

Interim Classification of Groundwater for the purposes of the EU Water Framework Directive

December 2008

Introduction

The EU Water Framework Directive (2000/60/EC) (WFD) establishes a framework for the protection, improvement and management of surface and groundwaters.

The overall aim for groundwater is to achieve at least 'good quantitative status' and 'good chemical status', by 2015, as well as preventing deterioration in those waters that have been classified as 'good' status.

These environmental objectives and the measures required to achieve them are to be identified and presented in individual River Basin Management Plans (RBMPs).

An essential step in this process will be the classification of the status of groundwater, which in turn will assist in identifying the objectives that must be set in the individual RBMPs.

The interim classification of groundwater as of December 2008 is presented here.

Materials and Methods

The interim classification is primarily based on information collected by the Environmental Protection Agency (EPA) and River Basin District Projects between 2000-2007. Physico-chemical and hydrometric groundwater level and flow data have been gathered by the EPA at a representative network of groundwater wells and springs nationally. The Geological Survey of Ireland have provided supplemental data on closed mines.

In addition, assessments of the conservation status of Groundwater Dependent Terrestrial Ecosystems (GWDTE) were carried out by NPWS.

Water Status Definition

For groundwater bodies, the approach to classification is different from that for surface water. For each body of groundwater, both the chemical status and the quantitative must be determined. Both have to be classed as either 'good' or 'poor'. The WFD sets out a series of criteria that must be met for a body to be classed as good chemical and quantitative status. The criteria for good chemical status are further elaborated in the Groundwater (Daughter) Directive (GWD).

Classification of groundwater bodies differs from that undertaken for surface water bodies, in that the surface water standards relate to ecological status

and these standards define the classification boundaries. Groundwater status does not directly assess ecology, but the classification process takes account of the ecological needs of the relevant rivers and groundwater dependant terrestrial ecosystems (GWDTEs) that depend on contributions from groundwater. Another key component of the groundwater classification is assessment of the impact of pollution on the uses (or potential uses) of groundwater from the groundwater body, e.g. for water supply.

Groundwater body classification is based on the "objectives" defined in Annex V of the Water Framework Directive and Annexes I – III of the Groundwater Daughter Directive (GWD). These objectives are:

1. No saline or other intrusions;
2. Achieving the objectives of the Water Framework Directive for dependent surface waters including no deterioration in status;
3. No damage to any wetlands that depend on the groundwater body;
4. No impact on Drinking Water Protected Areas;
5. No significant impairment of human uses of groundwater.

The key principles for groundwater classification that are identified in the EU Working Group C "Guidance on Groundwater Status and Trends" (2008) and the UKTAG "Proposals for a Groundwater Classification System and its Application in Regulation" (2007) have been applied in the classification process. The guidance requires undertaking a number of tests as a means of determining status. These are summarised in Figure 1. The tests are intended to be applied where a risk to the achievement of good chemical and quantitative status is identified, and are used to assess whether those identified risks have affected the chemical and quantitative status of groundwater. Where no risks are identified, a water body can be classed as good status without undertaking the more detailed investigations required by the tests.

If a groundwater body fails any of the classification tests, then the groundwater body is at poor status. The five chemical and four quantitative tests applied by the EPA for groundwater bodies in the Republic of Ireland are summarised below.

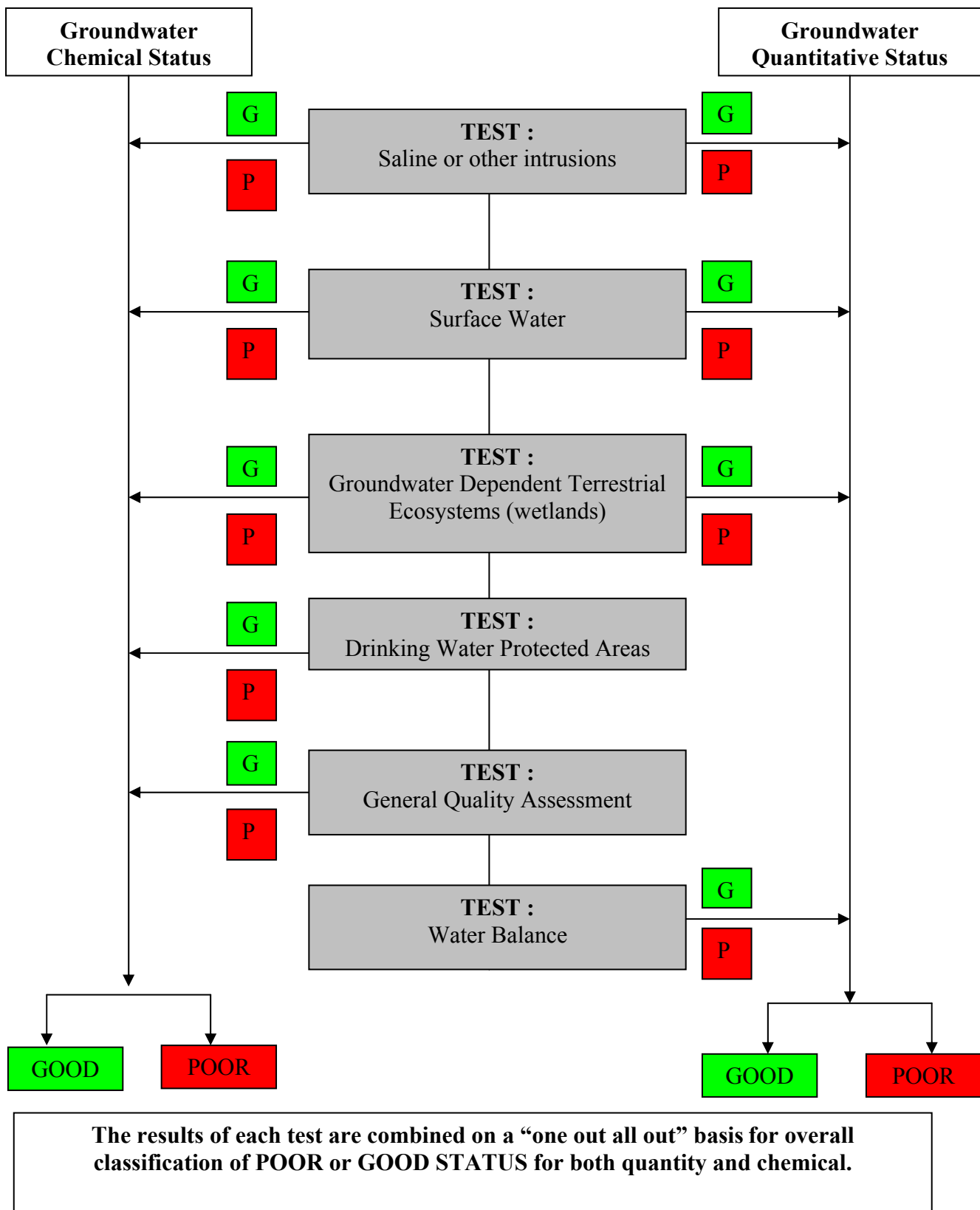


Figure 1 Overall procedure of classification tests for assessing groundwater status (From “Guidance on Groundwater Status and Trend Assessment” EU Working Group C - Groundwater, 2008)

Chemical Status

Article 3 of the GWD lays down criteria for assessing groundwater chemical status:

“1. For the purposes of the assessment of the chemical status of a GWB [...] Member States shall use the following criteria:

- (a) groundwater quality standards as referred to in Annex 1,*
- (b) threshold values to be established by Member States in accordance with the procedures set out in Part A of Annex II [...]*”

Groundwater quality standards are set in the GWD for two pollutants: 50 mg/l for nitrates, and 0.1 µg/l and 0.5 µg/l (total) for active substances in pesticides, including their relevant metabolites, degradation and reaction products. “Threshold values” have been developed for Irish groundwater bodies for substances that are leading to (or likely to lead to) chemical and/or ecological status failures. These Member State defined quality standards are used as triggers for further investigation to determine whether or not the conditions for good chemical status are met, and do not by themselves define the actual boundary between good and poor status.

Five tests are relevant to the assessment of groundwater body chemical status; these are summarised below.

Test: Assessment for the presence of saline or other intrusions

This test is common to the assessment of groundwater chemical status and groundwater quantitative status.

Trigger for applying test	Criteria for poor groundwater chemical status
Failure of a threshold value indicative of a risk of saline intrusion; or Indications of a significant risk of other intrusions	(a) Significant and sustained upward trends in electrical conductivity indicating saline intrusion; (b) Significant or sustained upward trend in the concentration of indicators of the risk of other intrusions; or (c) Evidence that abstractions have been rendered unsuitable for use without additional treatment as a result of an intrusion.

Test: Assessment of adverse impacts of the chemical inputs from groundwater on associated surface water bodies

Trigger for applying test	Criteria for poor groundwater chemical status
Failure of a groundwater threshold value that is indicative of a potential adverse impact on associated surface waters; or An associated surface body is at less than good status and there is reason to suspect that inputs of pollutants via groundwater are contributing to the failure	(a) An applicable chemical or physicochemical standard for 'good status' is failed in an associated surface water body; and (b) The inputs via groundwater contribute greater than 50 % of the surface water standard in the surface water body

Test: Assessment of adverse impacts of groundwater on groundwater dependent terrestrial ecosystems (wetlands)

Trigger for applying test	Criteria for poor groundwater chemical status
Indications of significant damage to a wetland resulting from pollution where the source of pollution is suspected to be from groundwater	There is evidence of significant damage to a wetland caused by pollution and the pollutants responsible for that damage are judged to have reached the wetland via groundwater.

Test: Assessment whether the quality of untreated groundwater satisfies the drinking water protected areas requirements

Trigger for applying test	Criteria for poor groundwater chemical status
<p>Failure of a threshold value indicative of potential risks to abstractions for human consumption;</p> <p>Indications of a risk of failure of the drinking water protected area objective for the water body</p>	<p>(a) An applicable chemical or physicochemical threshold value has been exceeded for a drinking water protected area (or the threshold value is projected to be exceeded in the next RBMP cycle); and</p> <p>(b) There are statistically significant or sustained upward trend in the concentration of this parameter.</p>

Test: Assessment of the general quality of groundwater in the body in terms of whether its ability to support human uses has been significantly impaired by pollution

Trigger for applying test	Criteria for poor groundwater chemical status
Failure of a threshold value indicative of a potential risk to the general quality of the water body.	<p>(a) A chemical or physicochemical threshold value, that is applicable to human uses, has been exceeded at any representative monitoring point in a groundwater body or group of groundwater bodies; and</p> <p>(b) The average of the monitoring results representative of the groundwater in the body exceeds the threshold value.</p>

Quantitative Status

Four tests are relevant to the assessment of groundwater body quantitative status; these are summarised below.

Test: Assessment for the presence of saline or other intrusions

This test is common to the assessment of groundwater chemical status and groundwater quantitative status.

Trigger for applying test	Criteria for poor groundwater chemical status
Failure of a threshold value indicative of a risk of saline intrusion; or Indications of a significant risk of other intrusions	(a) Significant and sustained upward trends in electrical conductivity indicating saline intrusion; (b) Significant or sustained upward trend in the concentration of indicators of the risk of other intrusions; or (c) Evidence that abstractions have been rendered unsuitable for use without additional treatment as a result of an intrusion.

Test: Assessment of adverse impacts of groundwater abstraction on associated surface water bodies

Trigger for applying test	Criteria for poor groundwater quantitative status
A river flow standard that is required to achieve 'good status' is failed in an associated surface body and there is reason to suspect that groundwater abstractions may be contributing to the failure	(a) An applicable river flow standard for 'good status' is failed in an associated river water body; and (b) The total volume of groundwater abstractions in the surface water catchment associated with the failing river are greater than 50 % of the required surface water flow standard.

As no surface water bodies were classed as less than good due to abstractions, this test was not undertaken.

Test: Assessment of adverse impacts of groundwater abstraction on groundwater dependent terrestrial ecosystems (wetlands)

Trigger for applying test	Criteria for poor groundwater quantitative status
Indications of significant damage to a wetland resulting from insufficient water availability where alterations to groundwater levels are suspected to be the major cause of the insufficient water availability	There is evidence of significant damage to a wetland caused by insufficient water availability and the major reason for the insufficient water availability is judged to be alterations to groundwater levels resulting from human activities.

Test: Water balance (GWB scale)

Trigger for applying test	Criteria for poor groundwater quantitative status
Apply to all bodies where there are groundwater abstractions	<p>(a) The annual average volume of water abstracted from the groundwater represents more than 80 % of the long-term annual volume of recharge (i.e. water that replenishes the groundwater); or</p> <p>(b) The annual average volume of water abstracted from the groundwater represents more than 20 % of the long-term annual volume of recharge in bedrock groundwater bodies (30% in gravel bodies) and there is evidence of a long-term drop in groundwater levels in the body of groundwater; or</p> <p>(c) A Groundwater dependent terrestrial ecosystem (GWDTE) is damaged and the annual average volume of water abstracted from the groundwater represents more than 5% of the long-term annual volume of recharge in the groundwater body containing the GWDTE and there is evidence of a long-term drop in groundwater levels in the groundwater body.</p>

Groundwater Status Results

For each groundwater body, the lowest classification from the five chemical tests has been reported as the overall chemical status (Figure 2), and the lowest classification from the four quantitative tests have been reported as the overall quantitative status (Figure 3). The confidence associated with the results for the lowest classification case test has also been reported as either high or low confidence.

Additionally the results for chemical and quantitative status have ultimately been combined to give an overall classification of good or poor (Figure 4). If either the chemical or the quantitative assessment is poor, then a “one out all out” approach is used to determine the overall classification.

The summary results of the individual and overall classification are shown in Tables 1-3 and mapped in Figures 2-4. The overall results depicted in Table 4 show that 85% of the groundwater bodies are at Good Status and 15% (which relates to 16.6% of the total land area) are at Poor Status.

Table 1 Numbers of Groundwater Bodies in each Water Status category for Chemical Status								
	<i>EA</i>	<i>WE</i>	<i>SW</i>	<i>SH</i>	<i>SE</i>	<i>NW</i>	<i>NB</i>	<i>National</i>
Good	68	72	78	185	145	72	26	646
Poor	7	33	6	57	6	0	2	111
<i>Total</i>	75	105	84	242	151	72	28	757

Table 2 Numbers of Groundwater Bodies in each Water Status category for Quantitative Status								
	<i>EA</i>	<i>WE</i>	<i>SW</i>	<i>SH</i>	<i>SE</i>	<i>NW</i>	<i>NB</i>	<i>National</i>
Good	74	105	83	242	149	72	28	753
Poor	1	0	1	0	2	0	0	4
<i>Total</i>	75	105	84	242	151	72	28	757

Table 3 Numbers of Groundwater Bodies in each Water Status category for the combined Chemical & Quantitative Status								
	<i>EA</i>	<i>WE</i>	<i>SW</i>	<i>SH</i>	<i>SE</i>	<i>NW</i>	<i>NB</i>	<i>National</i>
Good	67	72	77	185	143	72	26	642
Poor	8	33	7	57	8	0	2	115
<i>Total</i>	75	105	84	242	151	72	28	757

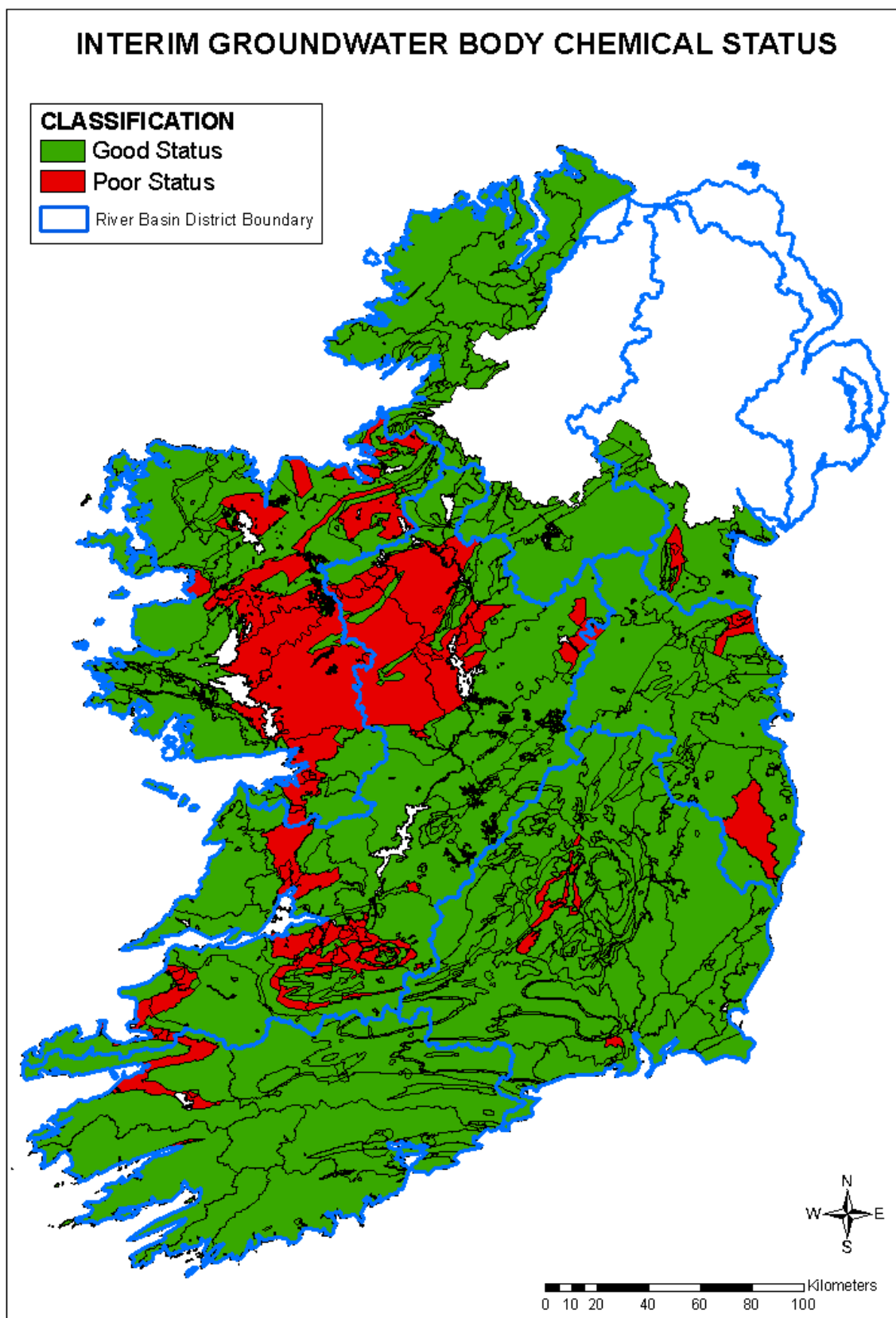


Figure 2 Overall chemical status for Ireland's groundwater bodies

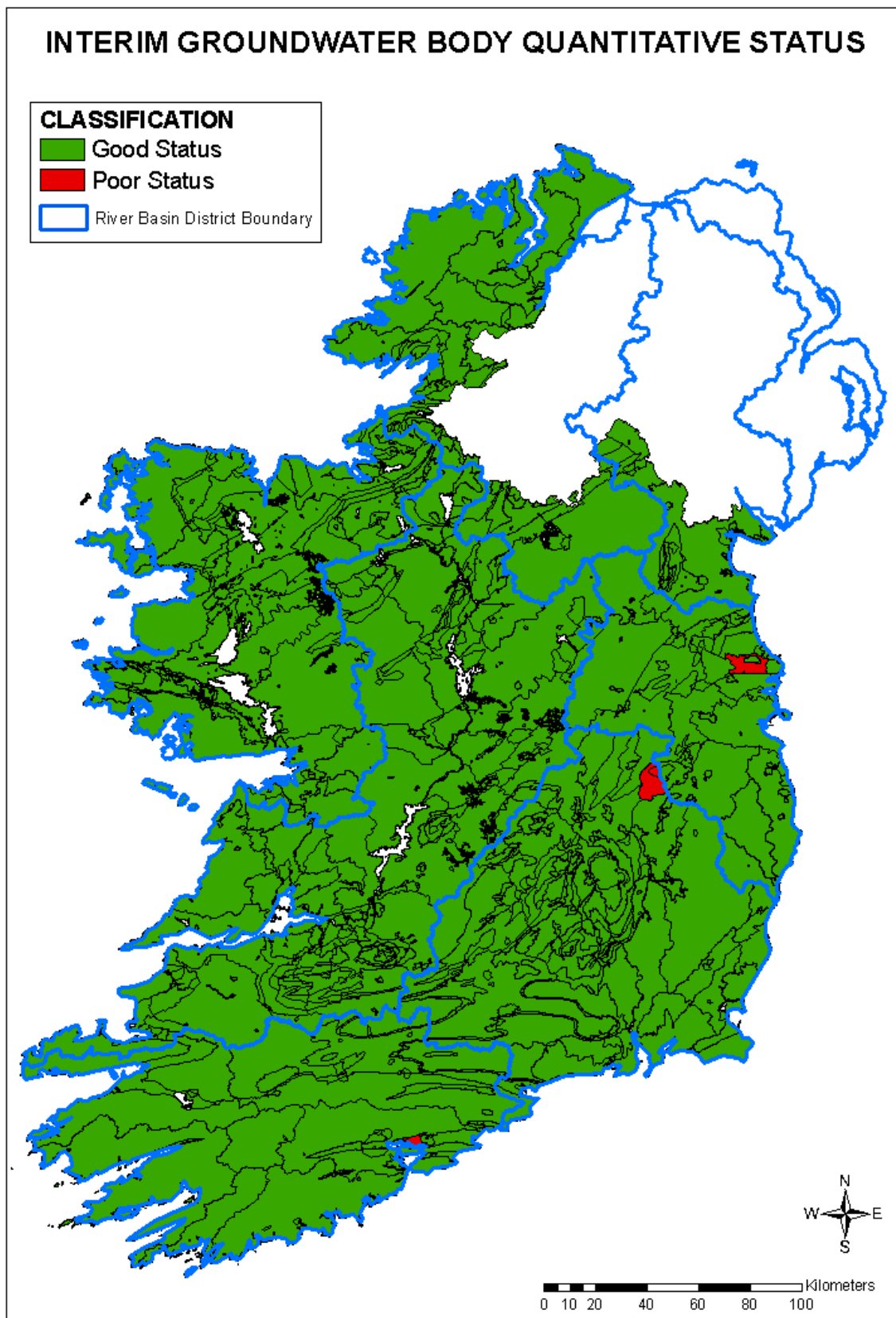


Figure 3 Overall quantitative status for Ireland's groundwater bodies

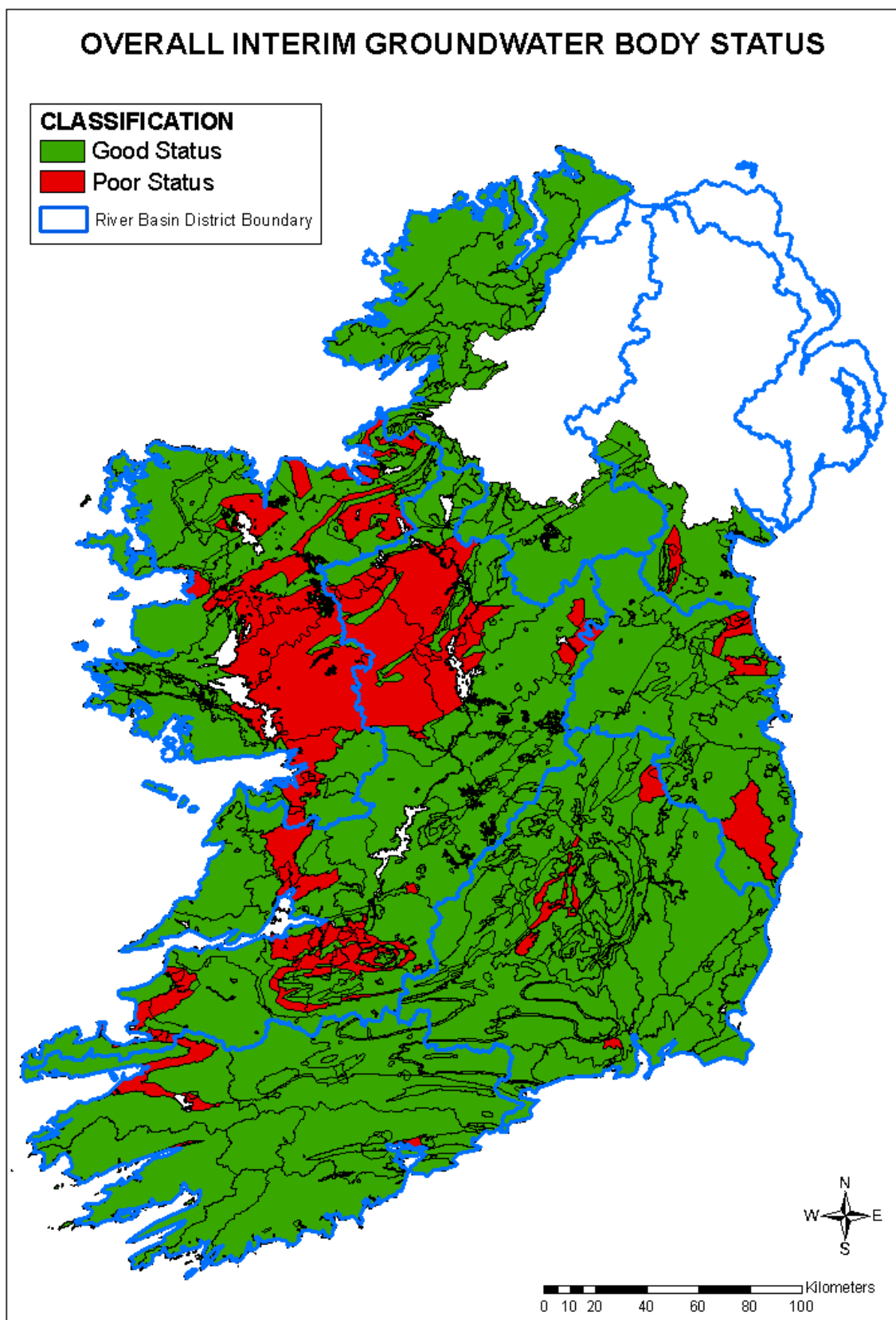


Figure 4 Overall combined chemical and quantitative status for Ireland's groundwater bodies