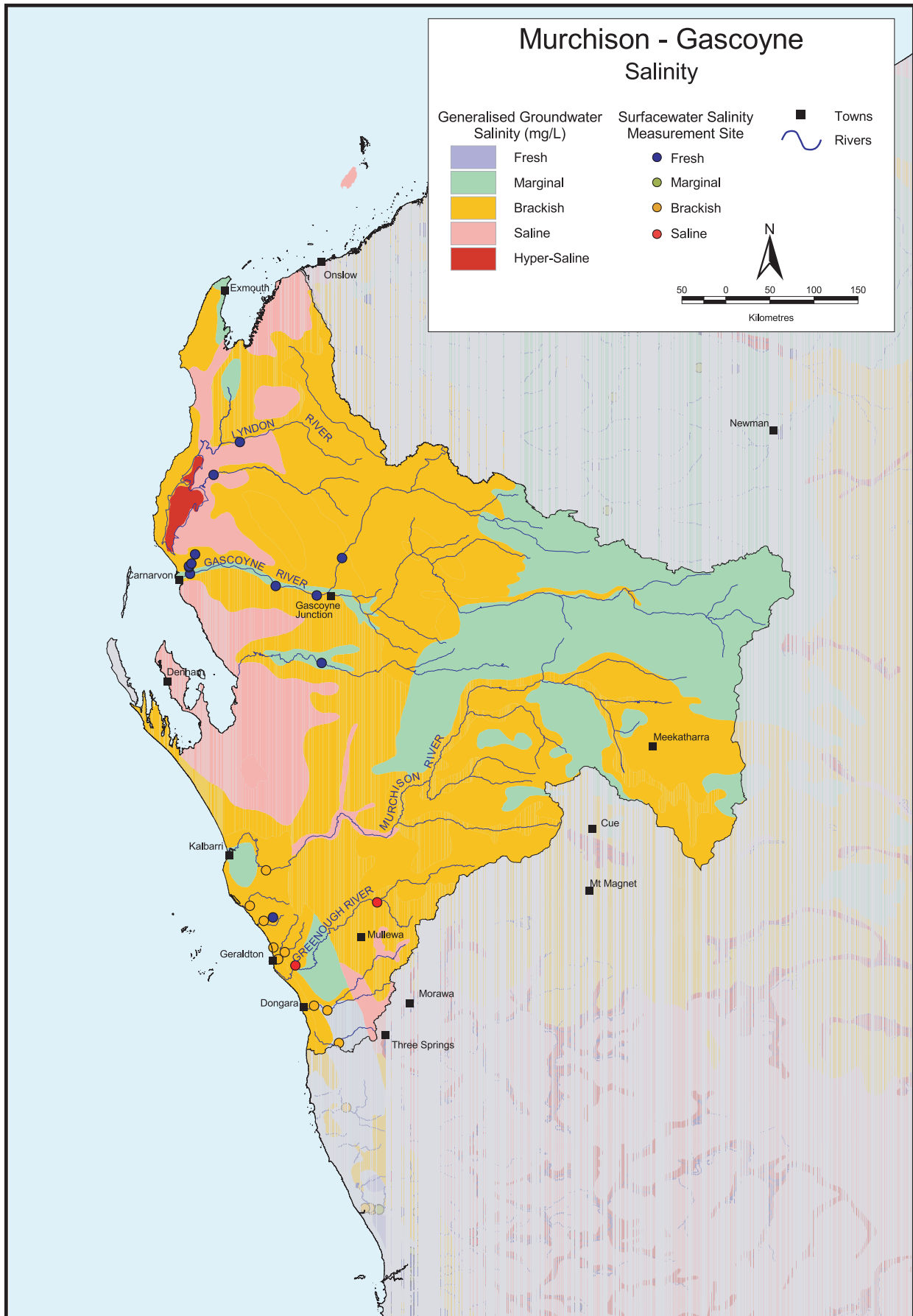






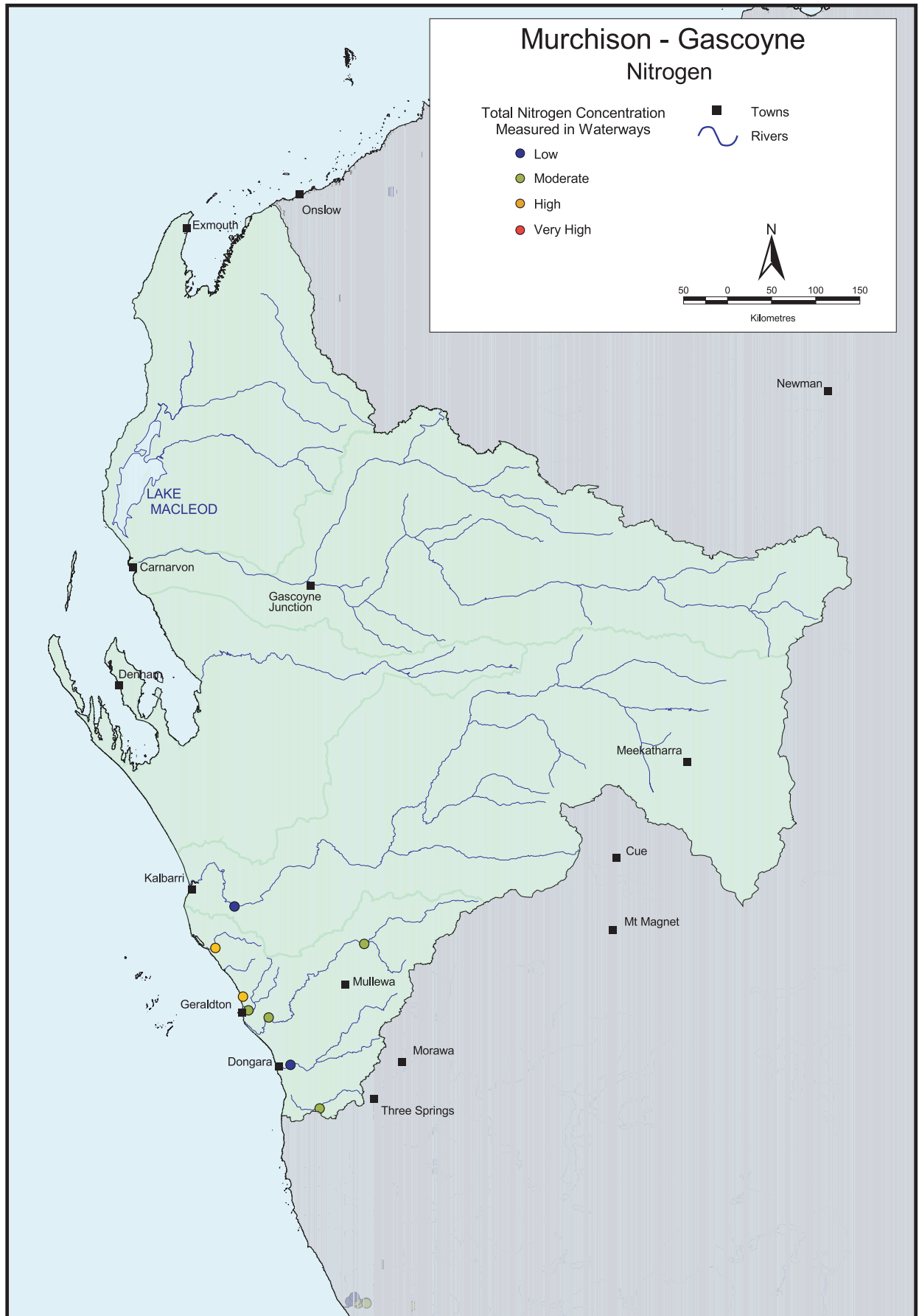
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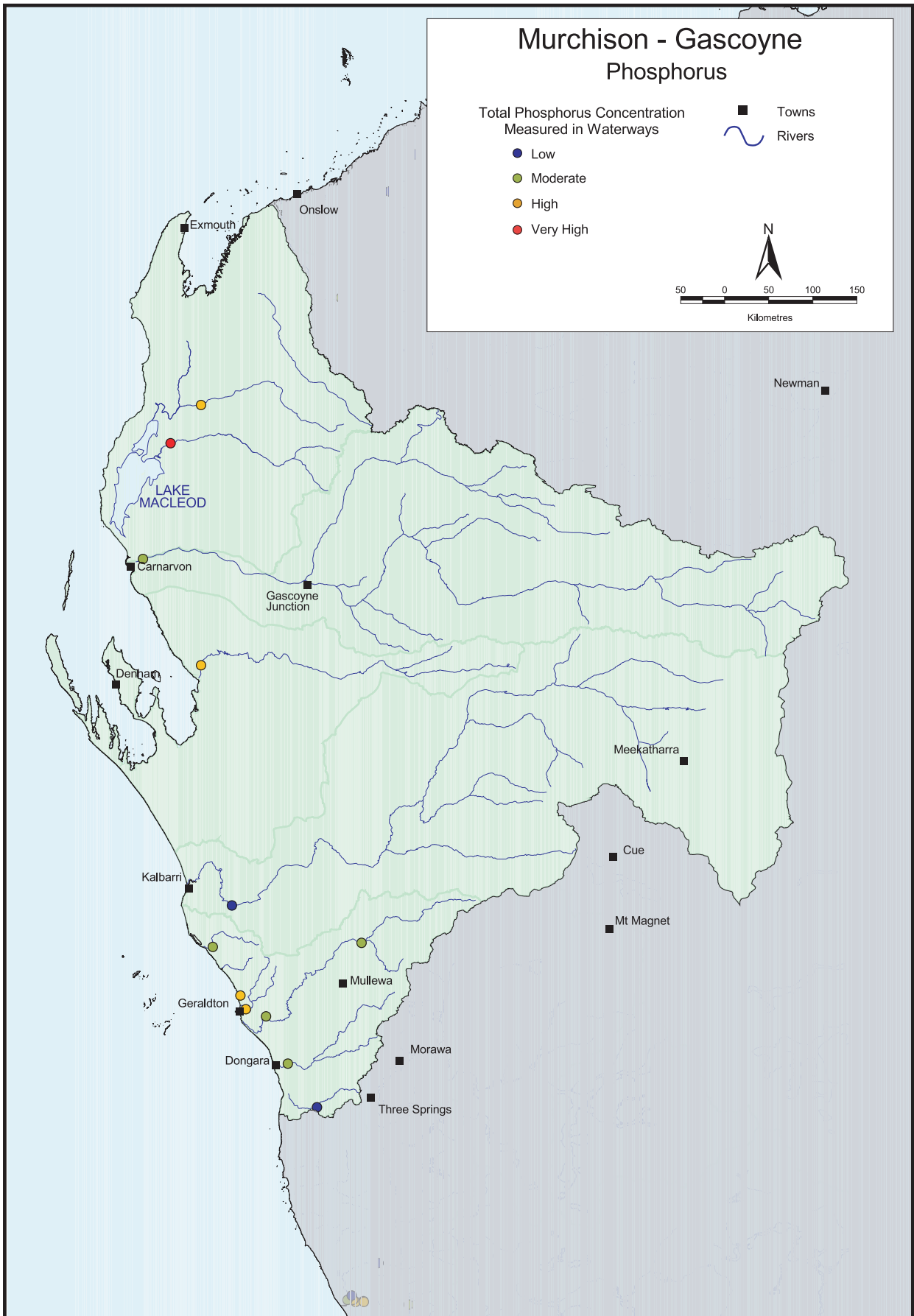






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PILBARA REGION



OVERVIEW

The Pilbara region is defined in this report, as AWRC Basins 706 to 710 inclusive. The region covers an area of over 200,000 km², from the Ashburton River in the south to the De Grey River in the north. Towns in the region include the major centres of Karratha and Port Hedland and a number of smaller mining towns. The region experiences extreme weather conditions from severe droughts to major floods resulting in highly variable river flows. The De Grey is the largest river by volume in the region and the third largest in the State. It has a mean annual flow of 1000 gegalitres, which is equivalent to approximately three times the annual potable water supplied to the State.

The region has a hot, semi-arid to arid climate with average annual rainfall varying between 200 and 350 mm. However, recorded annual rainfalls at stations in the Pilbara of between less than 50mm and greater than 1000 mm illustrate the extremely variable nature of the region's rainfall. For most of the region, rainfall predominantly occurs during the summer months, with the major falls resulting from cyclonic activity and to a lesser extent from thunderstorms. In the southern coastal area, winter rains resulting from southern low-pressure systems are equally dominant. However, in some years, winter rainfall can be widespread throughout the region and may exceed wet season rainfall.

The Pilbara region is within a geological province principally composed of hard sediments and igneous

Karijini National Park



rocks. There are three distinct geographical formations: a coastal plain, inland ranges and an arid desert region. The region has moderately high relief with the Hamersley Range being the highest range in the State. The two major divides of the river systems are the Hamersley and Chichester ranges. Rivers generally flow in a northerly direction north of the Chichester Range and in a westerly direction south of the range. The region's rivers discharge through direct ocean outlets or disperse through marshy flats. Rivers crossing the coastal plain have extensive floodplains, and contribute significant recharge to groundwater resources. Groundwater occurs throughout the region in the basement rocks, sedimentary basins and superficial deposits (Water and Rivers Commission, 2000a).

Mining and petroleum industries form the basis of the economy of the Pilbara region. The region contains deposits of important minerals such as iron ore, gold, nickel, copper and zinc, and large reserves of oil and natural gas. These industries have the potential to impact on water resources directly through activities such as dewatering and waste disposal, and indirectly through the development of water supplies. Much of the region is also used for the grazing of sheep and cattle, some of which has resulted in erosion and sedimentation.

RESOURCES

Rivers

Allocation levels are generally low with the exception of the Harding River, which was dammed to supply West Pilbara towns with water. Salinity is generally low and most rivers are fresh. Nutrient levels are also generally low; however, there is the potential for high nutrient loads with large flow events.

Generally, fringing vegetation in the Pilbara is in reasonable condition. The Harding Dam captures 80% of the runoff from the 1070 km² catchment area of the Harding River and has a significant effect on downstream pools and their fringing vegetation (Water and Rivers Commission, 1997a). Vegetation is deteriorating on the Harding River downstream from the dam. Significant deterioration in vegetation health on the Fortescue River floodplain and some of its tributaries is thought to be a combination of the

construction of Ophthalmia Dam and other factors, such as climate change and historical overgrazing of vegetation (Water and Rivers Commission, 1997a). Severe vegetation loss has also occurred at Millstream on the Fortescue River.

Widespread erosion and sedimentation has occurred both through natural causes such as high flow events, and human causes, such as overgrazing and feral animals. Degradation is also widespread on the extensive coastal floodplain areas, particularly the Ashburton, Cane and parts of the De Grey rivers.

Flooding occurs frequently, and although it does not have a major impact on towns, it does have an impact on infrastructure such as roads and bridges, Aboriginal communities and pastoral properties and a financial impact on industry through lost transport opportunities.

Mining and pastoralism have exerted the greatest pressures on water resources in the Pilbara in the past. Massive dewatering from mining operations in the Pilbara is changing the nature of some streams from ephemeral to permanent with associated impacts on natural vegetation and fauna. There is also the potential for contamination from acid mine drainage associated with mining in the Pilbara. Increased mining development is anticipated with subsequent impacts on water quality and water allocation pressures.

Population increases associated with mining and industrial developments, horticultural activities and tourism are also exerting pressures. There are environmental impacts possibly associated with Ophthalmia Dam on the Fortescue River, which provides the water supply for Newman. There is also anticipated industrial expansion in the West Pilbara with high water allocation demand. Tourism is increasing in the region with potential impacts on fringing vegetation and water quality, and increased erosion and contamination.

Groundwater

Where groundwater resources have been assessed the condition is generally good. Most of the groundwater in the region is located in fractured rock aquifers, with the majority of groundwater sourced from the Hamersley and Pilbara provinces (Allen, 1997). However, both the

sedimentary and fractured rock groundwater resources are very important to the region as they provide the majority of water supplied to towns and industry.

Groundwater is generally available in large quantities and of good quality, with some areas of high use, such as Millstream and Onslow. The most significant and exploited groundwater resources are the alluvial aquifers of the coastal plains and the valley fill aquifers within the Fortescue Valley and the Hamersley Range. Salinity, nutrient enrichment and contamination levels are generally low.

Increased demand in the Port Hedland and Karratha regions for town water supplies is anticipated. Demand is also likely to increase across the region, particularly in the West Pilbara from development associated with mining and industry.

As for rivers, there are potential impacts on groundwater from acid discharge from mining and processing operations. Abandoned mine pits have the potential to cause salinisation of groundwater.

Estuaries

Twenty-four recognised estuaries or embayments are located in the Pilbara region, but only limited information is currently available. The De Grey River estuary is the largest shallow estuary in northwest Australia. All of the recognised estuaries are largely unmodified except for the ports of Dampier and Port Hedland. Nutrient enrichment and contamination in the Pilbara estuaries is generally low.

Fortescue River



Wetlands

The region contains seven recognised important wetlands, which are summarised in Table 13. All of the wetlands listed below are fresh, except for the Leslie Saltfields System, and provide important dry season refuges. The De Grey River contains the longest permanent river pools in northwest Australia (Australian Nature Conservation Agency, 1996). The Karijini Gorges and Millstream Pools on the Fortescue River are listed on the Register of National Estate and

are both located within national parks. The Karijini Gorges, near Wittenoom, contain a series of permanent spring-fed pools. The Millstream Pools also contain permanent pools and springs. Both systems are also popular tourist destinations and need to be carefully managed to minimise impacts. Pressures on other wetlands include grazing, feral animals and mining activities, such as dewatering and wastewater discharge (Australian Nature Conservation Agency, 1996).

Table 13: Summary of significant wetlands of the Pilbara region

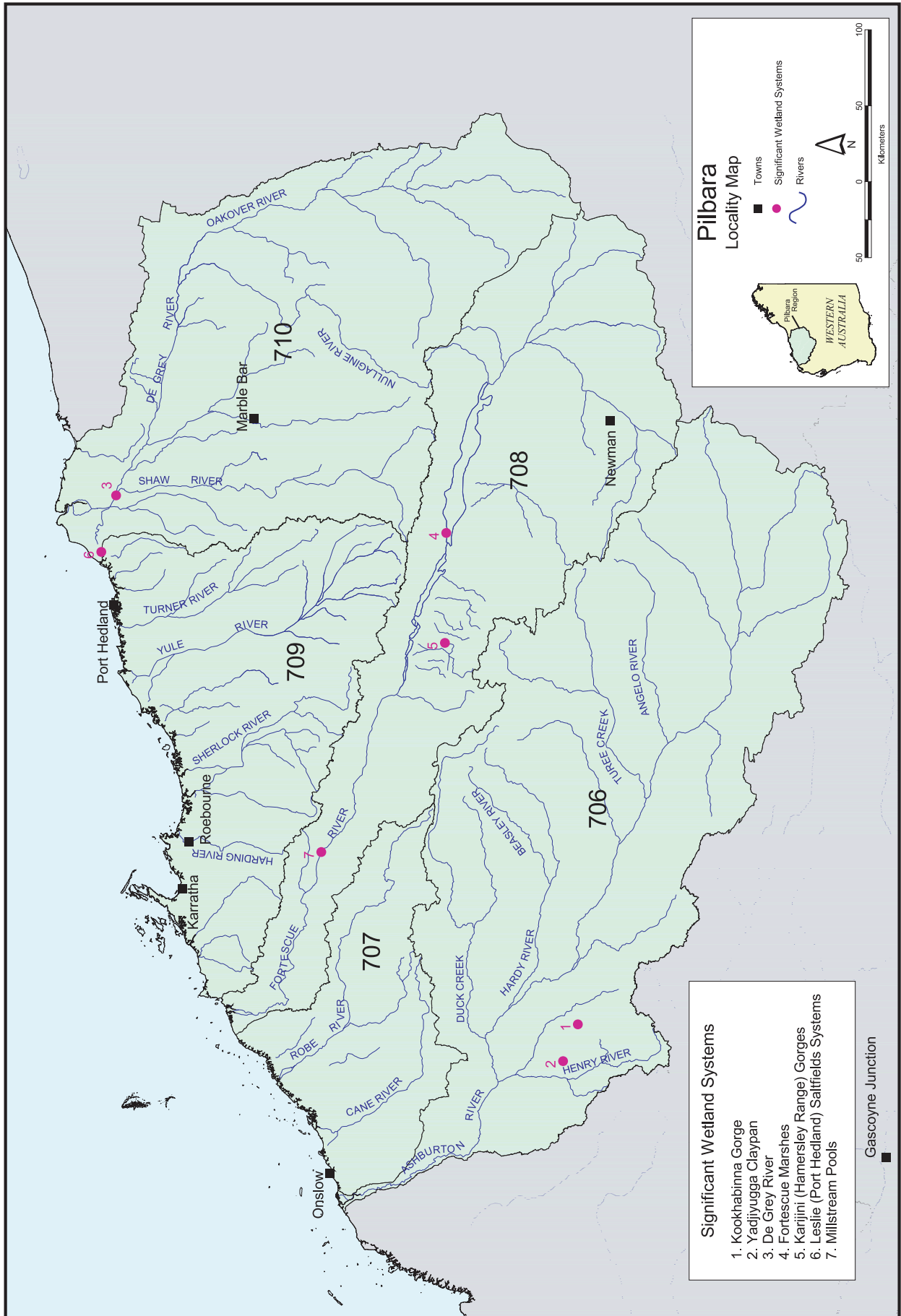
Wetlands	Ramsar	Directory of Important Wetlands in Australia	Register of National Estate	Other
Kookhabinna Gorge		GAS001WA		
Yadjiyugga Claypan		GAS004WA		
De Grey River		PIL001WA		
Fortescue Marshes		PIL002WA		
Karijini (Hamersley Range) Gorges		PIL003WA	✓	
Leslie (Port Hedland) Saltfields System			PIL004WA	
Millstream Pools		PIL005WA	✓	

Evidence of erosive flows leaving exposed tree roots



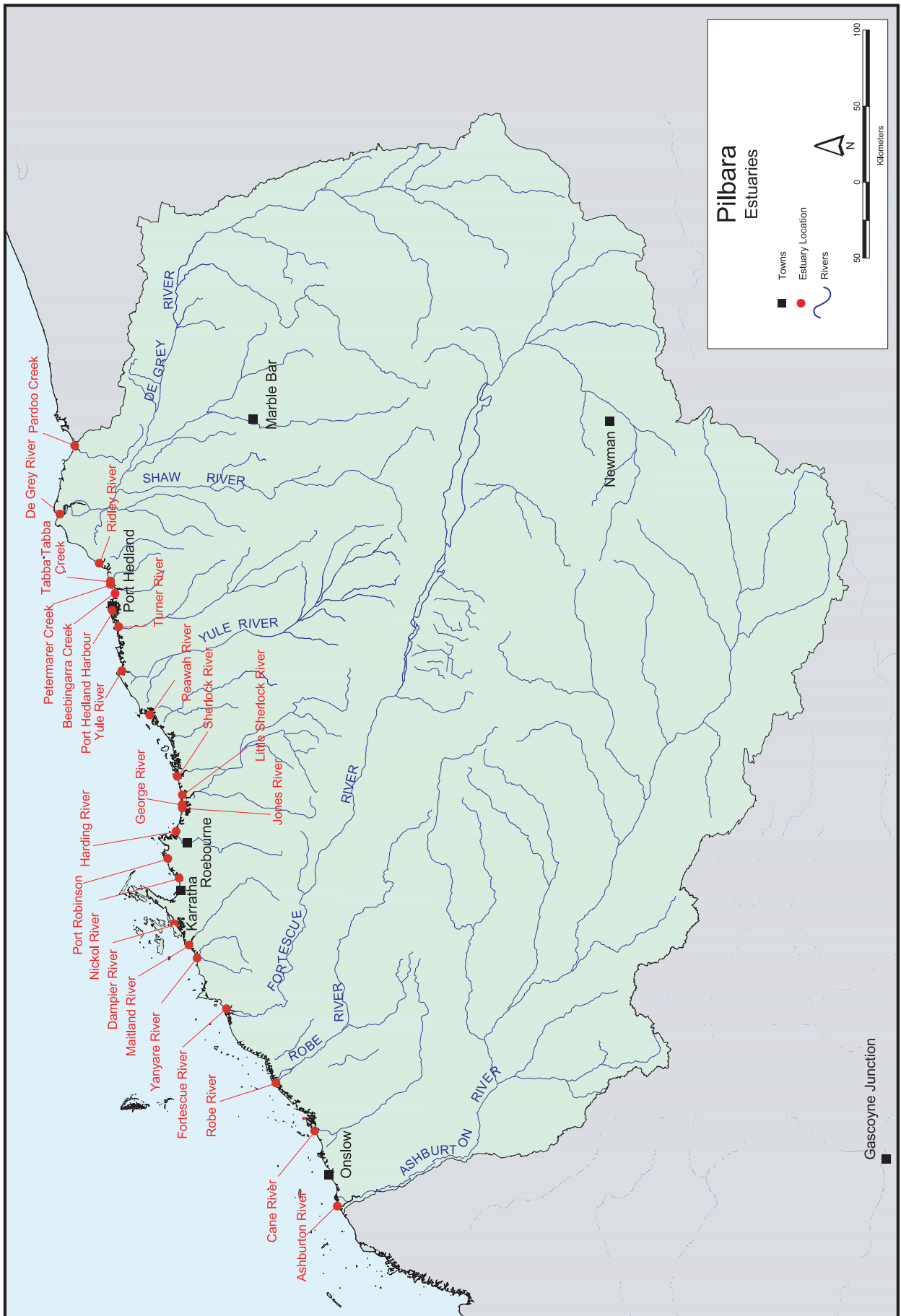
Introduced plant species at Millstream - Chichester National Park

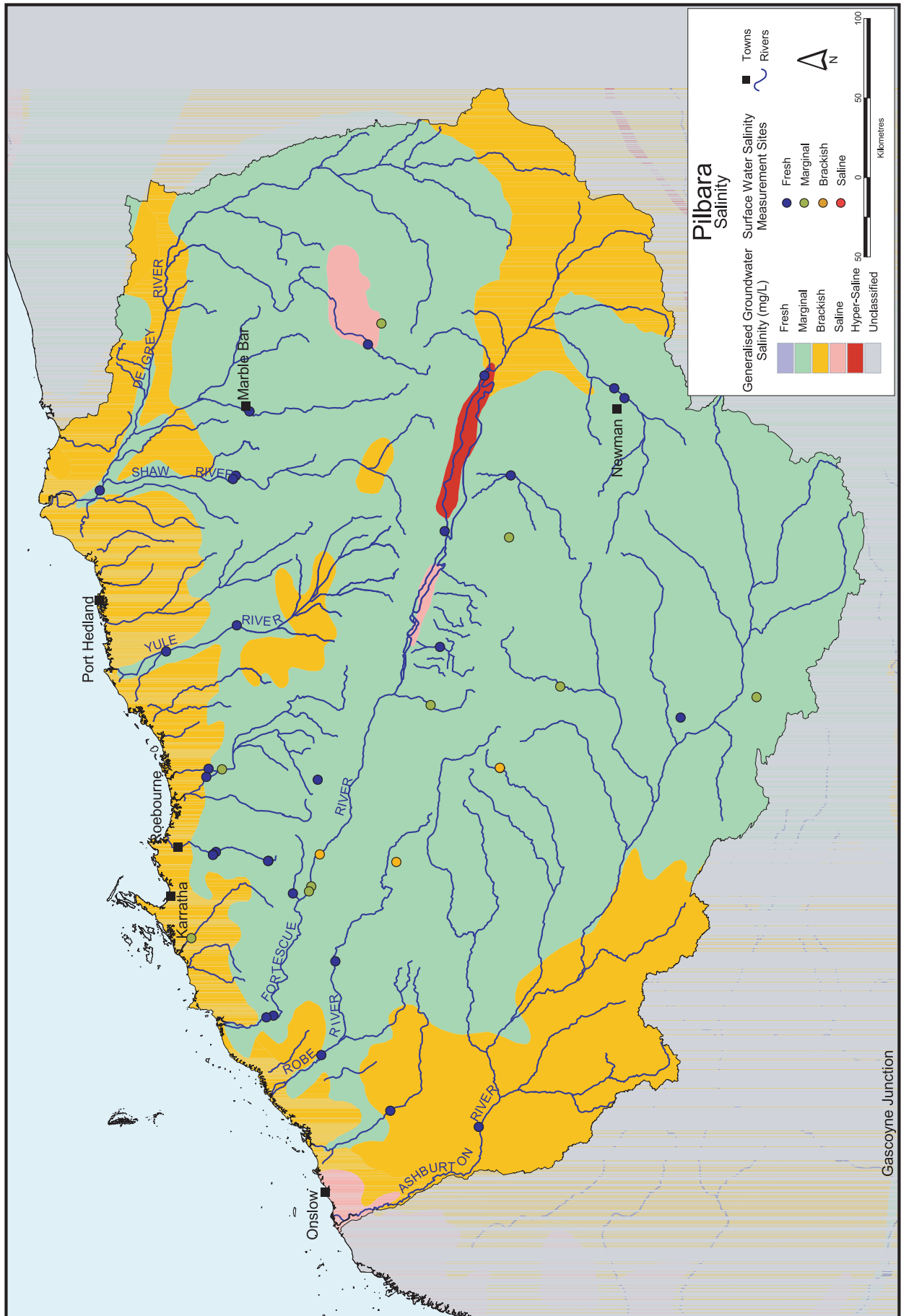






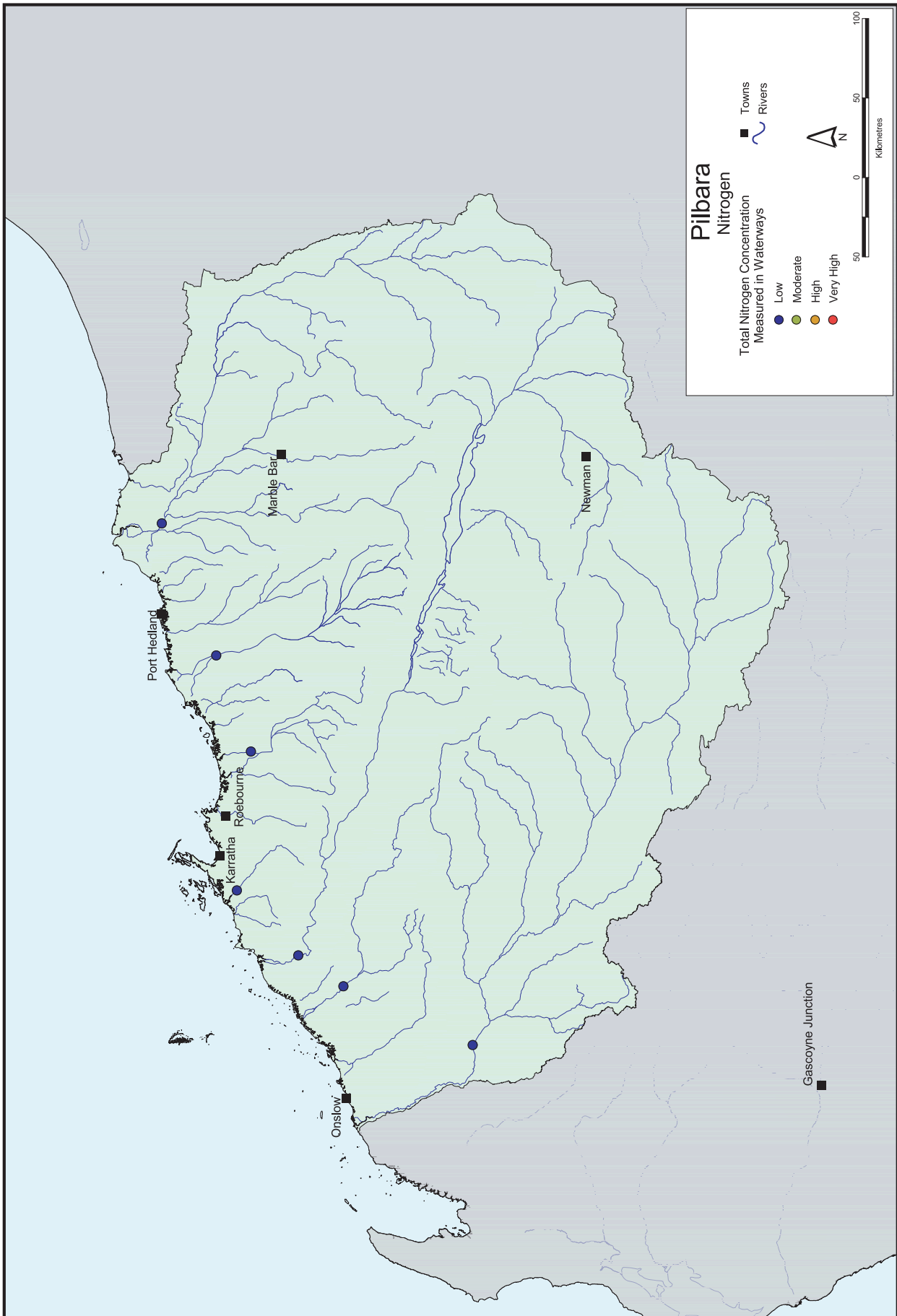
PILBARA REGION

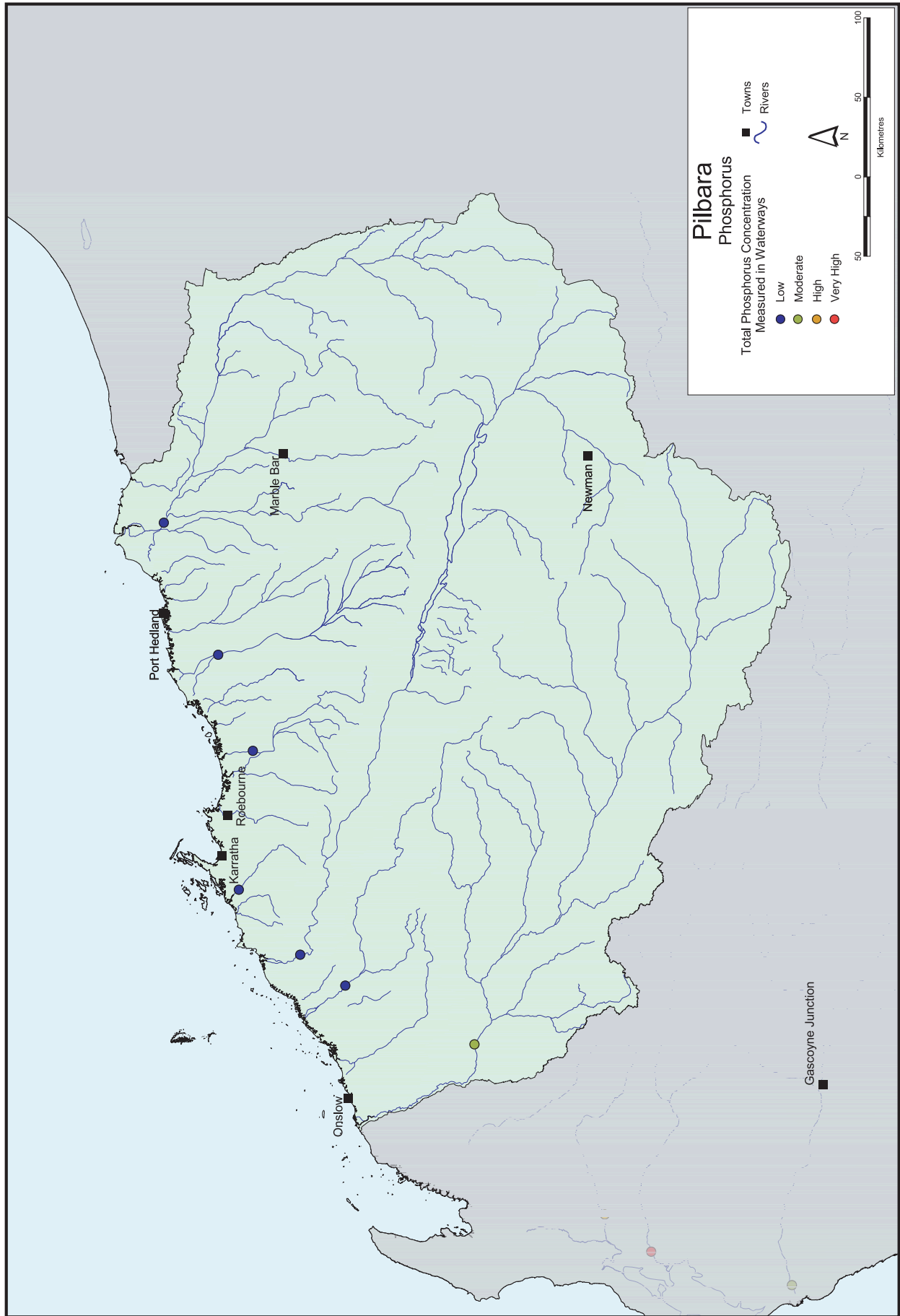






PILBARA REGION







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