natural scotland
SCOTTISH GOVERNMENT

The river basin management plan for the Scotland river basin district 2009–2015

Chapter 1:
State of the water environment

Chapter guide*

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*Appendices for this document are available on the SEPA website at:
www.sepa.org.uk/water/river_basin_planning.aspx

1. Introduction

Understanding where our water environment is under threat and where it requires improvement is essential information for its successful management. This chapter describes the characteristics of the Scotland river basin district (the Scotland RBD), SEPA's assessment of the condition of our rivers, lochs, estuaries, coastal waters and groundwater, why their condition is important and the pressures adversely affecting them. These assessments are the foundations on which this management plan has been built.

Much of our water environment is already in a good condition and subject to fewer pressures than most other European waters. However, there are a number of significant environmental problems. Most of these affect the waters around our larger population centres, such as Glasgow and Edinburgh and the productive agricultural areas along the east coast.

Scotland is justifiably renowned worldwide for the high quality of our water environment. Many of our industries benefit from this reputation. The water environment is of obvious importance for the success of our whisky producers, bottled water manufacturers, tourism-related industries, fish farmers and commercial fisheries. Many more businesses depend on the water environment, using it for producing electricity, watering crops and washing raw materials. All rely on it to absorb their waste water. Our continued economic growth will also be aided by the resilience a high quality environment provides in a changing climate.

Our waters also make a substantial contribution to the quality of life of all our citizens. They are widely valued because of their role in providing drinking water and because of their significance for nature and wildlife[1]. Our surface waters are some of our most important recreational resources; places to fish, swim, dive, canoe, sail, watch nature or simply relax.

This plan for protecting and improving our waters is important because of the many benefits that we derive from a high quality water environment.

[1]Valuing the Water Environment: A Survey of Scottish Public Attitudes www.scotland.gov.uk/Publications/2006/10/23141730/0

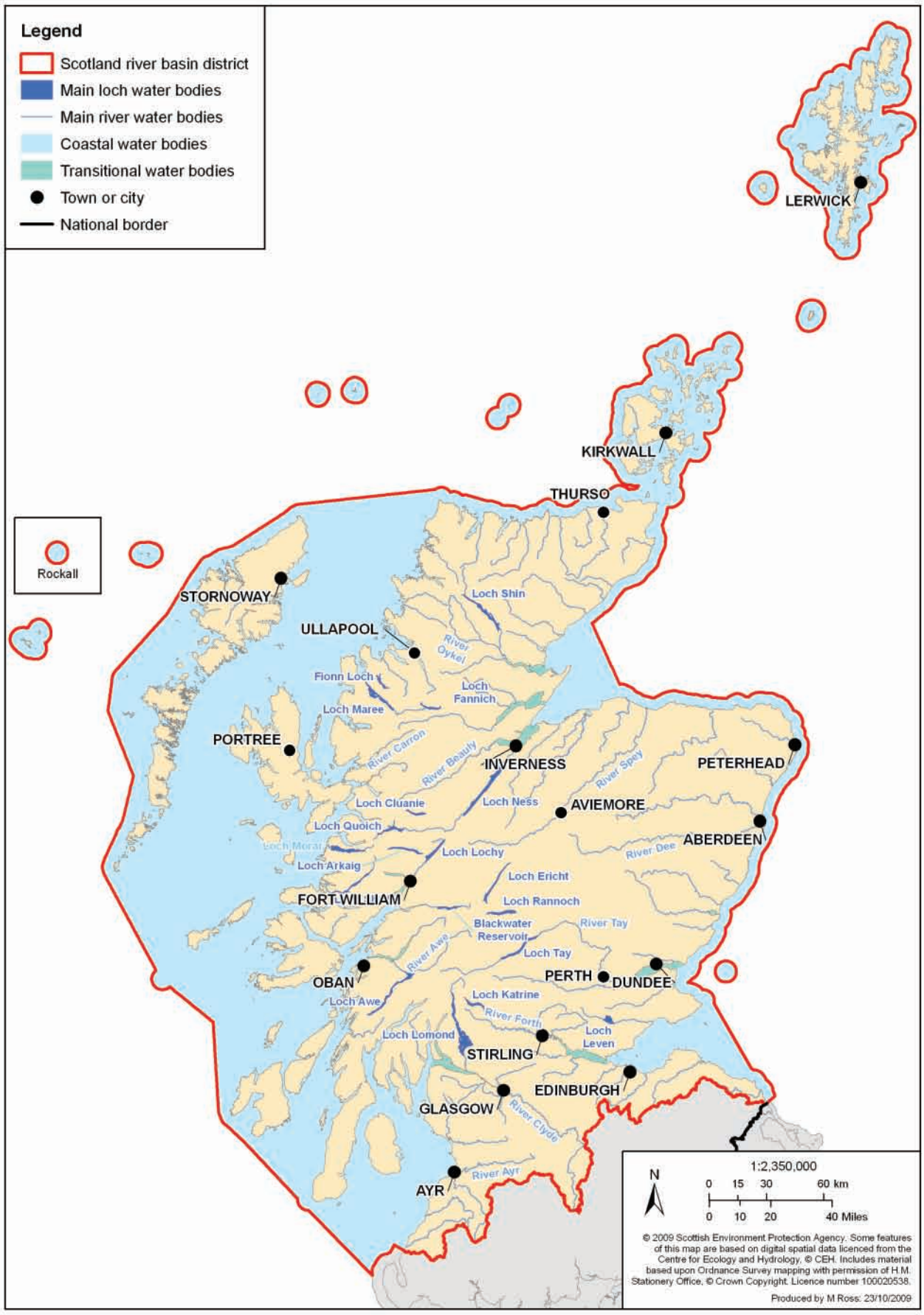
2. About the Scotland RBD

The condition of any river, loch, groundwater, estuary or stretch of coastal water is inextricably linked to the condition of other waters in the same river basin and to how we manage the basin's land. River basins comprise all the land, streams, rivers, lochs, wetlands and groundwater that eventually drain into the sea as well as the river's estuary and its adjacent coastal waters. 'Coastal waters' refers to the sea around our shores extending to 3 nautical miles seaward from the baseline for our territorial waters (See Map 1). Taking a source-to-sea approach and integrating land and water management are essential for the effective protection and improvement of the water environment. This is because impacts on one part of a river basin can often have effects elsewhere in that basin.

This plan is about the management of all the river basins of the Scotland RBD, which in total extend to an area of around 113,920 km^2. The Scotland RBD stretches from the Shetland and Orkney Islands in the far north of Scotland to the Southern Uplands in the south, and from Rockall and the islands of the Outer Hebrides and St Kilda in the Atlantic to the North Sea coasts of our mainland counties. The Scotland RBD is of similar size to that of river basin districts established in other countries across Europe. Beyond its southern boundary in the Southern Uplands, our rivers flow southwards into the adjacent Solway Tweed river basin district. This spans the border between Scotland and England and is covered by a separate river basin management plan available at: www.sepa.org.uk/water/river_basin_planning.aspx

The Scotland RBD includes Scotland's largest cities, Glasgow, Edinburgh, Aberdeen and Dundee. Around 4.8 million people live in the Scotland RBD. Outside of the main cities, the majority live in the area known as the Central Belt that lies between Glasgow in the west and Edinburgh in the east. Population densities in other parts of the Scotland RBD are typically less than 100 people per km^2. In much of the north and west of the mainland and in the islands of the west coast, the average is less than 10 people per km^2.

Map 1: The Scotland RBD[2]



[2]The area to the south of the district indicated in grey on map is part of the Solway Tweed river basin district.

The Scotland RBD contains the largest and most extensive mountain ranges in the UK, the deepest lochs, the fastest flowing rivers, the most coastal islands and the greatest area of coastal waters. Around 70% of the area and 90% of the volume of all the UK's inland surface water is found in Scotland and most of this in the Scotland RBD. The long coastlines of the Scotland RBD and the Scottish part of the adjacent Solway Tweed river basin district account for about 60% of the UK's coastline and 8% of Europe's coastline.

The Scotland RBD also has the wettest climate in the UK. Rainfall varies widely, ranging from an average of over 1,700 mm per year in the west to under 1,200 mm per year in the east. Near parts of the east coast, average rainfall is less than 700 mm per year. This compares with an average in southern England as a whole of nearly 800 mm per year and just over 600 mm in East Anglia. Temperatures in the Scotland RBD are generally a few degrees lower than elsewhere in the UK and moderated by proximity to the surrounding sea. Coldest temperatures typically occur away from the coasts. High rainfall and a cool climate mean that much of the land on higher ground in the Scotland RBD is characterised by extensive peatlands.

Climate change is already happening and further changes are unavoidable due to past and present emissions of greenhouse gases. Since 1961, average temperatures have risen in every season and in all parts of Scotland. Rainfall has increased significantly in winter, particularly in northern and western regions where winter rainfall has increased by almost 60%[3]. By the 2050s, average summer temperature is predicted to increase by between 1 and 4°C. If emissions continue at their current rate, by the 2080s it may be up to 7°C warmer. There is also likely to be a major change in rainfall patterns in Scotland, with winters becoming wetter and summers drier. Snowfall could also reduce by 60% or more in the mountains and might stop completely in other areas. The sea level in Edinburgh is projected to increase by up to as much as 18 cm by 2050 and over 39 cm by 2095[4].

The geological and human history of the Scotland RBD, together with its climate, has created an enormous variety of river and loch habitats that in turn support a great diversity of water plants and animals. The coast too is composed of a wide range of different habitat types including sea lochs, tall sea cliffs home to large populations of seabirds in the breeding season and machair coastal grasslands, developed on blown shell sand and rich in both biodiversity and cultural history.

Groundwater is present to varying degrees in all parts of the Scotland RBD, flowing through fractures in the hard rock areas of the Highlands, seeping between pore spaces in the sands and gravels of our river valleys and percolating deep within the sandstone aquifers of Fife. Around 30,000 private water supplies rely on groundwater as do some of our public water supplies. Businesses, such as mineral water producers and some of our farmers, distillers and manufacturers also rely on groundwater. Many of our wetlands depend on groundwater, which also maintains flows in our rivers during spells of dry weather, providing at least one third of the total annual flow in 60% of our rivers.

Our high quality water environment relies on the generally good quality of our soils. Soils play a vital role in filtering, storing and breaking down pollutants and so reducing diffuse pollution. Ensuring that soils are managed sustainably is key to maintaining good water quality. Soils also retain rainwater, thereby reducing the volume that flows across the surface of land and allowing time for it to percolate into groundwater. The overall effect is to dampen the rise and fall of river flows in response to periods of rain. Water levels rise more slowly than they would otherwise, peak flows are lower and a good flow is maintained for longer through dry periods. As well as creating a pattern of river flows that benefits our water plants and animals, the retention of water in soils helps protect towns and cities downstream from floods.

[3]A Handbook of Climate Trends Across Scotland, 2006, www.sniffer.org.uk
[4]More information on how the district's climate is predicted to change be found at UK Climate Projections - UKCP09

3. Importance of the Scotland RBD's water environment

3.1 Water and our economy

Our waters are important for our economy, health and social well-being and for wildlife. All businesses rely on the water environment in some way or another and it plays a prominent role in the success of many sectors. These include some that are of strategic importance to Scotland's economy, such as tourism, food and drinks manufacture and renewable energy generation.

Tourism is one of Scotland's largest industries. Tourism related expenditure is worth over £4 billion per year to the Scottish economy (5% of total gross value added) and the tourism related sector supports over 9% of all employment in Scotland[5].

The proximity of our lochs, rivers and coasts to mountainous land and our many long sea lochs and coastal islands create dramatic and world famous landscapes and seascapes that are important in economic as well as cultural and recreational terms. According to a recent visitor survey for VisitScotland, scenery and the opportunity for outdoor activities are main reasons for choosing Scotland as a holiday destination for UK and international visitors, and the quality of the Scottish scenery is the principal highlight that visitors' reported about their holiday.

There are currently 35 National Scenic Areas in the Scotland RBD. These are areas considered of national significance on the basis of their outstanding scenic interest. They cover a total land area of around one million hectares and a marine area of over 350,000 hectares. They comprise a mixture of richly diverse landscapes. Coastline, seascapes, lochs and rivers are prominent features in many.

The quality of our freshwater fisheries is recognised the world over. Atlantic salmon is widely regarded as Scotland's most iconic freshwater fish species. Fishing for salmon and its close relative, sea trout, takes place in almost every river. Angling for brown trout in both wild and stocked fisheries is also widespread. The average annual number of freshwater angler days in the Scotland RBD is estimated to be over one million. Expenditure by these anglers is around £100 million. Latest estimates are that freshwater angling across Scotland as a whole supports around 2,800 jobs and generates nearly £50 million in wages and self-employment income to Scottish households[6].

Angling is not confined to our freshwaters and the annual number of sea angler days per year by residents in the Scotland RBD is estimated to be well over one million. In Scotland as a whole, sea anglers are estimated to spend around £141 million per year[7]. This supports 3,148 full-time job equivalents and £69.67 million annually of Scottish household income in the form of wages, self employment income, rents and profits. Around 80% of the employment is in the Scotland RBD.

Tourism in the River Spey catchment

The Spey catchment in the North East of Scotland offers a wide range of angling opportunities, including internationally recognised salmon angling. The catchment's river and lochs are also increasingly important as outdoor activities, such as canoeing, kayaking, sailing, rafting, and walking (on the Speyside Way), grow in popularity. The Cairngorms National Park covers two thirds of the catchment. The presence of birds that live on and around the catchment's lochs and rivers, including ospreys and internationally important populations of waders, are another major attraction.

An economic study published in 2004 and commissioned by the Spey Catchment Management Partners estimated the number of angling activity days per year to be 54,746 and that angling in the catchment generated over £10.9 million worth of annual local output and supported the equivalent of 367 permanent full-time jobs. The number of watersports activity days was estimated to be 38,190. This was estimated to contribute £1.7 million worth of annual local output and support 48 full-time job equivalents.

[5]Tourism, Culture and Sport Statistics www.visitscotland.org/research_and_statistics/national_facts_and_figures.htm
[6]Research Report: The Economic Impact of Game and Coarse Angling in Scotland www.scotland.gov.uk/Publications/2004/03/19079/34369
[7]Technical Report: Economic Impact of Recreational Sea Angling in Scotland www.scotland.gov.uk/Publications/2009/07/31154700/0

Scotland is one of the largest commercial sea fishing nations in Europe and 66% of UK sea fish landings take place in Scotland[8]. Scotland is also the largest producer of farmed salmon in the European Union and the third largest producer in the world. Our fish and shellfish farming industries are estimated to have a farm gate value of £346 million and represent 80% of aquaculture production in the UK. Aquaculture makes an important contribution to the Scottish rural economy, especially in the Western and Northern Isles where many communities are sustained by employment in aquaculture - around 1,500 direct jobs and 4,700 downstream[9].

The success of both our recreational and commercial fisheries relies on a high quality water environment and there are more than 180 protected areas in the RBD specifically for the protection of economically important shellfish in our coastal waters and fish in our rivers and lochs.

The food and drink manufacturing sector contributes around 3% to Scottish gross value added. Drinks manufacture, including whisky production, contributed over £1.7 billion to Scottish gross value added in 2006. Scotland is noted for its production of Scotch whisky and there are around one hundred distilleries spread across the Highlands and islands. As many as 40,000 jobs depend on whisky production.

Electricity, gas and water supply contribute over 2.5% of Scottish gross value added. Hydropower produces around 11% of the total electricity generated in Scotland. Most of the reservoir-fed hydropower plants in the UK are in Scotland and nearly all of them in the Scotland RBD. These store water allowing electricity to be generated when it is required. This can help balance the intermittent electricity output of wind turbines, solar cells and run-of-river hydropower schemes.

Our economy also relies on our water environment to supply freshwater and to absorb our wastes. Our waters have a capacity to provide these important services without detriment to their ecological quality. As our climate changes, wetter weather may enhance this capacity during the winter months by increasing the quantity of water available for abstraction or to dilute waste discharges. However, the drier and hotter summers will reduce it because of less water being available and because higher summer temperatures will lower oxygen levels. Reduced oxygen levels make surface waters less able to cope with our wastes. A high quality water environment makes us more resilient to these effects because it has more capacity in reserve to accommodate increased stresses than waters already subject to significant pressures.

The more intensive rainfall of our changing climate will make flooding more common. To manage this, we will depend not only on engineered flood defences but also on natural flood attenuation. The high quality of our environment places us in a good position to do this. For example, many of our river floodplains are relatively undeveloped and their flooding helps reduce flood peaks in downstream towns and cities.

3.2 Water and our well-being

The water environment provides the Scotland RBD's drinking water and takes away its waste sewage. These are vital services for the health and well-being of all those who live in the Scotland RBD as well as its visitors. Whether involving relaxation, exercise, learning, sport, thrills or adventure, recreation is also important for well-being. Our high quality water environment provides a setting for numerous shore-based recreational activities and a venue for a wide range of water-based ones.

During 2005, three quarters of the Scottish adult population claimed that they had made at least one visit to the outdoors for leisure and recreation purposes[10]. If only just as part of the scenery or backdrop to a walk or picnic, the water environment will have been part of the recreational experience in many of these visits. Like our mountains, our rivers, lochs, canals, wetlands and seas are a cornerstone of the Scottish rural landscape. In our towns and cities, river corridors often provide the main areas of greenspace for recreation and are rich in both wildlife and cultural interest.

[9] www.scotland.gov.uk/Topics/Fisheries/Sea-Fisheries
[10] www.scotland.gov.uk/Topics/Fisheries/Fish-Shellfish
[11] SNH 2005 Scottish Recreation Study www.snh.org.uk/pdfs/publications/commissioned_reports/ReportNo220.pdf

Fishing remains one of Scotland's most popular pastimes. However, our water environment provides opportunities for participation in a wide range of water-related leisure activities. Water-dependent adventure activities and sports have grown enormously in the last few years. Like fishing, they rely on the diversity and high quality of our water environment and are thriving because of it. They include activities such as body boarding, canyoning, coasteering, diving, kayak surfing, kite surfing, open canoeing, sailing, sea kayaking, surfing, white water kayaking, white water rafting and wind surfing. The Scotland RBD provides world class venues for many of these activities. To safeguard the quality of our waters for recreation, 73 areas have been identified as protected areas known as bathing waters. Further information on the condition of these areas can be found in Chapter 5 available online at:
www.sepa.org.uk/water/river_basin_planning.aspx

3.3 Water and our wildlife

The well-being we derive from our water environment and our water economy depend on the health of our waters – their ecological quality and biodiversity. A healthy water ecosystem underpins our way of life, enabling us to enjoy multiple benefits from our waters. It is also the reason why our water environment provides a stronghold for some of Europe's rarest and most threatened plants and animals.

Many of our surface waters and wetlands lie within the Scotland RBD's 296 protected areas[11] for the conservation of internationally rare or endangered wildlife. These areas form part of the European Natura 2000 network. As well as rivers and lochs they include large stretches of our coastal waters and estuaries. However, many of our waters that are not part of the Natura network also support rare and threatened species and are valuable wildlife habitats in their own right.

The European otter has thrived in our coastal waters, rivers and lochs while declining over several decades in other parts of Europe. Our gravel rivers provide home to populations of the globally threatened freshwater pearl mussel and many of the best salmon runs in the UK are found in the Scotland RBD's rivers. The humid environment of steep-sided ravines and gorges in Northern and Western Scotland supports the richest and most diverse moss communities in Europe. And growing on the rocks of our rivers are some of the rarest lichens in Britain, including species found nowhere else in the UK.

A significant number of our water plants and animals are identified as conservation priorities in the UK's Biodiversity Action Plan. For example, most of the UK's populations of two rare water plants – the slender naiad and the Shetland pondweed – are found in lochs in the Scotland RBD, and the majority of the UK's naturally low and very low nutrient, clear-water lochs are also found here. Some of the latter provide a stronghold for populations of rare cold-water fish, such as the Arctic charr and a whitefish species, the powan.

Our coastal waters are among the most biologically diverse in the world: they support internationally important populations of seals, bottlenose dolphins and hundreds of thousands of breeding seabirds. They include saline lagoons, one of the most threatened wildlife habitats in Europe. The diversity of our coastal waters is a result of the influence of the very different geographical and environmental conditions around our shores. These range from very exposed Atlantic island coasts to extremely sheltered waters at the heads of long, narrow sea lochs. Each of these extremes supports a unique community of water plants and animals, contributing to the rich and abundant diversity of our marine life. In the North Sea, fed by inputs from our large east coast rivers, populations of sediment-dwelling invertebrate animals are particularly abundant and provide the food supply for commercially important fish populations.

The productivity of our estuaries, large intertidal areas and many freshwater lochs make them ideal as 'stepping stones' on international migratory pathways for large numbers of wading birds and waterfowl. Many of these stepping-stone waters are part of the European Natura network or listed as Wetlands of International Importance under the Ramsar Convention. Our rivers also provide important wildlife corridors through towns and farmland. They are used by many species, including fish, otters, bats, birds and plants for migration, dispersal and feeding.

[11]These are Special Areas of Conservation and Special Protection Areas identified under the Habitats Directive or Birds Directive and for which the maintenance or improvement of the status of waters is important for their protection.

4. Overall status of the Scotland RBD's waters

4.1 Assessing the condition of our waters

The environmental quality of the Scotland RBD's surface waters and groundwater - the degree to which they have been impacted by human activity - varies widely as do their natural characteristics. To reflect this variation, SEPA has subdivided our waters into over 3,000 water bodies. Classifying the condition, or status, of each water body gives us a picture of where the water environment is in a good condition and where improvements need to be targeted.

There are 2,013 river, 309 loch, 284 groundwater, 40 estuary and 449 coastal water bodies in the Scotland RBD. SEPA has recently completed its first comprehensive assessment of the status of these water bodies. For this purpose, SEPA put in place a revised and expanded programme of environmental monitoring and assessment at the end of 2006. The assessment methods used were developed jointly with the rest of the UK. A number of them have also been checked for comparability with those used by other countries across Europe. All are based on environmental quality criteria set out in European legislation. As a result, for the first time Scotland's water environment has been classified on the same basis as that of rest of the UK and Europe.

The Scotland RBD contains a large number of protected areas. These are areas that have been identified as requiring special protection for their surface water and groundwater or for the conservation of wildlife directly depending on water. These areas include, among others, waters that:

- support economically important shellfish;
- have been designated as bathing waters;
- provide water for human consumption; or
- support plant and animal species or habitats identified as requiring special protection under European legislation.

Protected areas for shellfish, bathing and water for human consumption have been identified in part to protect human health. The environmental conditions needed to do this are different from those needed to protect the ecological quality of our water environment. Some of the rare plants and animals requiring special protection under European legislation also have very particular environmental needs. Further information on the protected areas in the Scotland RBD and the assessment of whether they are achieving the environmental quality criteria necessary for their protection can be found in Chapter 5 available online at: www.sepa.org.uk/water/river_basin_planning.aspx

Previous classification schemes

SEPA and its predecessor bodies have many years' experience of classifying the condition of Scotland's water environment. The first national river quality classification scheme was introduced as long ago as 1974 and enabled the significant improvements made since then to be quantified. SEPA has been responsible for classifying surface waters since its formation in 1996. The schemes it has used for this purpose were developed from the earlier schemes and were designed to describe the cleanliness of waters based on chemical and biological assessments. In contrast, the classification results in this plan describe the impacts on the water environment of a wide range of human activities not just pollution pressures. Further information on previous classification schemes can be found on SEPA's website at: www.sepa.org.uk/water/monitoring_and_classification/previous_schemes.aspx

The classification results provide us with our best understanding to date of the condition of Scotland's water environment. They show that 2,012 of the Scotland RBD's water bodies, or 65%, are currently at good or better status. They also indicate where there is high confidence that action is needed to improve the water environment and where the need for action is less clear. This information provides the basis for prioritising action or targeting further monitoring effort. You can find information on the classification results for individual water bodies, including information on the confidence in the results, using the interactive map available on SEPA's website at: www.sepa.org.uk/water/river_basin_planning.aspx

As SEPA obtains more information from monitoring, and assessment methods are refined in the light of scientific advances and further standardised with those used by other countries in Europe, understanding of the condition of the water environment will further improve. These improvements in understanding will be taken into account when this plan is updated.

4.2 Overall status of surface waters

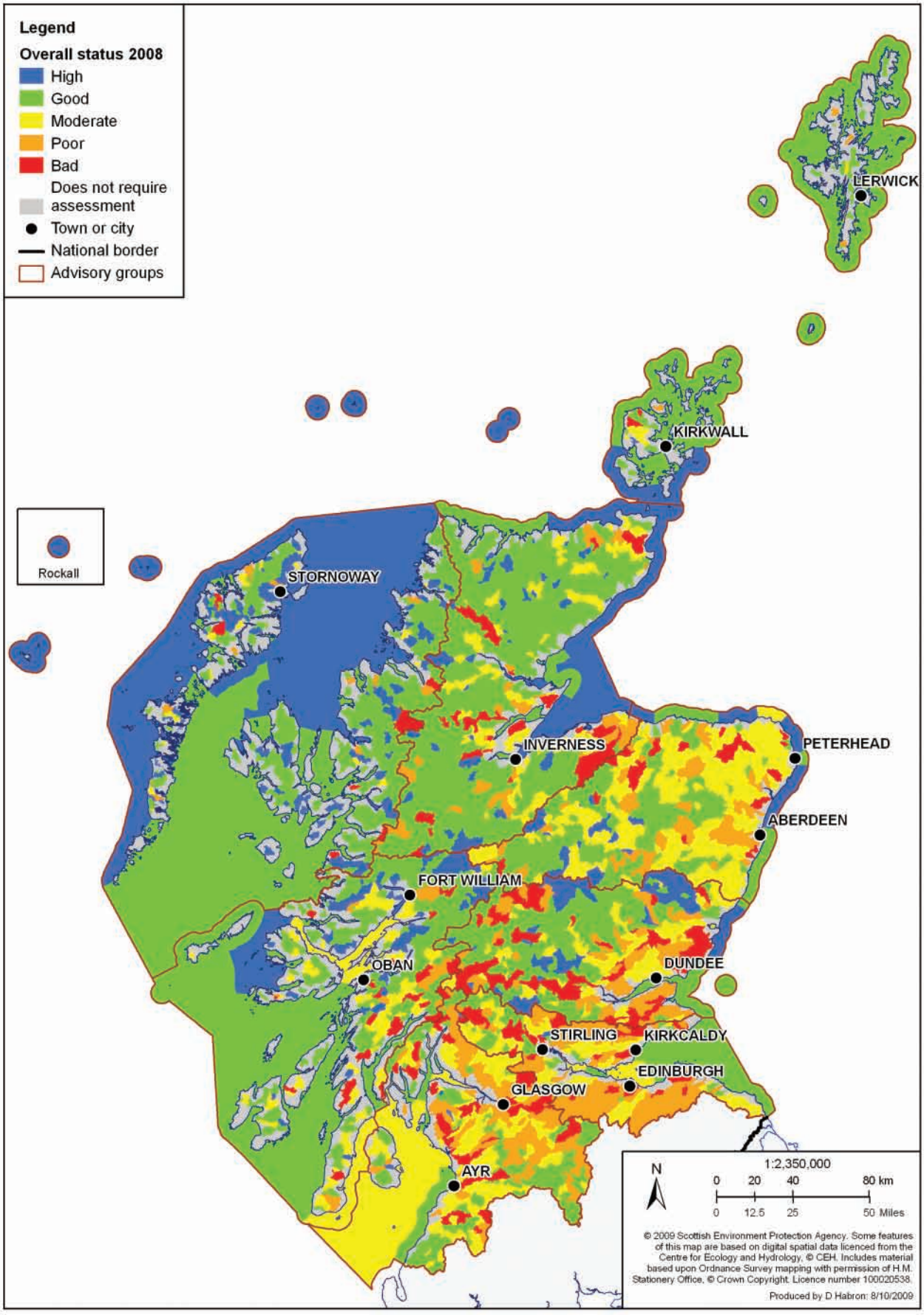
Table 1 and Map 2 below summarise the classification results for rivers, lochs, estuaries and coastal waters. Just less than 64% of our surface water bodies are at good or better status. Many are little disturbed by human activity compared to the majority of water bodies elsewhere in the UK and Europe.

Table 1: Status of surface waters in the Scotland RBD in 2008

	Rivers		Lochs		Estuaries		Coastal waters	
Status	Number of water bodies	Length (km)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)
High/Maximum	191	1520	61	145	14	161	158	15,695
Good	935	9434	143	493	20	310	263	26,191
Moderate	407	4650	48	123	5	125	28	3,909
Poor	300	3098	39	126	1	10	0	0
Bad	180	2115	18	74	0	0	0	0
Totals	2,013	20,817	309	961	40	606	449	45,795
Proportion good or better (%)	56	53	66	65	85	78	94	91

Because water bodies vary in size, a particular number of water bodies does not correspond to a given area or length of surface water. For completeness, Table 1 and other Tables in the plan provide information on both numbers of water bodies and the corresponding length or area of waters they represent.

Map 2: Status of surface waters in the Scotland RBD in 2008



What are river water bodies?

Any sizeable stretch of river will have a number of small, tributary streams draining into it. A river water body includes all the tributary streams and interconnected small lochs upstream of the downstream end of the water body that are not part of another, upstream water body.

The maps included in this plan do not show all the tributary streams of each river water body. Instead, river water bodies are represented by shaded areas. These correspond to the catchment areas, or drainage basins, that are exclusive to each water body (ie not shared with any upstream water bodies) and within which are found all the rivers, streams and, sometimes, small lochs that comprise the water body.

Where information on river length is given (eg Table 1), this refers to the length of the main watercourse(s) in each river water body. It does not include the length of the water body's smaller tributary streams.

4.3 Overall status of groundwater

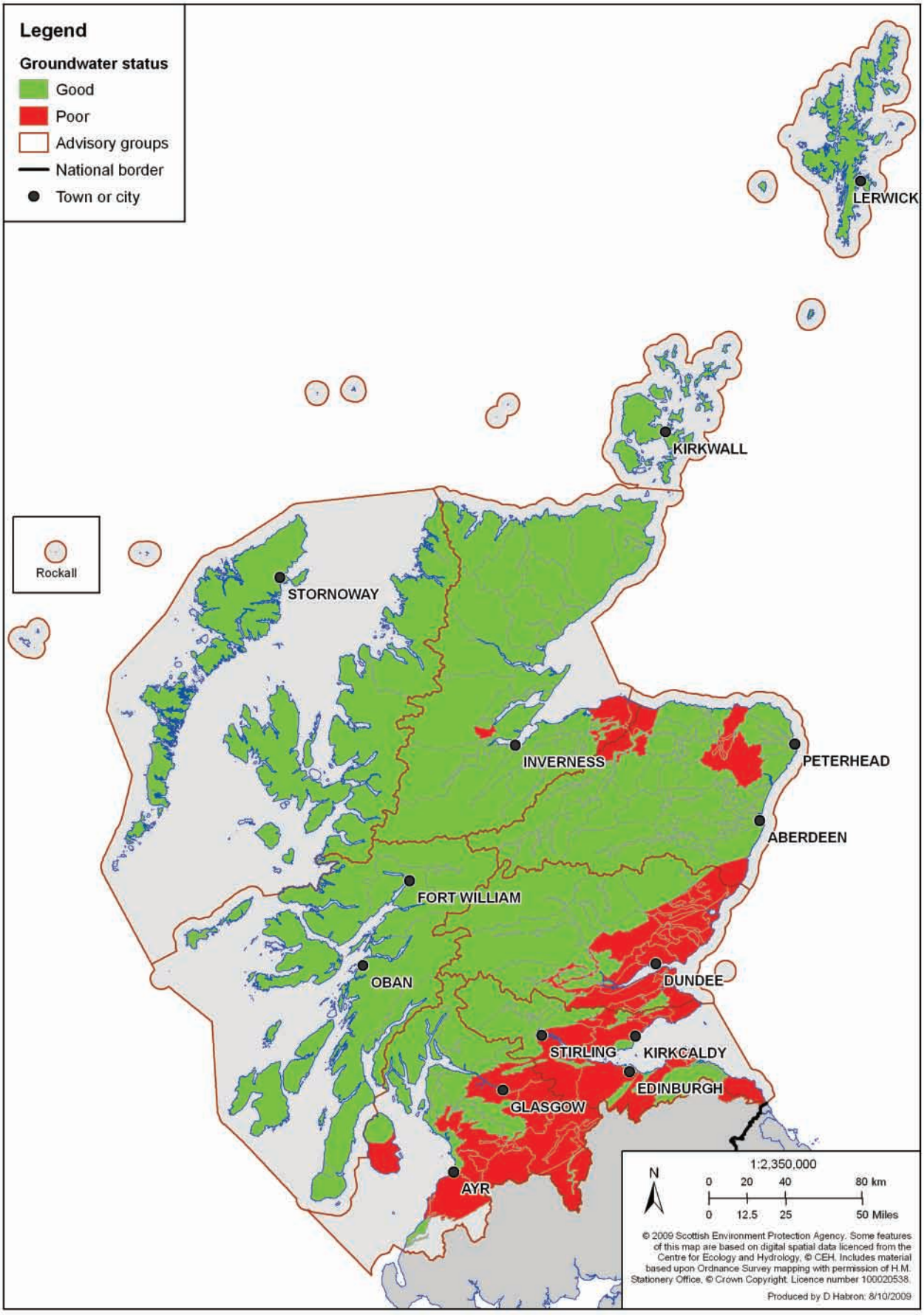
Table 2 and Map 3 below summarise the overall classification results for groundwater. These distinguish whether bodies of groundwater are in a good or poor condition. The classification takes account of whether or not the water bodies are polluted and whether or not the volume of any water being abstracted from them[12] is sustainable without significant impacts on rivers or wetlands that depend on the groundwater. Nearly 76% of our bodies of groundwater, representing 83% of the area of groundwater, are at good status.

Table 2: Status of groundwater in the Scotland RBD in 2008

Status	Groundwater status	
	Number of water bodies	Area (km^2)
Good	215	55,267
Poor	69	11,301
Total	284	66,568
Proportion good (%)	76	83

[12]This includes all volumes of water that are authorised to be abstracted.

Map 3: Groundwater status in the Scotland RBD in 2008



5. Ecological quality of surface waters

For surface waters, the status of water bodies (see Table 1 and Map 2) describes their relative ecological quality. Unless it is a heavily modified or artificial water body, a water body's status describes:

- by how much its ecological quality differs from near natural conditions. This is referred to as the body's "ecological status";
- whether or not, if present at all, the most toxic substances identified at European level are at safe levels.

Artificial water bodies are man-made water bodies, such as many canals. Heavily modified water bodies are surface water bodies that:

- have been substantially changed in character as a result of physical alterations;
- could not be restored to good ecological status without significant adverse impacts on the wider environment or on activities that cannot operate without the alterations, such as flood protection and water storage for drinking water supply and hydropower generation.

SEPA has identified 408 heavily modified and artificial water bodies in the Scotland RBD (see Chapter 4 available online at: www.sepa.org.uk/water/river_basin_planning.aspx). For these bodies, status describes:

- the extent to which a water body's ecological quality has been maximised, given the limits imposed by the physical modifications necessary for the body's use, or uses; or for the protection of the wider environment (eg conservation of biodiversity or built heritage). This is referred to as the body's "ecological potential";
- whether or not, if present at all, the most toxic substances identified at European level are at safe levels.

Ecological quality

Ecological quality refers to the health of aquatic ecosystems as reflected by the mix and abundance of a range of water plants and animals. Our surface waters support a great variety of plant and animal communities, each adapted to the different natural characteristics of the waters in which they occur. Pressures on water quality; water flows and levels; or alterations to beds, banks and shores can dramatically alter the characteristics of water bodies. Such changes can have profound effects on the condition, abundance and balance of the plants and animals. Water bodies whose ecological quality is severely damaged can support few uses. They provide fewer social and economic benefits than good ecological quality waters. They are often visibly unpleasant giving an impression of neglect; in some cases they even pose a risk to health.

Further information on how ecological quality is assessed can be found in Appendix A to this Chapter. Details of our ecological status and ecological potential classification schemes can be found in the Scotland RBD (Classification of Water Bodies) Directions 2009[13].

Table 3 below summarises SEPA's assessment of the ecological status of bodies of surface water other than heavily modified and artificial bodies. Table 4 summarises the ecological potential of our heavily modified and artificial water bodies. Map 4 shows how ecological status and potential vary across the Scotland RBD.

There are 2,811 bodies of surface water in the Scotland RBD. Of the 2,398 that are not heavily modified or artificial, 66% are already at good or high ecological status. Of those that are heavily modified or artificial, 50% are at good or maximum ecological potential.

[13]The Scotland River Basin District (Classification of Water Bodies) Directions 2009 www.scotland.gov.uk/Publications/2009/12/14130729/3

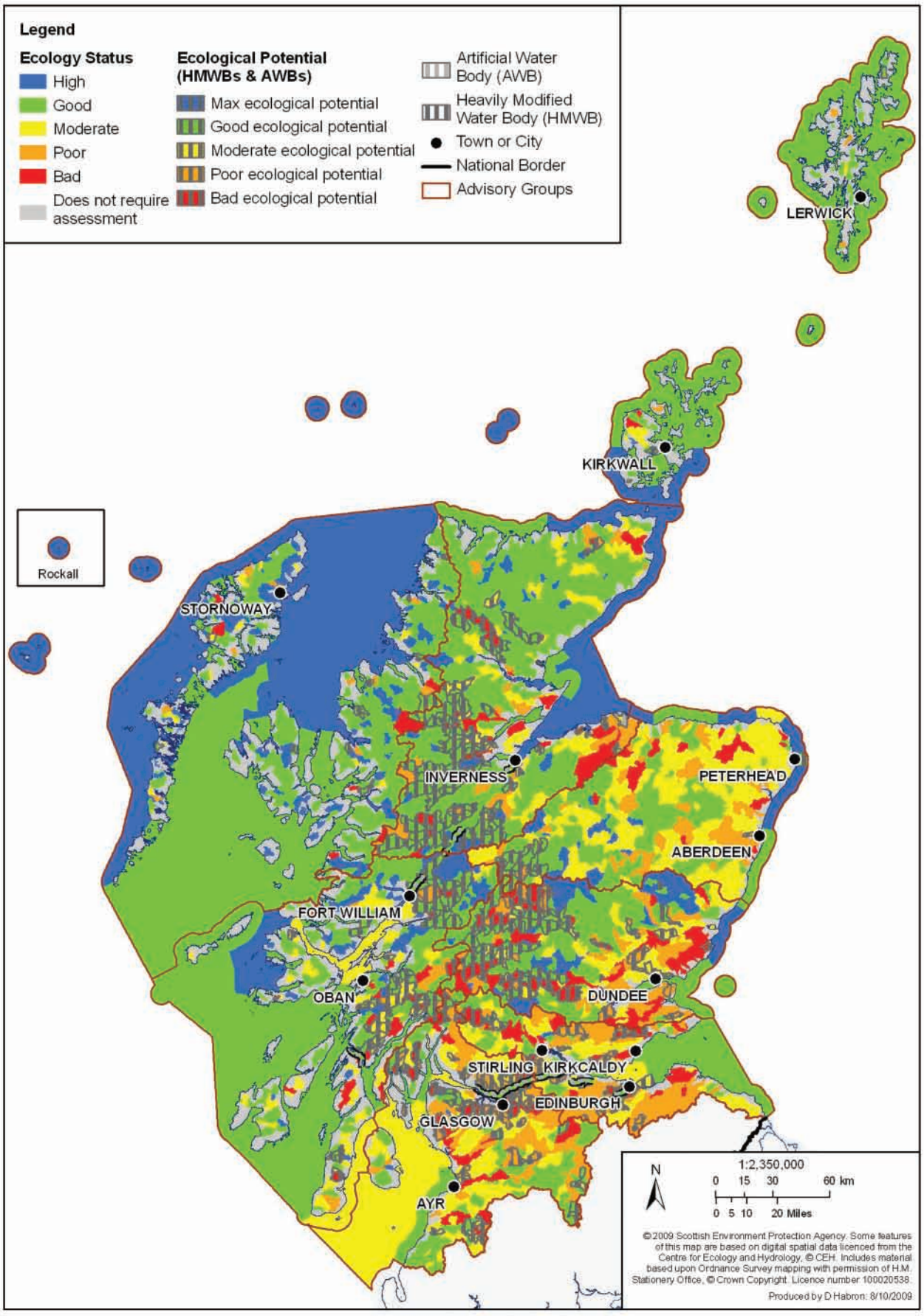
Table 3: Ecological status of bodies of surface water (other than heavily modified and artificial water bodies) in the Scotland RBD in 2008

Ecological status class	Rivers		Lochs		Estuaries		Coastal waters	
	Number of water bodies	Length (km)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)
High	190	1492	60	144	14	161	158	15,695
Good	801	8,168	89	252	16	309	252	26,138
Moderate	357	4227	36	101	3	82	27	3,863
Poor	242	2512	20	98	0	0	0	0
Bad	126	1508	7	10	0	0	0	0
Totals	1,716	17,907	212	605	33	552	437	45,696
Proportion good or high (%)	58	54	70	65	91	85	94	91

Table 4: Ecological potential of heavily modified and artificial water bodies of surface water in the Scotland RBD in 2008

Ecological potential class	Rivers		Lochs		Estuaries		Coastal waters	
	Number of water bodies	Length (km)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)
Maximum	1	28	1	1	0	0	0	0
Good	134	1,266	54	242	4	1	11	53
Moderate	50	423	12	22	2	43	1	46
Poor	58	586	19	27	1	10	0	0
Bad	54	607	11	64	0	0	0	0
Totals	297	2,910	97	356	7	54	12	99
Proportion good or maximum (%)	45	44	57	68	57	2	92	54

Map 4: Ecological status and ecological potential of bodies of surface water in the Scotland RBD in 2008



6. Significant pressures

To improve the status of water bodies, the pressures responsible for impacts on them have to be identified. If possible and appropriate, these pressures can then be reduced. This will allow our waters to recover and the objectives for our water environment (see Chapter 2 available online at: www.sepa.org.uk/water/river_basin_planning.aspx) to be achieved.

Assessing pressures and impacts

In 2004, SEPA completed an initial analysis of pressures and their impacts on the waters of the Scotland RBD[14], including a public consultation. SEPA has since improved and refined its understanding of impacts and their causes.

The results of this initial analysis were used in targeting SEPA's environmental monitoring work. The resulting classifications of the status of surface water and groundwater bodies represent the best understanding yet of the impacts on Scotland's water environment.

SEPA also expanded its knowledge of pressures. SEPA and its predecessor bodies have long held information about discharges for the purposes of their pollution control duties. However, until recently, Scotland had no comprehensive repository of information on other pressures. Since 2005, the Water Environment (Controlled Activities) (Scotland) Regulations have required operators of any sizeable discharges, abstractions and impounding works (eg dams) to provide details to, and obtain authorisation from, SEPA. Knowledge of other pressures on the Scotland RBD's waters has been improved by utilising a variety of sources of information combined, where necessary, with environmental modelling. For example, SEPA has used information collected from field surveys, maps and aerial photographs, to create a new database of physical modifications to the beds, banks or shores of surface waters. It has also used information on land use alongside environmental monitoring and modelling results to identify diffuse source pollution pressures. Combining the detailed information on pressures with its classification results has allowed SEPA to identify those pressures that are causing water bodies to be at less than good status.

Although a majority of our water bodies are at good ecological status or better, 43% are adversely affected by human activities. This includes heavily modified water bodies that are, by definition, impacted even though no further improvements to their ecological quality may be possible (ie they are at good or maximum ecological potential).

SEPA has been collecting and analysing information on the pressures on surface waters and groundwater. This has enabled it to identify pressures that are having significant impacts on water bodies. The pressures responsible for these impacts are listed in Table 5 below. Water bodies affected by more than one type of pressure are counted in the figures given for each applicable pressure type.

[14] www.sepa.org.uk/water/water_publications/characterisation_reports.aspx

Table 5: Relative scale of impact of different pressures on water bodies in the Scotland RBD in 2008

Pressure	Water bodies caused to be at less than good status or designated as heavily modified water bodies (%)		
	Proportion of all surface waters	Proportion of all groundwater bodies	Proportion of all water bodies
Pollution	18	20	18
Alterations to water flows and levels	18	12	17
Modification of beds, banks and shores	16	n/a	16
Barriers to river continuity for fish migration	14	n/a	14
Impact of invasive non-native species	<1	n/a	<1

Note to Table 5
Information on the number and length/area of water bodies affected by the different pressures listed in this Table can be found in the following Sections of this Chapter.

The geographic distribution of pressures on water bodies can differ substantially depending on the type of pressure. For example, the damming of rivers to create a storage reservoir for drinking water supply has typically been undertaken away from the principal sources of pollution. As a consequence, water bodies may have excellent water quality but be at less than good status because of changes to their water flows and levels, or vice versa. Because different pressures tend to be affecting different water bodies, the proportion of water bodies adversely affected by any one pressure is less than the overall proportion of water bodies that are at less than good status.

7. Water quality in the Scotland RBD

To be in a good condition, our waters need to be clean and free of pollutants in concentrations that would harm the water plants and animals they support. There has been significant progress in preventing and reducing pollution over the last few decades. This has resulted in the water quality of 82% of all the Scotland RBD's water bodies being good or better.

7.1 Water quality of surface waters

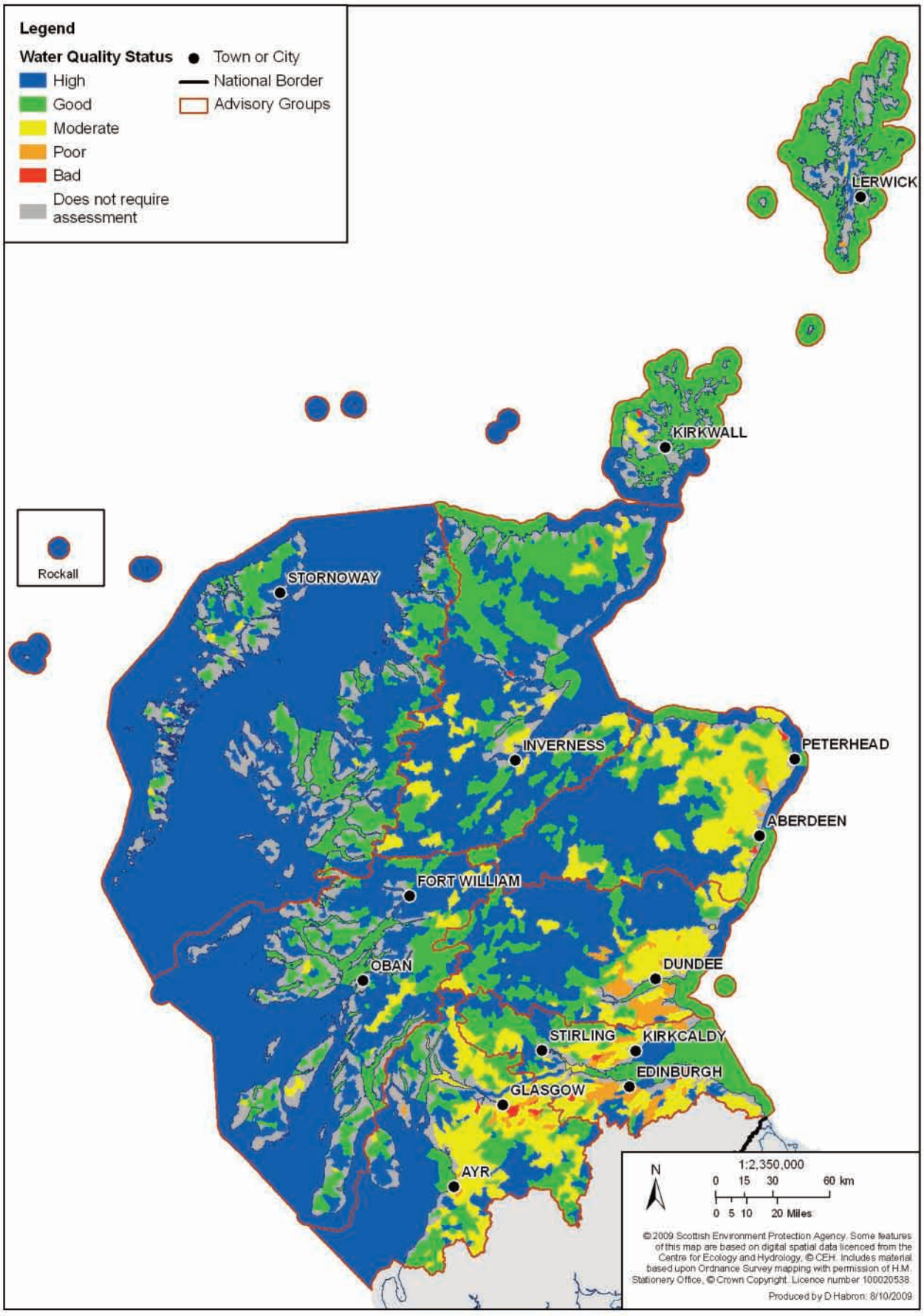
Table 6 and Map 5 below summarise the condition of water quality in the Scotland RBD's rivers, lochs, estuaries and coastal waters.

Table 6: Water quality of bodies of surface water in the Scotland RBD in 2008

	Rivers		Lochs		Estuaries		Coastal waters	
Water quality	Number of water bodies	Length (km)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)
High	1,042	10,585	104	279	23	244	241	34,620
Good	557	5,621	117	349	11	228	203	11,054
Moderate	350	3,923	73	315	6	134	5	121
Poor	56	611	12	12	0	0	0	0
Bad	8	77	3	5	0	0	0	0
Totals	2,013	20,817	309	960	40	606	449	45,795
Proportion good or better (%)	79	78	72	65	85	78	99	99

Note to Table 6
Information on the chemical, physicochemical and biological indicators that SEPA used in assessing water quality can be found in Appendix B and on the interactive map on SEPA's website at: http://gis.sepa.org.uk/rbmp

Map 5: Water quality of bodies of surface water in the Scotland RBD in 2008



Pollution and surface waters

Different pollutants cause different impacts on water plants and animals. Excessive inputs of nutrients accelerate the growth of algae and other water plants causing oxygen depletion and major changes in the balance of different plants and animals. This process is known as eutrophication. Aquatic animals can also be starved of oxygen as a result of inputs of organic matter, for example, in sewage. The breakdown of this matter uses up the oxygen normally dissolved in the water. Other pollutants can be directly toxic, causing death of organisms, reducing their growth or interfering with reproduction. Some of these pollutants breakdown only very slowly in the water environment and can accumulate over time, sometimes within the bodies of animals. Over thirty of the most dangerous substances or groups of such substances have been identified at European level and are known as priority substances.

We rely on the water environment to safely absorb and breakdown pollutants contained in discharges from sewage treatment works and industrial discharges. Climate change will affect the ability of the water environment to provide this service. Drier summers will mean less water to dilute pollutants. The breakdown of pollutants often uses oxygen. Warmer summer temperatures will mean lower oxygen levels to start with. This will increase the stress on water plants and animals and decrease their ability to cope with our discharges. For waters already under pressure from nutrient inputs, higher temperatures will further stimulate excessive and damaging proliferations of water plants. More frequent intense storms are likely to result in more of the toxic pollutants that have collected on our roads and other urban surfaces being washed into the water environment. Similarly, more soil and nutrients from agricultural land is likely to be washed into surface waters. Increased storminess will also mean that, without improvement, our sewerage systems will overflow into rivers more often.

Table 7 below lists the principal pollution pressures that are adversely affecting surface water quality. Inputs of nutrients are the largest of these pressures. They are playing a significant role in causing 15% of the Scotland RBD's surface water bodies to be at less than good status.

The principal sources of nutrient inputs are agriculture and the disposal of sewage. Other pollutants from agriculture and the disposal of sewage are, respectively, each responsible for adversely affecting 4% of all surface water bodies.

Table 7: Principal pollution pressures on surface waters in the Scotland RBD in 2008

Principal pollution pressures	Sources	Water bodies in which pressure is preventing the achievement of good status (%)				
		Proportion of all rivers	Proportion of all lochs	Proportion of all estuaries	Proportion of all coastal waters	Proportion of all surface water bodies
Inputs of nutrients	All sources	17	20	5	0	15
	Agriculture	13	10	5	0	10
	Sewage collection and disposal	9	6	3	0	7
Other point and diffuse inputs affecting oxygen levels or that are toxic to aquatic animals and plants	All sources	9	6	10	6	8
	Agriculture	5	2	3	0	4
	Sewage collection and disposal	5	2	10	1	4
Acidification	Burning of fossil fuels	1	9	0	0	1

7.2 Water quality of groundwater

Table 8 and Map 6 below summarise the water quality of the Scotland RBD's bodies of groundwater. The majority (80%) of our groundwater bodies have good water quality: They are at "good groundwater chemical status".

Groundwater quality

Groundwater quality is described by the groundwater chemical status of bodies of groundwater. Chemical status indicates whether or not any pollutants in groundwater are causing:

- harm to surface waters into which the groundwater eventually flows;
- damage to wetlands that depend on the groundwater for their water needs;
- deterioration of the quality of water being abstracted (or planned to be abstracted) from the water body for human consumption;
- significant impairment (eg because of widespread pollution) of the ability of the groundwater body to support other uses.

Table 8: Chemical status of bodies of groundwater in the Scotland RBD in 2008

Groundwater chemical status	Number of water bodies	Area (km²)
Good	226	57,159
Poor	58	9,409
Totals	284	66,568
Proportion good (%)	80	86

Once polluted, restoration of groundwater is difficult and likely to take many years to achieve. This is because pollutants tend to be flushed out of groundwater bodies only very slowly. The long natural lag-time for groundwater replenishment means that identifying and tackling potential problems, before they cause long-term damage, is important.

As well as classifying the current chemical status of bodies of groundwater, SEPA is undertaking a programme of monitoring and assessment to identify significant and sustained upward trends in the concentrations of pollutants in groundwater. These are trends that, if unaddressed, would lead to deterioration of the chemical status of bodies of groundwater. Table 9 summarises the results of this assessment. Upward trends have so far been identified in 9% of groundwater bodies.

Table 9: Significant and sustained upward trends in the concentrations of pollutants in bodies of groundwater in the Scotland RBD in 2008

Significant and sustained upward trends	Number of water bodies
None identified	258
Trend present	26
Trend reversed	0

Map 6: Chemical status of bodies of groundwater and upward trends in pollutant concentrations in the Scotland RBD in 2008

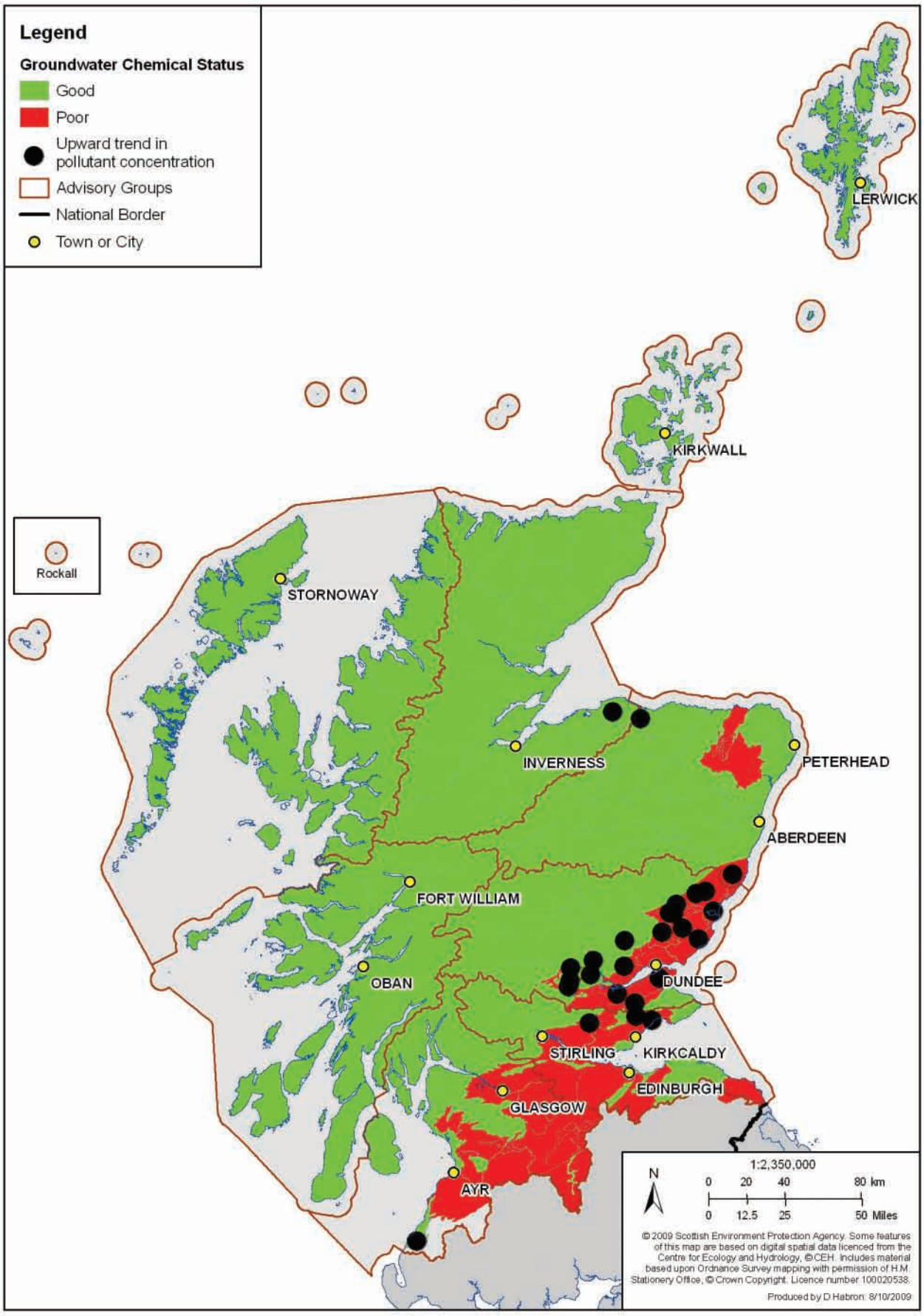


Table 10 below lists the principal pollution pressures that are adversely affecting the chemical status of bodies of groundwater. Inputs of nitrates are by far the largest of these pressures and are a cause of 15% of the Scotland RBD's groundwater bodies being at poor chemical status. The principal source of nitrate inputs is agriculture. Overall, 74% of the bodies of groundwater that are in poor chemical status are under pressure from diffuse source pollution from agricultural activities.

Table 10: Principal pollution pressures on bodies of groundwater in the Scotland RBD in 2008

Principal pollution pressures	Sources	Bodies of groundwater caused to be at poor status			
		Number of bodies	Area of bodies (km^2)	Proportion of all groundwater bodies (%)	Proportion of total area of groundwater (%)
Inputs of nitrates	**Agriculture**	43	3,730	15	6
Inputs of pesticides	**Agriculture**	6	1,112	2	2
Inputs of heavy metals	**Abandoned mine workings**	15	5,679	5	9
	Contaminated land	1	219	<1	<1

Note to Table 10
SEPA is continuing to investigate the extent of impacts on groundwater resulting from contaminated land and will update its assessment on an annual basis.

8. Condition of Water flows and levels

8.1 Water flows and levels in surface waters

The ecological quality of surface waters is sensitive to changes in the pattern of water flows and water levels. Table 11 and Map 7 below summarise the condition of water flows and levels in the Scotland RBD's rivers, lochs, estuaries and coastal waters. Overall, in 82% of surface water bodies, flows and levels are in a good or better condition.

Flows and levels in surface waters

Dry rivers are rare but they can be found in the Scotland RBD, for example, in rivers downstream of some reservoir dams; where whole streams are diverted into reservoirs; or during periods of dry weather in summer where abstractions can suck out the remaining river flow. More commonly, water abstraction during dry weather can reduce the wetted width of rivers. This loss of habitat can result in a loss of species and decreased abundance of others. It can also increase the vulnerability of water plants and animals to pollution and high summer temperatures.

Variation in flows and levels is also important in all surface waters to maintain their characteristic ecological diversity. An estuary without the ebb and flow of the tide or inputs of river flows will not provide the conditions necessary for a natural complement of estuarine plants and animals. In rivers, higher flows provide a trigger for migratory fish like salmon to make their runs upstream and successfully navigate waterfalls and other obstacles to migration. They also move fine and larger sediments around as well as detritus and other food sources. This creates the diversity of shifting habitats on which different water plants and animals depend. In lochs serving as reservoirs, extreme variation in water levels between winter and summer can result in the loch margins becoming a hostile environment for water plants and animals and the creation of a scar zone of bare sediments.

As our climate changes, higher river flows in the west and north of the Scotland RBD may help dilute pollutant discharges to rivers. However, the quantity of pollutants reaching the sea without first having been broken down in rivers may increase. In the drier summers, discharges of pollutants to rivers may not be adequately diluted. Rivers that are not well-shaded by bank-side vegetation may over-heat during the extended periods of low flow, reducing oxygen levels and increasing stress on water animals. Longer periods of drought will lead to extended periods in which rivers shrink to occupy a fraction of the width of their beds. This will lead to reduced productivity and declines in the abundance of plant and animals. Hotter summers will also increase demands for freshwater at just the time when there is less of it that can be abstracted without impacting the ecological quality of our rivers and lochs.

Table 11: Condition of water flows and levels in bodies of surface water in the Scotland RBD in 2008

Condition of water flows and levels	Rivers		Lochs		Estuaries		Coastal waters	
	Number of water bodies	Length (km)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)
High	1,443	14,151	215	512	40	606	449	45,795
Good	146	1,675	17	59				
Moderate	144	1,665	11	19	0	0	0	0
Poor	80	939	15	123	0	0	0	0
Bad	200	2,390	51	248	0	0	0	0
Totals	2,013	20,817	309	960	40	606	449	45,795
Proportion good or better (%)	79	76	75	59	100	100	100	100

Notes to Table 11

- The condition of water flows and levels of all water bodies, other than artificial river water bodies, has been assessed on the same basis. In heavily modified water bodies, the condition of water flows and levels may be worse than good on this basis whilst still representing the best that can be achieved without significant impacts on the use served by the modifications (eg hydropower generation etc).
- The condition of water flows and levels in artificial water bodies, such as canals, is taken as good where it is consistent with the achievement of good ecological potential.

Map 7: Condition of water flows and levels in bodies of surface water in the Scotland RBD in 2008

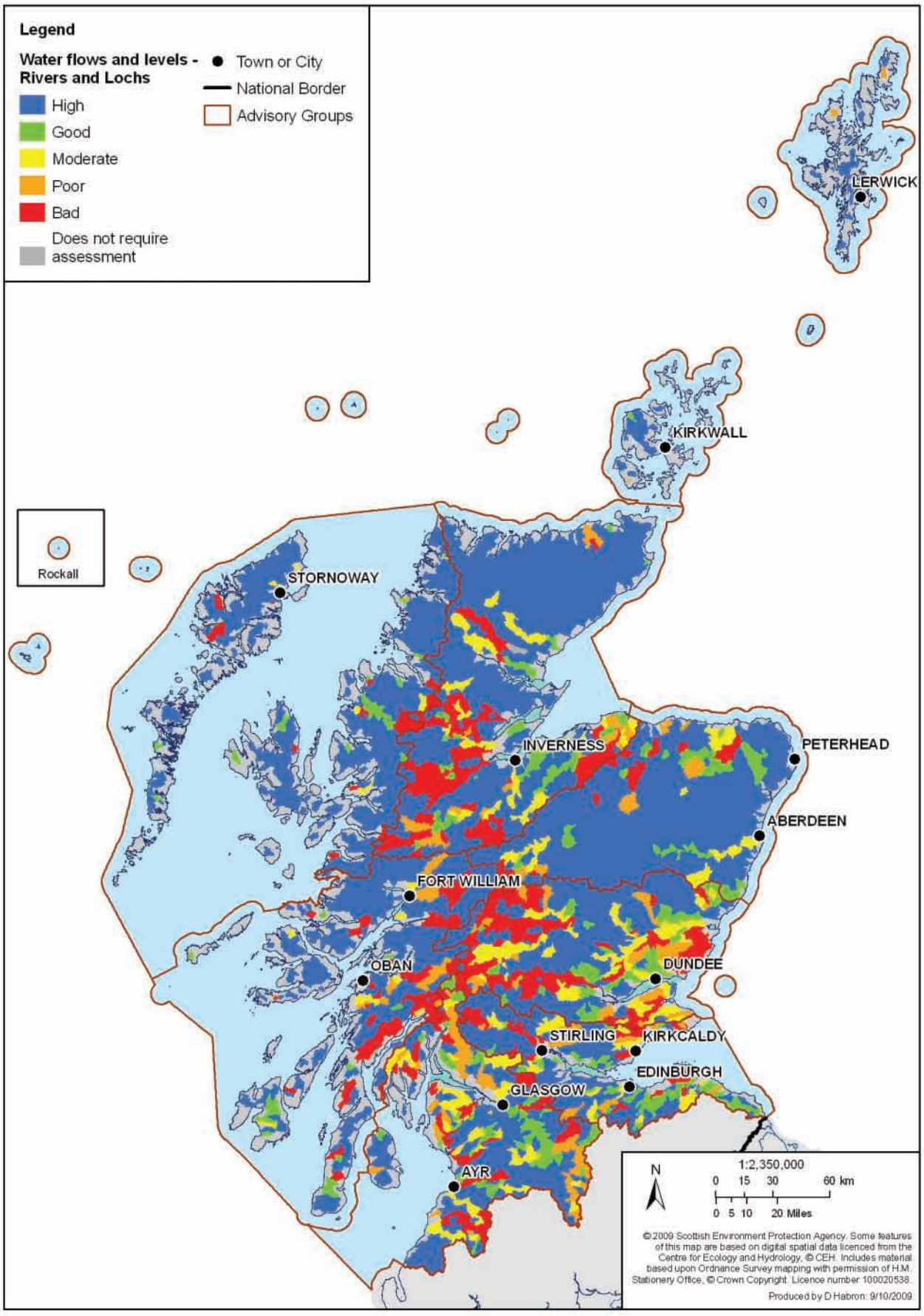


Table 12 below lists the principal pressures that are adversely affecting water flows and levels in rivers and lochs. SEPA has not identified any significant impacts on water flows in estuary and coastal water bodies.

There are two main types of pressure on water flows and levels; impoundment of rivers by damming to create a water storage reservoir; and direct abstraction without impoundment.

The main activities for which reservoirs have been created are drinking water supply and hydropower generation. Water flows and levels in the reservoirs and in the rivers immediately downstream of the reservoir dams are altered by the impoundment of the water in the reservoir and its subsequent abstraction. Many of the impacted water bodies have been designated as heavily modified because of the resulting substantial physical alterations. Reservoirs used for hydropower generation are concentrated in the uplands of the central and northern parts of the Scotland RBD. Those for drinking water supply are typically found nearer to the larger towns and cities towards the south of the Scotland RBD.

The main direct abstractions without impoundment are for irrigating crops or providing drinking water. The impacts of these activities are concentrated along the east and north-east coasts. Direct abstractions are also used for drinks production and fish farming.

Table 12: Principal pressures on water flows and levels in bodies of surface water in the Scotland RBD in 2008

Pressures	Principal activities responsible	Water bodies in which pressure is preventing the achievement of good ecological status [including those designated as heavily modified as a result] (%)	
		Proportion of all rivers	Proportion of all lochs
Abstraction, including abstraction and regulation of river flows at dams	All activities	21	25
	Drinking water supply	3	9
	Hydropower generation	9	14
	Agricultural irrigation	4	0

8.2 Water flows and levels in groundwater

Table 13 and Map 8 summarise the condition of water flows and levels in the Scotland RBD's bodies of groundwater. In 88% of these water bodies, water flows and levels are already in a good condition. This is known as being at "good groundwater quantitative status".

Groundwater flows and levels

The condition of groundwater flows and levels is described by the groundwater quantitative status of bodies of groundwater. Quantitative status indicates whether or not any changes to groundwater flows and levels resulting from human activities, such as water abstraction, are causing:

- harm to surface waters that depend on groundwater flows during dry weather;
- damage to wetlands that depend on groundwater for their water needs;
- salty water at the coast or polluted water from neighbouring bodies of groundwater or surface water to be drawn into the body of groundwater; or
- groundwater levels to fall because (over the long-term) the rate of abstraction is greater than the rate at which groundwater is being replenished from rainfall.

Table 13: Quantitative status of bodies of groundwater in the Scotland RBD in 2008

Groundwater chemical status	Number of water bodies	Area (km^2)
Good	250	59,824
Poor	34	6,744
Totals	284	66,568
Proportion good (%)	88	90

Map 8: Quantitative status of bodies of groundwater in the Scotland RBD in 2008

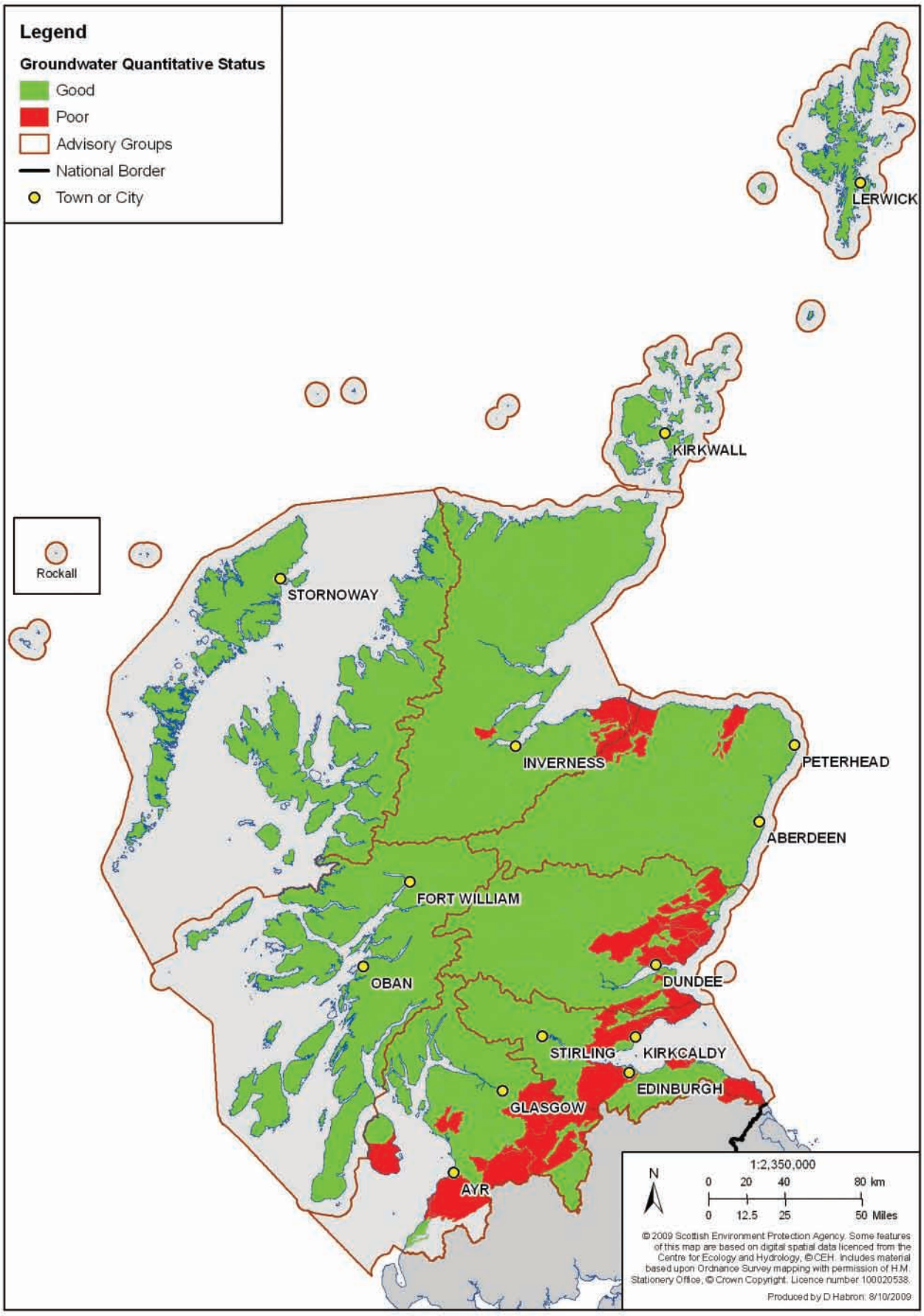


Table 14 below lists the principal pressures that are adversely affecting water flows and levels in bodies of groundwater. Over-abstraction of groundwater is not a widespread problem in the Scotland RBD. The impact of depleted groundwater inputs on river flows is the reason for 33 of our groundwater bodies being at poor status. These bodies represent a total area of groundwater of 7,400 km^2. In three water bodies representing an area of 320 km^2, there is an imbalance in the rate of replenishment of the groundwater versus the rate at which it is being abstracted so water levels are falling over the longer term.

Abstraction for the purposes of irrigating agricultural land is the biggest cause of impacts on groundwater flows and levels.

Table 14: Principal pressures on groundwater flows and levels in the Scotland RBD in 2008

Pressures	Principal activities responsible	Bodies of groundwater caused to be at poor status		
		Number of bodies	Area of bodies (km^2)	Proportion of all groundwater bodies (%)
Abstraction	All activities	34	6,744	12
	Agricultural irrigation	19	3,008	7
	Mining	5	2,060	2
	Food and drink production	8	1,652	3
	Drinking water supply	8	1,281	3

9. Condition of beds, banks, shores and fish migration

9.1 Condition of beds, banks and shores

The ecological quality of rivers, lochs, estuaries and coastal waters can be adversely affected by changes to the condition of their beds, banks and shores.

Beds, banks and shores of surface waters

The beds, banks and shores of surface waters provide the habitats on which many water plants and animals depend. Some, such as rooted plants, seaweeds and many shellfish, like barnacles, live attached to beds. Other animals live among the diversity of bed, bank and shore habitats, using them for shelter, feeding and reproduction. Leaves and other detritus from vegetation on banks and shores can also provide important sources of food for aquatic insects and other animals.

Alterations to beds, banks and shores caused by activities such as land claim, dredging, river straightening and bank-reinforcement can reduce the area, diversity and quality of habitats. This can lead to the loss or impoverishment of animal and plant species. Loss of vegetation on banks and shores can also lead to increased vulnerability to pollution and erosion, and to reduced inputs of food sources. Dense forestry planting or extensive stands of tall, invasive non-native plants, such as giant hogweed, on the banks of rivers and lochs can lead to severe shading and the loss of water plants and the animals that depend on them.

As our climate changes, we are likely to experience more frequent and intense storms. The resulting flood flows in rivers will lead to increased erosion, particularly where river banks have been destabilised by the removal of their natural cover of trees and other deep rooting vegetation. The stability of the shores of our estuaries and coastal waters may also be changed by increased storminess. Sea level rise is also likely to engulf lower lying intertidal zones. Where there is limited space for the intertidal area to reform inland, this important habitat for marine life will be reduced in area.

Table 15 and Map 9 below summarise the condition of bed, banks and shores in the Scotland RBD surface water bodies. Overall, in 84% of these bodies, the beds, banks and shores are in a good or better condition.

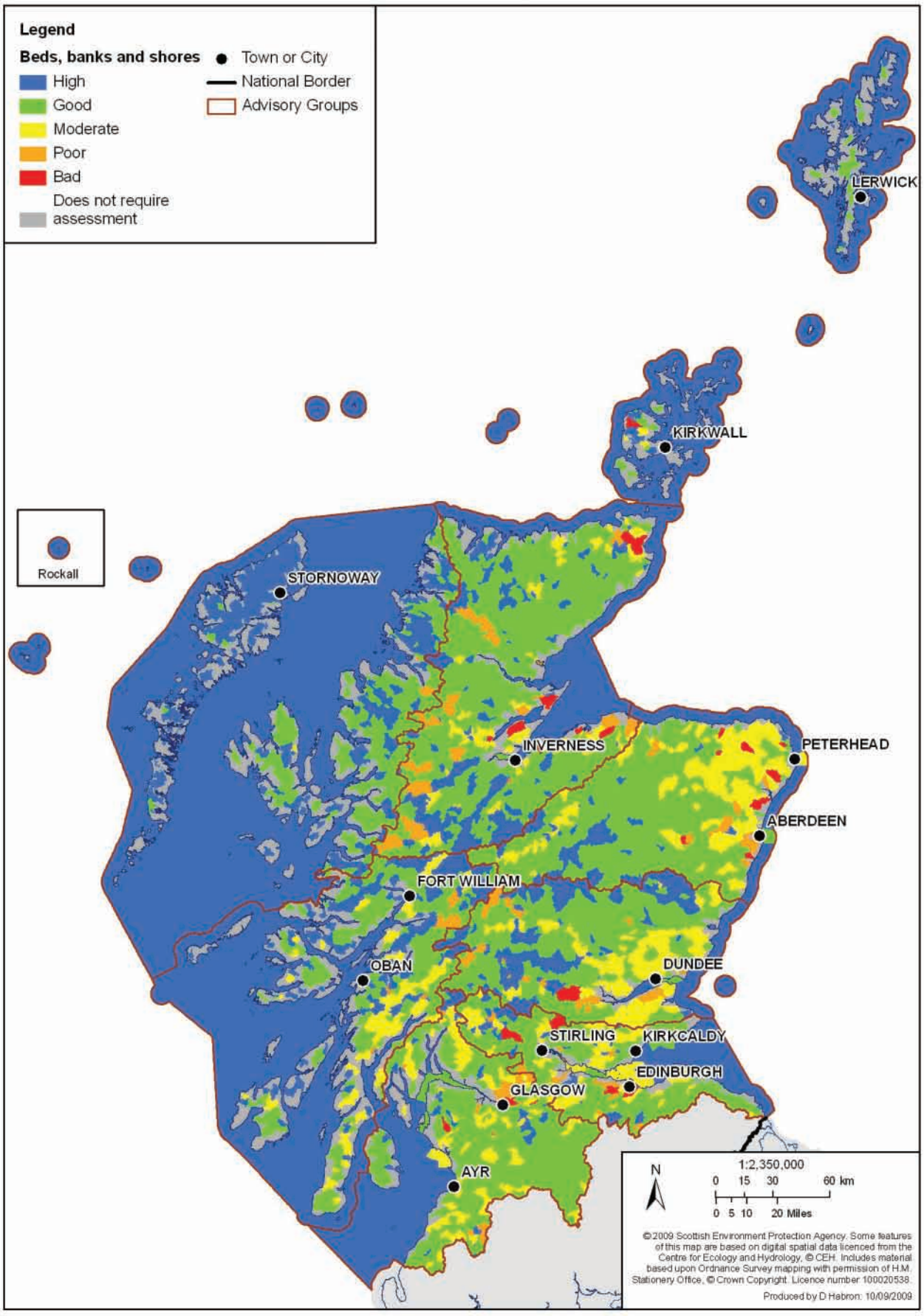
Table 15: Condition of beds, banks and shores in bodies of surface water in the Scotland RBD in 2008

Condition of water beds, banks and shores	Rivers		Lochs		Estuaries		Coastal waters	
	Number of water bodies	Length (km)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)
High	458	3,330	206	500	26	370	437	45,209
Good	1,212	13,810	21	51	8	182	6	240
Moderate	281	3,060	45	213	1	38	4	340
Poor	36	353	37	196	3	11	2	7
Bad	26	264	0	0	2	5	0	0
Totals	2,013	20,817	309	960	40	606	449	45,796
Proportion good or better (%)	83	82	73	57	85	91	99	99

Notes to Table 15

- The condition of the bed, banks and shores of all water bodies other than artificial river water bodies has been assessed on the same basis. In heavily modified water bodies, the condition of the bed, banks and shores may be worse than good on this basis whilst still representing the best that can be achieved without significant impacts on the purpose served by the modifications (eg flood protection etc).
- The condition of the bed, banks and shores of artificial water bodies, such as canals, is regarded as good where it is consistent with the achievement of good ecological potential.

Map 9: Condition of the beds, banks and shores of bodies of surface water in the Scotland RBD in 2008



9.2 Condition of fish migration

The ecological quality of rivers and lochs can be adversely affected by man-made obstacles to fish migration, such as weirs and dams. Table 16 and Map 10 summarise SEPA's initial assessment of the continuity for fish migration of the Scotland RBD's rivers and the consequent implications for fish access to lochs. Overall, continuity for fish migration is considered good or better in 86% of our river and loch water bodies. Not all of these water bodies will have migratory fish. In some, fish access will be prevented by natural barriers to upstream fish migration, such as impassable waterfalls. In others, the natural characteristics of the river channel may lack suitable habitat to attract migratory fish species.

Table 16: Continuity of rivers for fish migration in the Scotland RBD in 2008

	Rivers		**Condition of lochs in terms of the effect of river continuity conditions on access of fish to lochs**	
Continuity for fish migration	Number of water bodies	Length (km)	Number of loch water bodies	Area (km^2)
High	1,709	17,205	260	815
Good	23	354	7	21
Moderate	55	970	5	17
Poor	226	2287	37	108
Totals	2,013	20,817	309	961
Proportion good or better (%)	86	84	86	87

Map 10: River continuity for fish migration in the Scotland RBD in 2008

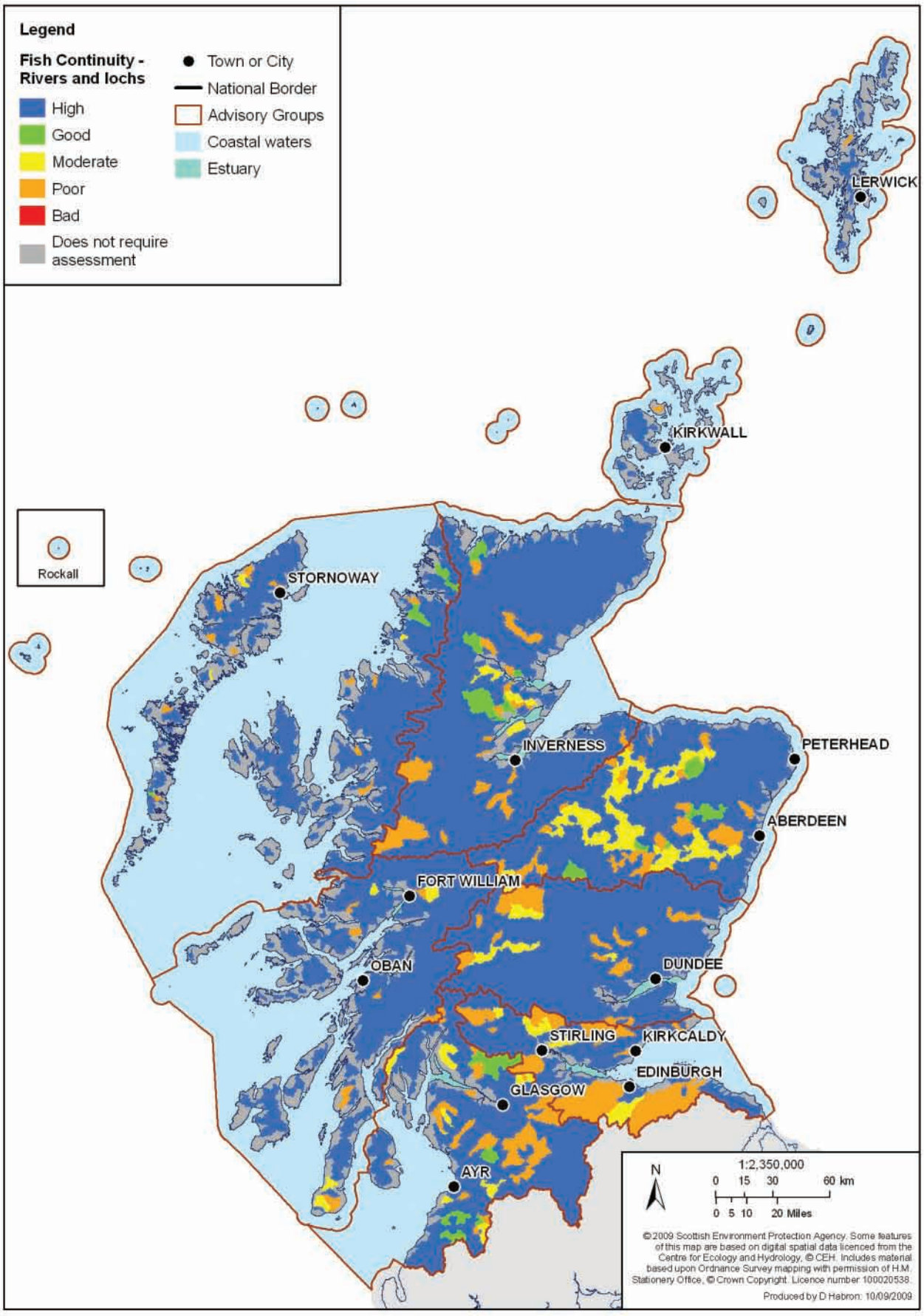


Table 17 lists the principal pressures that are adversely affecting beds, banks, shores or fish migration. Impacts on beds, banks and shores of rivers are concentrated in urban and arable agricultural areas. The majority of the impacts on lochs are on those used as water storage reservoirs for hydropower generation and drinking water supply. Draw-down of water levels during the summer months makes the shore zone of the loch inhospitable to water plants and animals. Some lochs are also affected by engineering works to stabilise roads and railways. In estuaries and coastal waters, the principal cause of adverse impacts is land-claim, where parts of the water bodies have been in-filled for use as agricultural land or for urban development. Barriers to fish migration occur at dams used to create reservoirs for hydropower generation and drinking water supply. They are also found in urban areas in the form of old weirs and poorly designed culverts.

Table 17: Principal pressures on beds, banks, shores and river continuity in the Scotland RBD in 2008

Pressures	Principal activities responsible	Water bodies prevented from achieving good ecological status [including those designated as heavily modified as a result] (%)				
		Proportion of all rivers	Proportion of all lochs	Proportion of all estuaries	Proportion of all coastal waters	Proportion of all bodies of surface water
Engineering modifications	All activities	14	25	15	1	13
	Protection from flooding and subsidence of urban areas	3	5	10	1	3
	Flood protection and drainage of agriculture land	1	0	8	0	1
	Navigation, including ports and harbours	0	1	10	0	0
	Legacy impacts from old engineering works	2	1	0	0	1
Bank and shore vegetation	All activities	9	1	0	0	6
	Forestry	4	0	0	0	3
	Agriculture			0	0	
Barriers to fish migration	All activities	14	15			
	Other barriers such as culverts and small weirs	11	8			
	Dams operated for hydroelectricity generation	3	4			
	Dams operated for public drinking water supply	1	3			

10. Impact of non-native invasive species

The ecological quality of surface waters can be affected by infestations of invasive non-native water plants or animals. These are species from other parts of the world that have been introduced to Scotland's waters, usually inadvertently. Once they get a foothold, they tend to thrive at the expense of our native water plants and animals.

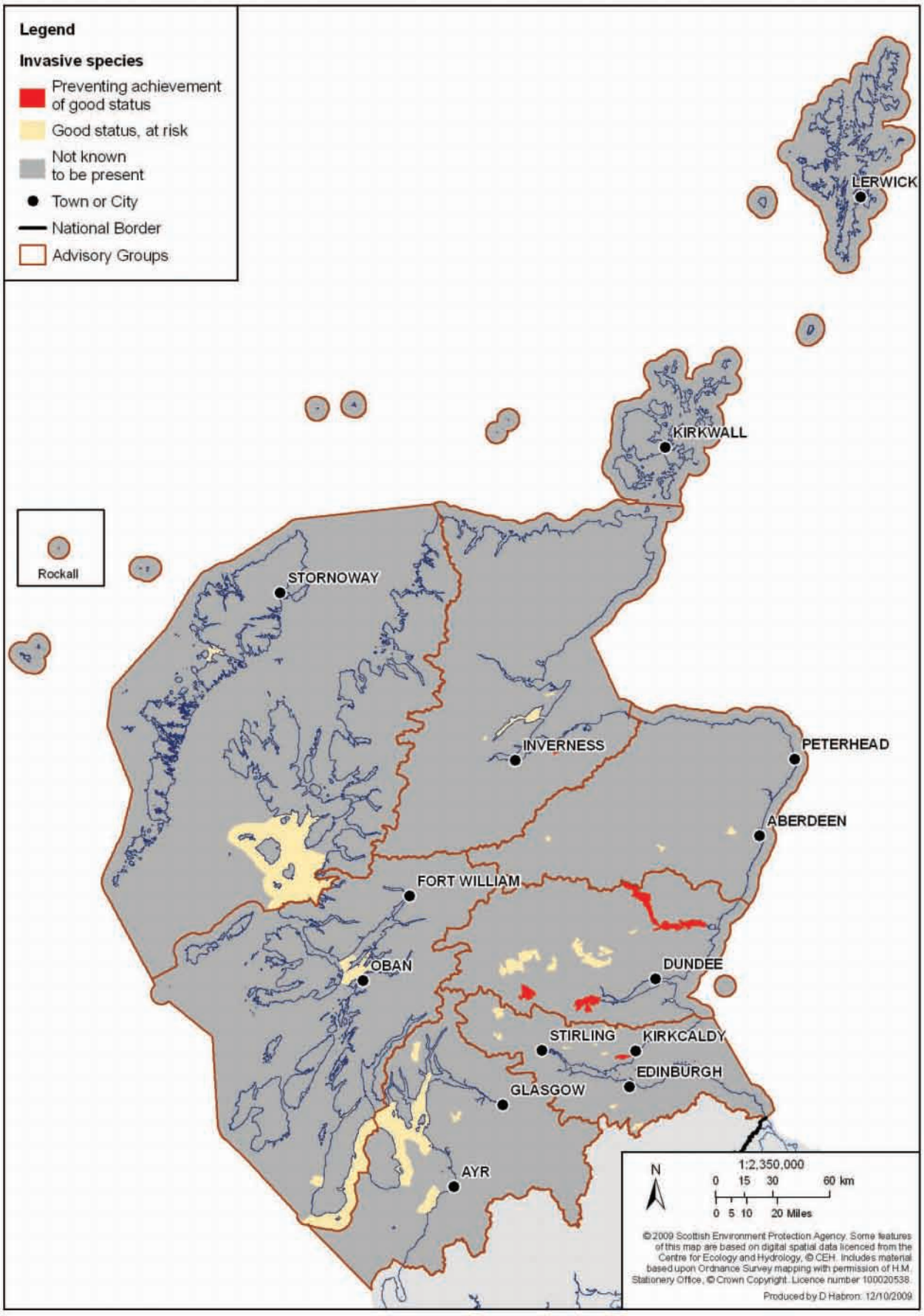
Many species from other parts of the world do not do well enough in our current climate to pose a risk to our native plants and animals. However, a warming climate may tip the balance in favour of some of these currently benign species with the resulting threat to the ecological quality of our surface water bodies.

Table 18 and Map 11 summarise SEPA's current assessment of the impact of non-native invasive plants and animals on the Scotland RBD's rivers, lochs, estuaries and coastal waters. The only species so far identified as causing significant impacts on the ecological quality of river water bodies is the North American signal crayfish.

Table 18: Surface waters known to be adversely affected by invasive non-native species in the Scotland RBD in 2008

Adverse impact of invasive non-native species	Rivers		Lochs		Estuaries		Coastal waters	
	Number of water bodies	Length (km)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)	Number of water bodies	Area (km²)
Causing ecological quality to be moderate	7	136	0	0	0	0	0	0
Causing ecological quality to be poor	0	0	0	0	0	0	0	0
Causing ecological quality to be bad	0	0	0	0	0	0	0	0

Map 11: Bodies of surface water affected by invasive non-native water plants and animals in the Scotland RBD in 2008



This is the first assessment of its kind. Non-native invasive species have been found in 43 other water bodies. Because the species concerned tend to eventually overrun the native plants and animals, SEPA has identified the ecological quality of these water bodies as being at risk. Scottish Natural Heritage and SEPA will continue to monitor and investigate the impacts of invasive non-native species and update our assessment of their impacts accordingly.

11. Wetlands

In addition to assessing the status of surface waters and groundwater, SEPA is committed to assessing the status of all wetlands that depend on surface water or groundwater for their water needs.

Wetlands play an important role in regulating the water flows in our rivers and in protecting our surface waters from pollution. Wetlands store and slowly release rainwater to surface waters. They also filter out soil particles and absorb nutrients that have washed from fields. This reduces excess sediment and nutrient inputs to our rivers and lochs.

Wetlands are also an important habitat for a wide range of plants and animals, for example they provide breeding and resting spaces for migratory birds.

To grow, wetland plants take carbon dioxide from the atmosphere. When they die, the plants do not completely decompose. Instead, they form the characteristic peat soils of wetlands. These soils lock-up large quantities of carbon.

SEPA's assessments of the status of bodies of groundwater already reflect its current understanding of the effects of groundwater abstraction on wetlands. SEPA is working with colleagues in other countries in Europe to improve scientific understanding of these effects. As knowledge and assessment methods improve, SEPA will update its status classification results accordingly. SEPA's assessments of the condition of the beds, banks and shores of rivers also take account of whether wetlands are present on the banks.

SEPA is developing an inventory of all the Scotland RBD's wetlands and risks to them. SEPA will present its first full assessment of the status of the Scotland RBD's wetland resources in 2013.