Draft River Basin Plans

Groundwater Body Classification

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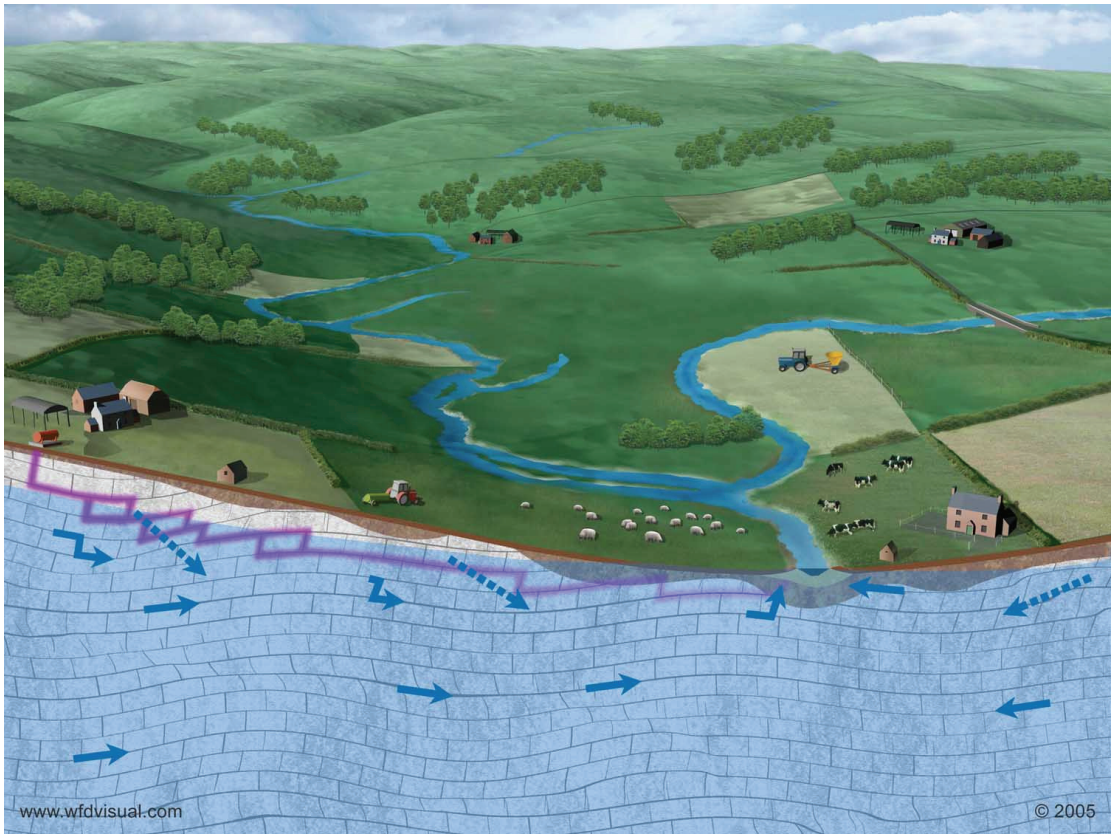

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Contents

Report compiled by Geological Survey of Northern Ireland on behalf of Water Management Unit Northern Ireland Environment Agency

1.0 Background

Groundwater occurs nearly everywhere beneath the ground across Northern Ireland. It is used as a source of water for public, industrial and private supply through abstraction from boreholes, wells and springs. In addition it plays a significant role in supporting surface water flows and levels through natural discharge from the ground to rivers, lakes, streams and wetlands. This contribution to surface waters can also act to dilute pollutant concentrations in the surface water, therefore helping support the overall ecological and amenity value of these systems.

The EC Water Framework Directive (2000/60/EC) (WFD) requires the status of groundwater management units (groundwater bodies) within each river basin to be determined as 'good' or 'poor' (with respect to the target date of 2015). This document summarises the approach taken to determining status for groundwater bodies in Northern Ireland, the results of which are reported in the draft river basin management plans (www.ni-environment.gov.uk).

2.0 Groundwater Body Delineation

As required by the WFD and to help with assessment and management of available groundwater resources, management units known as **groundwater bodies** were delineated across Northern Ireland as part of the WFD Article 5 assessment (www.ni-environment.gov.uk). The bodies were assigned to specific river basin districts (RBD's) and in some places extend across the border between Northern Ireland and Ireland to their natural hydrogeological boundaries. Further information on the methodology used for groundwater body delineation can be found at www.wfduk.org/. The distribution of groundwater bodies can be seen at (www.ni-environment.gov.uk).

3.0 Pressures on Groundwater

Whilst the pressures from **groundwater abstraction** in Northern Ireland are generally much less than many parts of the UK and Ireland, any abstraction of groundwater has the potential to impact water levels or flows at nearby rivers, lakes or wetlands. For this reason it is important to have some knowledge of where abstraction takes place and how much water is being abstracted. It is possible to construct a 'water balance' for groundwater bodies and associated sub-catchments, comparing inputs (recharge) against outputs (abstraction and flows required to support dependent ecology).

Further background on quantitative pressures acting on groundwater can be found in guidance developed for the Article 5 assessment at www.wfduk.org.

The natural **'quality' of groundwater** is such that it is usually suitable for drinking with minimal or no treatment required. This is partly due to the filtration and other natural processes which occur as water passes slowly through the geological strata. There are, however, a wide variety of activities that occur within the RBD's which have the potential to impact on this natural quality and cause the groundwater to become polluted to varying degrees.

Diffuse pressures include agricultural activity where overuse of organic and inorganic fertilisers can lead to elevated concentrations of nitrate and phosphorus and overuse or inappropriate disposal of pesticides can lead to detections of

pesticide compounds in groundwater. Such substances can also enter groundwater where they are used in association with amenity, infrastructure or forestry land use.

Point sources such as sites where hydrocarbons or solvents are used or stored can also result in local impact on groundwater quality if a pollution event occurs. Impacts on local groundwater quality can also occur in the vicinity of waste disposal sites where leachate generated in the waste mass leaks to the underlying water table. Similarly, vertical drainage from land contaminated by historical industrial use can result in deterioration in groundwater quality. Other activities that can lead to local impacts on groundwater quality range from the poor siting, construction or maintenance of a septic tank to the illegal dumping of waste or other hazardous materials.

Further background on chemical pressures acting on groundwater can be found in guidance developed for the Article 5 assessment at www.wfduk.org .

The likelihood that groundwater beneath a particular locality or within a specific catchment will be impacted from surface activity also partly depends on the nature of the soils and geological material above the groundwater body in addition to the nature of the strata in which the groundwater is stored. This last factor can also influence how widespread an impact may extend from a particular pollution event. How likely underlying groundwater in a particular location would be impacted from pollution occurring from surface activities is partly described as **groundwater vulnerability**. By considering the different nature of the soils and sub-soils in a specific area, 'groundwater vulnerability' can be mapped to show where groundwater is more or less likely to be impacted. Where the strata containing the groundwater (the aquifer) is overlain by thick deposits of poorly draining clayey material and clay-rich soils then the groundwater is protected to some degree (but not necessarily entirely) from impact and vulnerability is usually considered to be low. Where the water table is very close to the surface or where the material comprising or overlying the aquifer is more permeable and allows drainage readily through it then groundwater is more vulnerable.

4.0 Groundwater Monitoring

Groundwater quality in Northern Ireland is measured through the collection of water samples from wells, boreholes and springs and subsequent field and laboratory analysis. The analysis commonly carried out includes:

- major and minor ions for general and background chemistry;
- metals;
- pesticides, solvents, hydrocarbons; and
- microbiology

A variety of groundwater chemistry datasets were used to help determine the degree and scale of impact on groundwater quality within groundwater bodies. Datasets used included:

- NIEA regional groundwater monitoring from 2000-2006;
- Northern Ireland Water groundwater supply monitoring;
- Drinking Water Inspectorate monitoring of potable sources;
- NIEA landfill monitoring; and
- Other ad-hoc groundwater monitoring

Relevant data was used to identify or help determine actual impact on groundwater quality. The data was also used to identify trends for certain parameters to see where impacts may be beginning to occur, were getting worse or becoming more widespread.

To assist with meeting the requirements of the WFD, the regional groundwater quality monitoring network was recently modified to improve and better target data collection (www.ni-environment.gov.uk). In addition there was an increase in the number of sites monitored for groundwater level and discharge.

5.0 Groundwater Classification

Groundwater bodies within each RBD were assessed with respect to the main land-use pressures considered to potentially be acting upon them. Both chemical (diffuse and point sources) and quantitative (water abstraction and quarry dewatering) pressures were considered. A variety of information relating to:

- scale, frequency and distribution of the pressure;
- the nature of the pathway between the pressure and the water table; and
- existing information/data on groundwater (and surface water) quality and levels and associated trends;

was used to consider whether an impact was occurring or potentially likely to occur. This assessment of risk and impact allowed classification of groundwater bodies as being at either **good** or **poor** status (with respect to the target date of 2015).

Classification was undertaken following the WFD United Kingdom Technical Advisory Group (UKTAG) guidance to ensure some consistency in assessment across the UK and Ireland (for cross-border bodies) and across different RBD's. This guidance follows overarching guidance produced at European level. A number of individual tests are required to be undertaken for both chemical and quantitative classification and are summarised in Figure 1. A single failure of any test results in the overall failure of status. An overview of the classification process and more detail on each test can be found in the following UKTAG papers (www.wfduk.org):

Outline of Groundwater Classification for the purposes of the Water Framework Directive (www.wfduk.org)

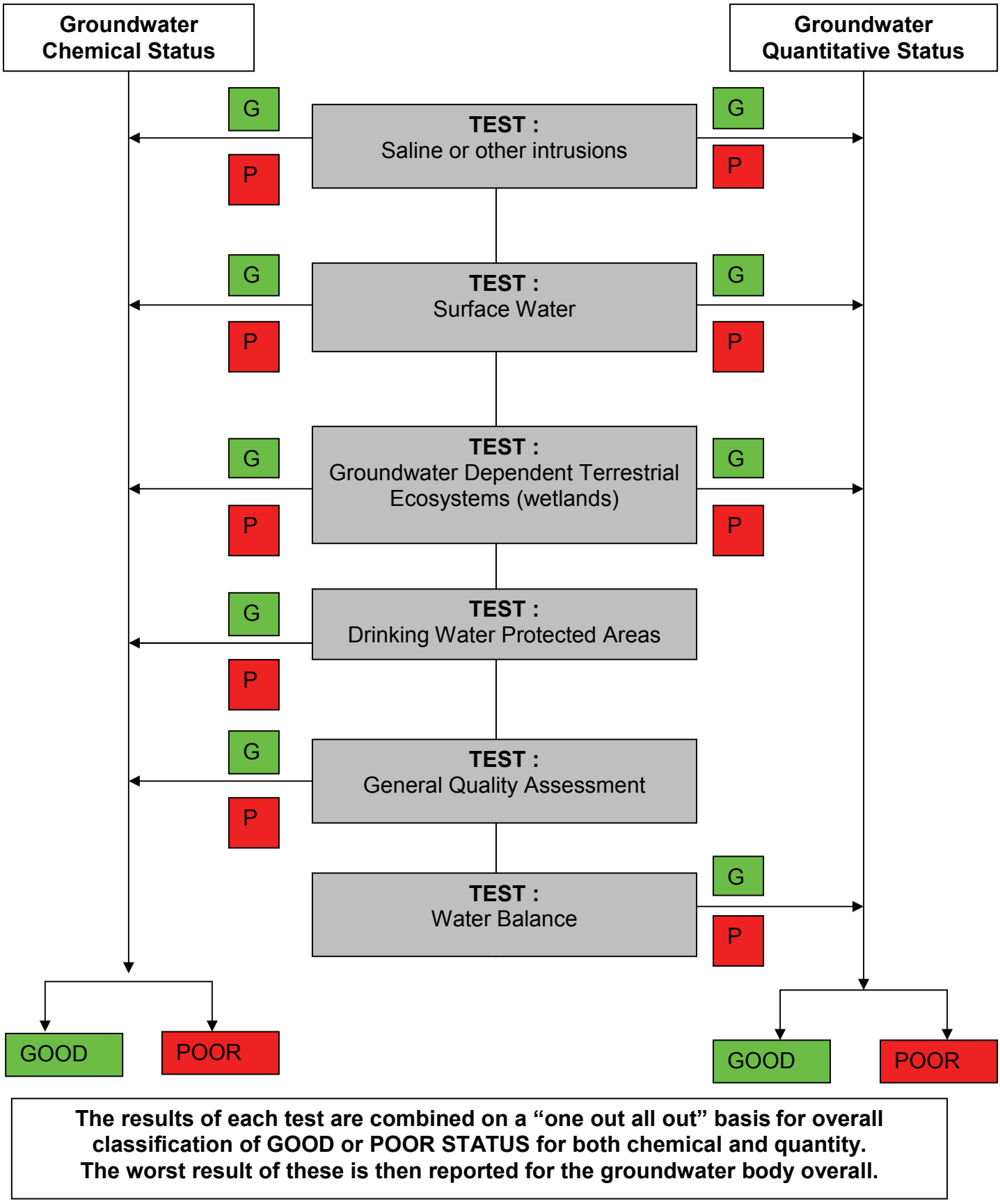
Proposals for a groundwater classification system and its application in regulation. Final Report SR1-2007
(www.wfduk.org)

Groundwater Chemical Classification for the purposes of the Water Framework Directive and Groundwater Daughter Directive. Paper 11b (i) (www.wfduk.org)

Groundwater Quantitative Classification for the purposes of the Water Framework Directive. Paper 11b (ii)
(www.wfduk.org)

To enable classification to be undertaken properly it is important to consider the relationship between groundwater bodies and the surface water bodies, transitional waters and wetland systems to which they eventually discharge to. Hence in addition to considering resource availability and the general quality of groundwater within the body, it was also necessary to understand where nearby surface water systems were

under stress and/or not meeting their environmental objectives and consider whether the volume or quality of groundwater discharging was a significant contributory factor to this impact.



The results of each test are combined on a "one out all out" basis for overall classification of GOOD or POOR STATUS for both chemical and quantity. The worst result of these is then reported for the groundwater body overall.

Figure 1 Groundwater Classification Tests Summary

6.0 Classification Assessments

A range of individual assessments were undertaken to consider the significance of pressures acting on groundwater and dependent ecosystems in the context of the specific tests, resulting in a determination of good or poor status for each groundwater body.

Further information on the assessments undertaken can be accessed by clicking on the links below:

Reference	Assessment
WFD-GW-1	Quantitative pressures – Water Balance
WFD-GW-2	Quantitative pressures – Surface Waters
WFD-GW-3	Quantitative pressures – GWDTE's
WFD-GW-4	Quantitative/Chemical pressures – Saline Intrusion
WFD-GW-5	Quantitative/Chemical point source pressures – Mineral Workings
WFD-GW-6	Chemical diffuse source pressures – Nitrate
WFD-GW-7	Chemical diffuse source pressures – Pesticides
WFD-GW-8	Chemical pressures – Phosphorus
WFD-GW-9	Chemical pressures – Drinking Water Protected Areas
WFD-GW-10	Chemical point source pressures – Urban areas
WFD-GW-11	Chemical point source pressures – Mine workings
WFD-GW-12	Chemical point source pressures – Contaminated land
WFD-GW-13	Chemical point source pressures – Landfill
WFD-GW-14	Chemical point source pressures – PPC Sites

The above specific assessments are intended to be read in conjunction with the relevant UKTAG guidance papers on groundwater chemical (UKTAG Paper 11b(i)) and groundwater quantitative (UKTAG Paper 11b(ii)) classification available from www.wfduk.org.

This assessment undertaken represents the first ever determination of an overall 'status' for groundwater bodies across Northern Ireland and it supports meeting WFD objectives and the requirements of the River Basin Management Plan (RBMP). In undertaking the assessment NIEA has liaised with the Environmental Protection Agency (EPA) in Ireland with respect to classification of cross-border groundwater bodies.

Many of the classification tests require monitoring data that is both representative of the pressure/pathway/receptor being considered and of adequate duration and frequency to determine statistically robust trends[1]. For certain assessments such data is not yet available for this first RBMP. However, where appropriate, available historical groundwater quality data has been used inform status classification. For some tests there is insufficient monitoring data from dependent ecosystems such as rivers or lakes for specific pollutants (e.g. pesticides) to fully determine whether impacts are occurring. In such cases it is not considered appropriate to consider putting groundwater at poor status until additional data becomes available through ongoing monitoring or where there is other definite evidence of impact where groundwater is involved.

[1] UKTAG Guidance Task 12(a). Guidance on Groundwater Monitoring (www.wfduk.org)

For groundwater dependent terrestrial ecosystems (GWDTE's), the supporting quantitative and chemical criteria which define the sites designated 'environmental' objective (condition) have generally not yet been defined. In addition, further work is required to understand the local hydrogeological relationship between the supporting groundwater body and the GWDTE. This is a similar situation to the rest of the UK, Ireland and Europe.

In addition to making a decision on 'status', consideration has been given to whether a groundwater body may be 'at risk' of not achieving good status and also what confidence can be recorded for each decision. Within the NIEA analysis some groundwater bodies have been recorded as being 'at risk' but still at good status (in the absence of sufficient evidence to confirm poor status). Ongoing data collection and analysis is planned over this first RBMP period to reduce uncertainty in the assessments and allow updating of status assessment, where necessary, for the next RBMP.

Where groundwater bodies have been defined as being at poor status, in many instances the impact relates to only a relatively small proportion of the overall body. It is within this area further investigation/monitoring and/or measures to improve the situation will need to be targeted. It has also become clear as the assessment has progressed that there could be benefit in sub-dividing some larger groundwater bodies to allow more detailed analysis, improved management of pressures and better targeting of measures.

NIEA are committed to ongoing assessment of groundwater status over this first RBMP period to more fully identify and characterise all significant impacts on groundwater bodies and dependent ecosystems and improve confidence in the determinations made.