

River Basin Management Plans

# Groundwater Classification Methodology

## Groundwater Dependent Terrestrial Ecosystems

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### Introduction

All groundwater bodies in Northern Ireland will be classified in 2014-2015 to establish whether they are at good or poor status utilizing monitoring data for the past 6 years (2009 to 2014). Status is divided in qualitative and quantitative status and a number of tests are carried out for each, see Figure 1.

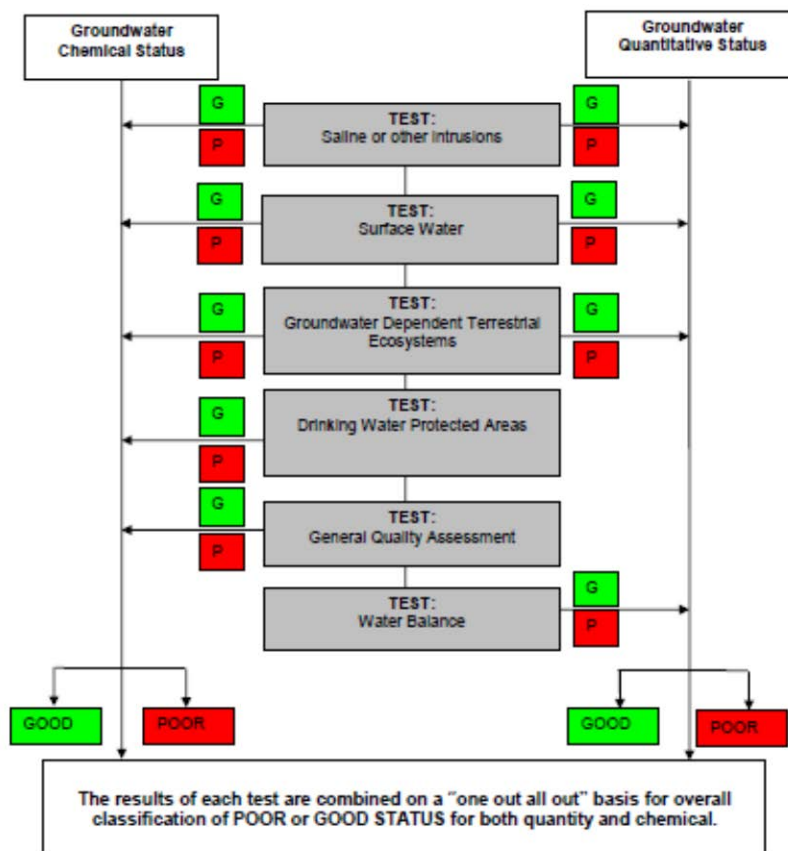


Figure 1: Overview of classification tests [from UK Technical Advisory Group paper 11b(i)].

### Groundwater Dependant Terrestrial Ecosystems classification test

The process of classifying Groundwater Dependant Terrestrial Ecosystems (GWDTE), as defined above, is laid out below. Explanation of the method is given below, with specific detail given to the origin and processing of data required for the implementation of the method. This has been applied to GWDTEs which are designated at Special Areas of Conservation (SACs).

1. NIEA Natural Environment Division (NED) review all SAC sites and identify candidate GWDTE sites that conceptually may have some degree of groundwater dependence, based on their EU feature designation

2. NIEA NED review condition assessment classifications for each candidate GWDTE site. Identify candidate sites with an un-favourable assessment indicative of a groundwater impact.

3. Review un-favourable condition assessment and characterise each as being either a potential groundwater quality or quantitative impact

4a. Identify if a representative monitoring point (MP) is within the same groundwater body as an un-favourable GWDTE and within 10km of the site

4b. Review licensed groundwater abstractions from the groundwater body an un-favourable GWDTE is within. Using expert judgement, consider if the total abstracted volume is likely to lead to a reduction in groundwater flows to a un-favourable GWDTE

5a. For an identified MP, calculate the annual mean concentration of Nitrate as NO<sub>3</sub> for the past 6 years. Does this exceed the threshold value as defined in Table 1 UKTAG (2012)? If yes, groundwater body is at poor status.

5b. Survey artificial drainage in proximity to each un-favourable GWDTE site. Does drainage intercept springs and/or the water table, removing potential flow to an un-favourable GWDTE?

6b. If either the review of licensed groundwater abstractions or the surface drainage survey indicate potential links between removal of groundwater available for flows to an un-favourable GWDTE then the GWB in the un-favourable GWDTE lies should be characterised as 'At Risk'.

**Table 1 – Groundwater nitrate threshold values (mg/l NO<sub>3</sub>) from UKTAG (2012)**

GWDTE category	Altitude		
	(<175 mAOD)	(>175 mAOD)	Any altitude
Quaking bog	18	4	
Wet dune			13
Fen (mesotrophic) and Fen Meadow	22	9	
Fen (oligotrophic) and wetlands at tufa forming springs	20	4	
Wet grassland	26	9	
Wet heath	13	9	
Peatbog and woodland on peatbog			9
Wetland directly irrigated by spring or seepage			9
Swamp (mesotrophic) and reedbed			22
Swamp (oligotrophic)			18
Wet woodland	22	9	

### **Review of Special Areas of Conservation (SAC) Candidate GWDTE's**

In collaboration with Natural Environment Division (NED) within the Northern Ireland Environment Agency, a review was carried out of all SAC's to determine if they are likely candidate GWDTE's.

A study was undertaken by MacDonald and McConvey (2005) in the first River Basin Planning (RBP) cycle to identify candidate GWDTE. This study involved an ArcGIS exercise to review the percentage of superficial deposits within the surrounding areas of each SAC's. If an SAC was surrounded by a significant percentage of high permeability superficial deposits it was considered to be GWDTE. This method proposed 22 SAC's as being likely GWDTE sites.

As an extension and an improvement to this method, ecologists from NED considered all SAC sites based on their own field experience of undertaking condition assessment surveys whilst being provided hydrogeological support from The Geological Survey of Northern Ireland. This review considers the designated species that have been identified and the geological context of each SAC feature. For example if a designated species has been identified at an SAC that is known to be dependent upon wet conditions only achievable by a groundwater flow, then it is likely that the SAC is to a greater or lesser extent dependent upon a flow of water from a groundwater source.

Many of the SAC's are large sites that include many different protected features. An example of this is the West Fermanagh Scarplands. This is designated for various features including tufa forming springs but also many features that are not relevant to GWDTE characterisation. The ecologists from NED split out the relevant habitat features associated with each SAC site that are likely to be groundwater dependant so that better attention and focus can be applied to them.

Likely groundwater dependant habitat features were considered as candidate GWDTE's.

### **Condition Assessments**

A condition assessment is undertaken on each SAC to assess if the habitat and species interests of a designated site are meeting the objectives for which the site was declared. These condition assessments involve a detailed survey of each site involving significant resource and expertise. A survey is performed on each site once every 6 years. A site can be assessed on a range of different habitats and species interests. For wetland SAC's, some of these are water related.

NED will review the most recent condition assessment results for the candidate GWDTE's to identify any that have an unfavourable condition assessment. Each of these assessments will be reviewed to identify if they are relevant to the water environment. For example, an unfavourable condition due to evidence of over grazing is itself not directly relevant to the water environment.

As can be seen in the flowchart above, if a candidate GWDTE has a relevant condition assessment that is unfavourable, the site will then be considered a candidate GWDTE in unfavourable condition and will progress on to the next stages of the risk assessment process.

Depending on the relevant unfavourable condition assessment for each GWDTE, it will be determined if this is possibly due to an impact from a deterioration in the quality or quantity of groundwater.

### **Groundwater Quality Assessment**

For all GWDTE's with an unfavourable condition assessment, possibly due to an impact from deterioration in the quality of groundwater, an assessment will be made to determine if there is further evidence to support the claim that groundwater could be a contributing factor.

It is worth noting that only reliable further evidence will be used. In the absence of any such evidence no further assessment will be

The groundwater body within which each GWDTE is located was identified. Monitoring points associated with that groundwater body or group of groundwater bodies were identified and any that are located within 10 km of a GWDTE were assessed to determine if it is a reliable monitoring point.

By combining information on the geology, land use and monitoring point structure (borehole design) an assessment will be made to determine if the monitoring point is representative of groundwater that could be a supporting water source for the GWDTE.

If a monitoring point is deemed to be representative, the average mean concentration of nitrate as NO<sub>3</sub> from the past 6 years of data will be compared to the threshold values relevant to the GWDTE type and altitude. If this exceeds the threshold value, groundwater is likely to be a contributing factor in the unfavourable condition of that GWDTE. The groundwater body within which the GWDTE is located will be characterised as at risk.

Nitrate is the only chemical parameter to be considered in this assessment for three reasons:

1. It is the only parameter that has so far been found to have a direct influence on the condition of GWDTE sites (UKTAG, 2012a)
2. Nutrient enrichment is known to be the major cause of unfavourable conditions of SAC sites in Northern Ireland
3. All candidate GWDTE sites lie within rural settings where diffuse pressures are dominant.

## **Groundwater Abstractions**

The licensing of abstractions was introduced in Northern Ireland in 2007. It is confidently assumed that the majority of the large and therefore significant groundwater abstractions have now been licensed and are included within the abstraction licensing database. It is however acknowledged that there are a lot of small abstractions, such as those associated with farming, that as yet have not been licensed and are therefore not included within the abstraction licensing database.

For the purposes of this risk assessment, the current abstraction licensing database was queried for all groundwater abstractions. This would exclude spring or spring fed abstractions.

## **Drainage**

It is common around and in wetlands for artificial drainage channels or buried drainage networks to be constructed so that water can be redirected away from the wetland so that land can be used for farming or other uses. This however is not good for the wetland. For GWDTE's, the drainage channels may be constructed below the groundwater level or intercept springs before they can reach a wetland. In effect,

drainage is a groundwater abstraction and it can serve to lower the groundwater levels in a GWDTE. Since many sites are sensitive to even small reductions in groundwater levels, drainage can have a significant impact on GWDTE's.

Drainage may also include underground works that have taken place which have led to an interception in groundwater flow prior to discharge at a GWDTE. This may include a quarry that was operational before Environmental Impact Assessments were required for quarry development applications. If such un-restored quarries contain groundwater seepages which can discharge to surface waters by gravity then they may be having a detrimental impact on a GWDTE down gradient of the quarry.

### Other lines of Evidence

To support the results, other lines of evidence can be used. These can include:

- groundwater level monitoring data – Is there a sustained downward trend in groundwater levels that cannot be accounted for by normal climatic effects?;
- site specific hydrogeological study reports – It is known that some GWDTE sites have had targeted investigations performed on them;
- modelling results – If groundwater flow or nutrient models exist specific to a given un-favourable GWDTE, then the outputs from these should be used to inform the CSM's and therefore influence the risk assessment; and
- future development potential – If there is awareness that there may be significant development that would lead to an increase in the volume of water being abstracted from groundwater within a groundwater body, projections of likely volumes should be included with the total volume of abstractions.

### References

UKTAG Paper (2012a). *Technical report on groundwater dependant terrestrial ecosystems (GWDTE) threshold values*. [www.wfduk.org](http://www.wfduk.org)

UKTAG Paper (2012b). *Characterisation of Risks to Groundwaters for the 2nd River Basin Cycle*. [www.wfduk.org](http://www.wfduk.org)

Entec (2010). *Cumulative Nitrogen and Phosphorus Loadings to Groundwater*. Commissioned study and report by SEPA, EA, EPA and NIEA.