UK Technical Advisory Group on the Water Framework Directive

Characterisation of Risks to Groundwaters for the 2nd River Basin Cycle

This Guidance Paper is a working draft defined by the UKTAG. It documents the principles to be adopted by agencies responsible for implementing the Water Framework Directive (WFD) in the UK. This method will evolve as it is tested, with this draft being amended accordingly.			
Working Paper Version:	V7. 14/Mar/2011	**Status:**	Released
WFD Requirement:	Annex II Characterisation of Risks	**UKTAG Review:**	March 2011

1 Purpose

1.1 Characterisation of risk is a requirement of Article 5 and Annex II of the EU Water Framework Directive (WFD). Specifically, "*Member States shall carry out an initial characterisation of all groundwater bodies to assess their uses and the degree to which they are at risk of failing to meet the objectives for each groundwater body under Article 4…… Following this initial characterisation, Member States shall carry out further characterisation of those groundwater bodies or groups of bodies which have been identified as being at risk in order to establish a more precise assessment of the significance of such risk and identification of any measures to be required...*"

1.2 The UKTAG Groundwater Task Team has produced this paper as part of the implementation of the EU Water Framework Directive (WFD) in the second River Basin Cycle. The paper details the principles of how we will characterise the risk of failing to meet the objectives for each groundwater body.

1.3 The paper translates EU guidance (CIS 2010) into more specific guidance for the UK and the Republic of Ireland. It focuses on the assessment of pressures. However, Annex II also requires an assessment of the physical characteristics of groundwater bodies. This element is addressed in separate UKTAG guidance on groundwater body delineation (UKTAG 2012e).

2 Overview of the Risk Characterisation Process

2.1 EU guidance (CIS 2010) explains that, "*underlying the many references to risk within the WFD is the concept that we are assessing the impact of human activity on the environment and specifically those impacts that threaten our ability to meet the objectives of Article 4".* This article contains five objectives for groundwater:

i. Prevent or limit the input of pollutants;
ii. Prevent the deterioration of status of groundwater bodies;
iii. Achieve good groundwater status (both chemical and quantitative);
iv. Implement measures to reverse any significant and sustained upward trend;
v. Meet the requirements of protected areas.

2.2 All the objectives of Article 4 apply for groundwater chemical status. For groundwater abstraction pressures (quantitative status), relevant objectives are (ii), (iii) and (v).

2.3 Two key concepts underpinning the Article 4 objectives relate to status and risk.

2.4 Status is a measure of impact or condition at a point in time, simplified to describe a single assessment for a whole water body or other relevant receptor. Two separate assessments of chemical and quantitative status are required for each groundwater body. UKTAG guidance is available on the assessment of groundwater status (UKTAG 2012a and 2012b).

2.5 As outlined in paragraph 1.1, we are required to characterise the risk of failing to meet the Article 4 objectives. In the context of this guidance, "risk" is defined as the risk of deterioration in status of a water body (or protected area), or the risk that planned improvements will not be met on target, as required by Article 5 and Annex II of the WFD[2]. Assessing the risk of deterioration in status involves:

- An assessment of the capacity remaining within the groundwater body to assimilate new pressures. This "*potential capacity*" is the difference between the current condition of the water environment and the applicable status criteria. Specific capacity limits for the assessment of pollution and abstraction risks are defined in Section 3.
- An assessment of trends in relation to the potential capacity.
- An assessment of improvement measures. Whether they are being implemented effectively or are suitable to deliver the target improvement objectives

2.6 The characterisation of risk therefore uses the same receptors and same form of assessment as those for status and trends. However, there are differences:

- Risk criteria are more precautionary than status.
- Risk and trends characterisation is a forward prediction over a maximum of 2 river basin cycles, whilst status is an assessment of the state of the water body over the previous river basin cycle (refer to Figure 1).
- Risk characterisation uses a greater degree of predictive assessment (which may include modelling), whilst status and trend assessments rely primarily on monitoring.

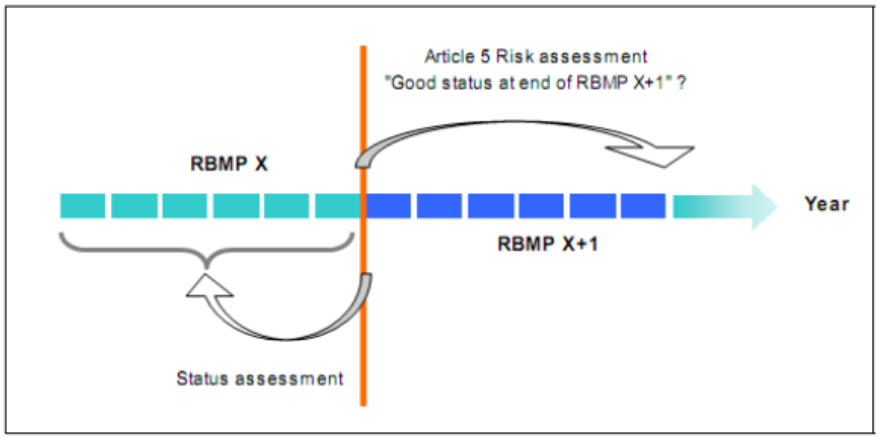

Figure 1: Risk characterisation looks into the future whereas status assessment looks back on the performance (from CIS Guidance[1])

[2] *Although the scope of the Article 5 "at risk" assessment includes the objective to implement measures to reverse significant and sustained upward trends in pollutants, such trend assessment is an integral part of two of the elements of chemical status. Therefore, it is implicit in the risk assessment for chemical status that the trend objective is taken into account.*

2.7 Risk criteria are outlined in Section 3 and assessment principles are outlined in section 4. UKTAG criteria for assessing trends and status are available in separate guidance (UKTAG 2012d, and UKTAG 2012a).

2.8 The assessment of status is a driver for restorative action, whilst risk characterisation is a driver for designing monitoring for the next river basin cycle. Risk characterisation will obviously play a role in driving preventative control measures, but the degree to which it influences decision-making depends on the nature of the pressure. In general, the concept of potential capacity at a groundwater body scale is most relevant where pressures are widespread across all parts of a groundwater body (for example abstractions, diffuse pollution and the cumulative impact of smaller point source pressures). It is less relevant for those point source pressures that are more serious and less widespread. This issue is described further in Section 6.

2.9 Each of the Article 4 objectives outlined in paragraph 2.1 requires separate reporting. However, the assessments are all underpinned by the common concepts of risk and status, as described in Table 1:

Table 1: Environmental Objectives for Groundwater and the means by which they can be Characterised

Article 4 Objective for Groundwater	Article 5 Characterisation Method
Prevent or limit the input of pollutants.*	n/a
Prevent the deterioration of status of groundwater bodies	Risk of deterioration in status
Achieve good groundwater status (both chemical and quantitative);	Status
Implement measures to reverse any significant and sustained upward trend*;	Risk of deterioration in status
Meet the requirements of protected areas*.	Status

** supporting notes are provided in paragraphs 2.10 to 2.13*

2.10 CIS guidance (CIS 2010) recommends that "*Prevent or limit measures are the first line of defence and are the most effective mechanism for protecting groundwater quality. If we correctly assess risks to meeting the 'prevent or limit' (P/L) objective and then implement appropriate risk management measures, in time all the other WFD groundwater quality objectives will be met*." As a consequence, UKTAG recommends:

- At a site specific scale, the prevent or limit objective should be the key influence in day-to-day controls on activities, as described in Section 6.
- At a national scale, however, separate characterisation and mapping of Article 5 risk against this objective is not required. Instead, the risk of failing this objective should be assessed through the characterisation or risks to other environmental objectives as outlined in Table 1.

2.11 With reference to Table 1, the identification and characterisation of statistically and environmentally significant trends is a specific requirement of the WFD and the Groundwater Daughter Directive. Guidance on trends (UKTAG 2009) indicates that the assessment of environmental significance is based an assessment of whether status will be failed within two future river basin cycles. The assessment therefore forms part of the assessment of the risk of deterioration in status.

2.12 Relevant protected areas for groundwaters are Drinking Water Protected Areas, designated terrestrial ecosystems that are groundwater dependent, and Nitrate Vulnerable Zones. For groundwaters, these protected areas are assessed as part of the tests for status (UKTAG 2012a and 2012b). Therefore UKTAG recommends that the risk of failing this objective is assessed through the characterisation or risks to status objectives as outlined in Table 1.

2.13 In summary,

- Risk is defined for the purposes of this document as the risk of deterioration in status of a water body (or protected area), or the risk that improvement objectives will not be met on target.
- The assessment of risk involves the same receptors and same form of assessment as those for status and trends.
- The characterisation requirements of Article 5 can be undertaken for all 5 groundwater objectives using the assessment of risk and status, alongside the physical characterisation requirement of groundwater bodies (UKTAG 2012e).

A hypothetical example of the interplay of risk, trends and status for chemical characterisation is provided in Figure 2.

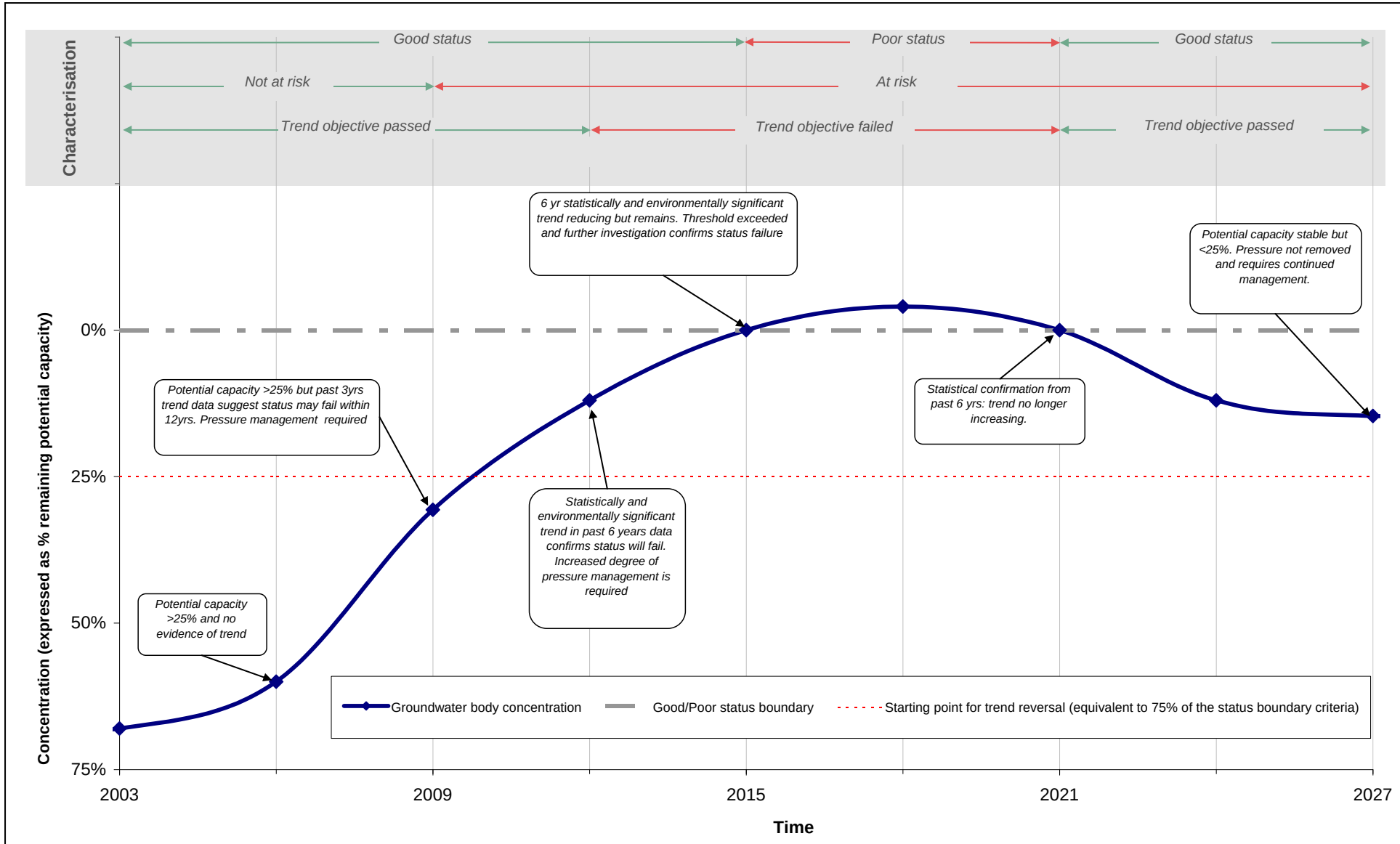

Figure 2: Example characterisation of the risk of deterioration in chemical status in a hypothetical groundwater body.
(The characterisation criteria are generic and do not relate to a specific receptor test.)

3 Criteria for Characterisation of the Risk of Deterioration in Status

3.1 For chemical pressures, groundwater bodies will normally be characterised as being at risk of deterioration if they fail the criteria outlined in Table 2.

Table 2: Criteria for groundwater bodies at risk of deterioration in chemical status	
Good status Groundwater body	For <u>any</u> status test and any pressure*: Less than 25%** of the potential capacity remains, <u>and</u> the status threshold is exceeded in at least one monitoring point, <u>or</u> trends*** are deteriorating and indicate that the status criteria will be failed within 12 years.
Poor Status Groundwater body	For <u>any</u> status test and any pressure*: The status criteria are failed, <u>and</u> trends or information on the pressures indicate that the planned improvement objective of the water body will not be met in the timescale associated with that objective.
,,***supporting notes are provided in paragraphs 3.2 to 3.4*	

3.2 *Chemical status requires an assessment against 5 distinct classification tests (UKTAG 2012a), each addressing a different set of receptors. The characterisation of risk requires an assessment of potential impacts on these receptors from key pressures. In practice, risk characterisation therefore requires the running of status and trends tests for a number of different pressures and at a variety of scales, depending on the receptor. The pressures selected and the degree of assessment required depends on an iterative risk assessment process as described in Section 4.

3.3 **A remaining potential capacity of 25% is equivalent to 75% of the relevant threshold value (refer to Figure 2). The figure of 75% is the default value prescribed by the Groundwater Daughter Directive as the starting point for actions to instigate reversal of chemical trends, and is therefore appropriate to use as the basis for the identification of risks. It takes into account groundwater lag times. Due to lag times, most control measures for groundwater chemical pressures require ongoing management (for example, the leaching of nutrients from agricultural fertilisers). Therefore, groundwater bodies are considered to remain at risk until the available capacity exceeds 25% even if the trend is stable or even improving (refer to Figure 2). Exceptions can be made to the default value for trend reversal for those groundwater bodies where restoration involves the elimination of the pressure, for example if a contaminated land site is completely remediated. In these situations, a less precautionary figure can be used as the capacity criterion. As an alternative to the default of 25%, a figure of 10% is recommended in these situations, but this value can be adjusted on a case by case basis, where local information is available on lag times and the cumulative impact of other uncontrolled pressures on the groundwater body.

3.4 ***For the formal trends objective, statistical trends must be extrapolated using data from at least the previous 6 years. For the purposes of assessing risk, trends can be extrapolated using the worse case predictions of either at least the previous 3 or 6 years data, and can also be assessed using more qualitative information on trends in land use pressures.

3.5 For abstraction pressures, groundwater bodies will normally be characterised as being at risk of deterioration of they fail the criteria outlined in Table 3.

Table 3: Criteria for groundwater bodies at risk of deterioration in quantitative status	
Good status Groundwater body	For <u>any</u> status test and any pressure*: Licensed** groundwater abstraction exceeds relevant groundwater status criteria, or less than 10% of the potential capacity remains*** <u>or</u> there is evidence of sustained, environmentally significant deteriorating trend in water levels as a result of groundwater abstraction, <u>or</u> there is evidence from long term planning that the licensed groundwater abstraction will exceed the relevant groundwater status criteria within 12 years.
Poor Status Groundwater body	For <u>any</u> status test and any pressure*: The status criteria are failed, <u>and</u> trends or information on the management of pressures indicate that the target improvement objective of the water body will not be met in the timescale associated with that objective.
,,***supporting notes are provided in paragraphs 3.6 to 3.7*	

3.6 *Quantitative status requires an assessment against 4 distinct tests (UKTAG 2012b), each addressing a different set of receptors. The characterisation of risk requires an assessment of potential impacts on these receptors from key pressures. In practice, risk characterisation therefore requires the running of status and trends tests for a number of different pressures and at a variety of scales, depending on the receptor. The pressures selected and the degree of assessment required depends on an iterative risk assessment process as described in Section 4.

3.7 **Actual abstraction is less than licensed abstraction. Information on actual abstraction reflects the amount of water that <u>is</u> being exploited and, where information is available, it should be used for classification of status. Licensed abstraction figures reflect the amount that <u>could</u> be exploited and is more appropriate for use in risk characterisation.

3.8 ***A default potential capacity criterion of 10% is recommended to allow for the cumulative impact of other uncontrolled pressures on the groundwater body. It is calculated from the difference between the available groundwater body resource (or local flow standard) and the total licensed abstraction. The value of the criterion can be varied from the recommended default if information on these uncontrolled pressures is available. For example, the value can be reduced to 0% if these uncontrolled pressures are considered insignificant.

4 Assessment Principles

4.1 As described in Section 3, the Article V characterisation of risk uses the same receptors and same form of assessment as the assessment of status and trends, but there are differences for example in the role of predictive assessment (which may include modelling). UKTAG criteria for assessing trends and status are available in separate guidance (UKTAG 2012a and 2012b). This section provides guidance on the appropriate balance of monitoring and modelling in different situations of risk and status. It does not prescribe specific assessment methodologies as these are pressure specific and should be developed by agencies as appropriate.

4.2 In accordance with CIS guidance (CIS 2010), a tiered approach to risk characterisation is recommended to focus resources on those areas of highest uncertainty and highest relevance to risk management (refer to Figure 3).

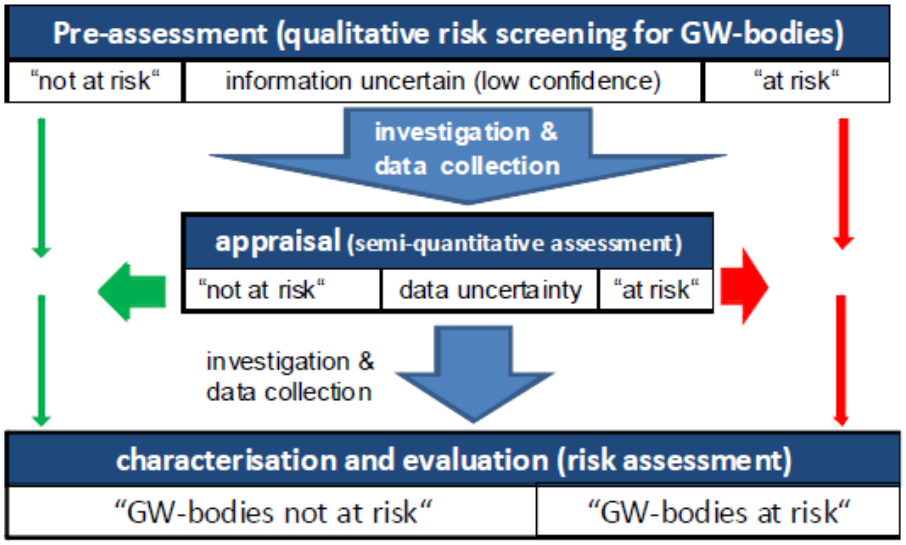

Figure 3: Tiered approach for risk assessment (from CIS guidance[1])

4.3 There is a very close link between risk assessment and confidence. The degree of confidence drives the intensity of characterisation effort and vice versa. Lower confidence justifies increased assessment tiers, involving monitoring and/or other elements of the weight of evidence. Higher confidence assists in supporting more expensive preventative measures, where required, for example land use planning restrictions, licensing regimes or more intensive forms of diffuse pollution measures. The highest level of confidence is required to support the most expensive measures, for example site specific restrictions placed on existing practices or active restoration of the groundwater body itself. Clearly, there is a very close relationship between the purpose of assessing confidence in characterisation and the equivalent assessment of confidence in classification and trends. Where pressures do not change over time, it is recommended that a single assessment of confidence is preferable to provide a simple, overall judgement of the strength of the weight of evidence from combined characterisation of status, risk and trends. This will, in turn, provide an indication of the degree to which we can justify measures being put in place.

4.4 Table 4 provides guidance on the appropriate tiers of characterisation to deploy. It is stressed that, in all cases, assessments must be based on appropriate conceptual understanding of flow and susceptibility with each groundwater body. CIS guidance provides additional guidance on conceptual modelling (CIS 2010).

Table 4: Recommended Groundwater Characterisation Tiers for the 2nd River Basin Cycle			
	Level of characterisation	Applicability	Example
Tier 1 qualitative risk screening.	• This tier is a simple conceptual understanding of the presence/absence of pressures and environmental susceptibility. • Monitoring is required only to corroborate these predictions.	• To support delineation of groundwater bodies and groundwater body groups (UKTAG 2011). • This level of assessment is required to begin the assessment of new pressures: To distinguish those groundwater bodies that are clearly not at risk from those where more advanced assessments are required to improve confidence.	e.g. Coal mining pressures. Use geology and activity maps to identify former and current coal mining areas. These areas will be at higher risk and will require tier 2 assessment. This assessment of risk is then corroborated using surveillance monitoring. Does the monitoring indicate additional risk areas? If so, can this be explained? Are the models wrong? These areas may also require tier 2 assessment.
Tier 2 semi-quantitative assessment.	• This tier is an overall weight of evidence judgement at the scale of whole water bodies or river sub-catchments. • This is a monitoring-based assessment. Predictive tools are required to corroborate and further improve confidence in the monitoring.	• This tier of assessment is required to improve confidence in characterisation, e.g. where a status threshold has been exceeded in at least one monitoring point, or where at least one monitoring point has a statistically significant upward trend. • This level of assessment is sufficient where additional measures are required on the scale of groundwater bodies or protected areas. e.g. enhanced operational monitoring, or generic diffuse pollution controls such as Nitrate Action Programmes.	E.g. Nitrates pressures. The assessment is based on an aggregation of average groundwater nitrates data across a whole groundwater body to compare with status criteria and then assess available capacity. • Compare monitoring results with river concentrations, using estimates of groundwater baseflow. • Also compare the monitoring with modelled nitrate loading. Quantify total loading using generic information on pressures. Then estimate bulk concentration in the groundwater body as a whole using an assessment of assimilative capacity (e.g. dilution from recharge). Assess confidence from degree of corroboration provided by all the information. Use confidence to identify appropriate measures or the need for tier 3 assessment.
Tier 3 quantitative assessment.	• This tier is a monitoring-based assessment delivering sufficient confidence to justify more expensive or site specific measures and to demonstrate their effectiveness. • Modelling is also required to improve confidence and help design measures. Usually spatially distributed numerical or analytical models.	• This level of assessment is required where targeted monitoring or control measures need to be tailored to site specific conditions. May also be necessary to justify appropriate extended deadlines in target improvement objectives. • This level of assessment is required to support revised delineation of groundwater bodies if this is required to manage variable pressures.	E.g. Abstraction. Tier 2 has indicated abstraction exceeds available resource. Monitoring has indicated water levels are dropping across a portion of the body also containing a dependent wetland. Tier 3 assessment is required and involves: • Increased operational monitoring of groundwater levels and the wetland community. • Numerical modelling of groundwater and surface water resources to a) improve confidence in the extent of the body that requires control and b) to test targeted control scenarios such as reduced licenses, winter storage, etc. Results used to help identify and communicate the need for specific control measures.

5 Implementation - Reporting & Assessment Cycle.

5.1 Under Article 5 of the Water Framework Directive, in 2005 Member States developed and reported on the first risk assessment for groundwater bodies and the likelihood of meeting or failing the WFD's environmental objectives by 2015. As a further preparation for the first cycle of River Basin Management Plans (RBMP), published in December 2009, monitoring programs and threshold values were established. Within the first management plan period (2009–2015) a review of risk assessments is due to be performed by December 2013 and thereby prepare for the second river basin management plan starting in December 2015, as noted in Figure 4.

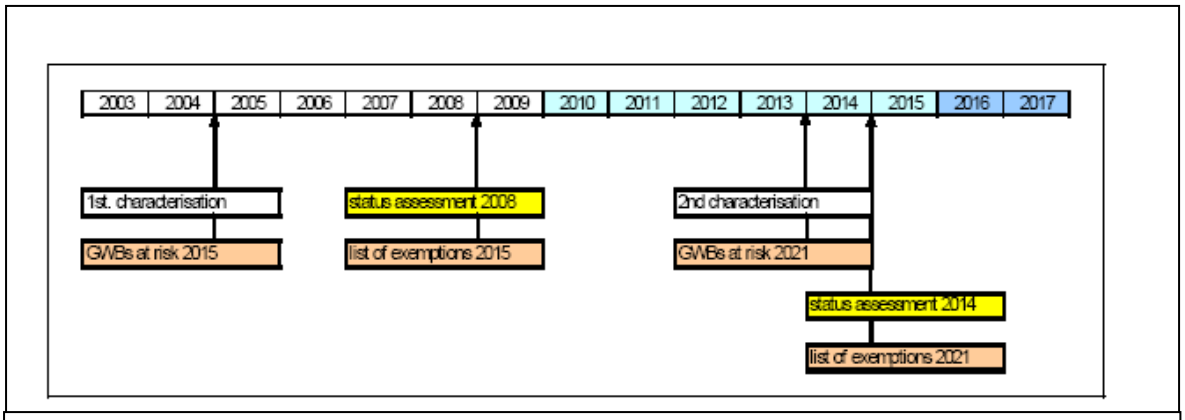

Figure 4: Implementation of the WFD – Timetable 1st and 2nd cycles. (from EU Guidance[1])

5.2 Within each Cycle, the assessment process is expected to run as follows:

- **Year 1/2** – start of new cycle. Tier 1 assessment of new pressures, new receptors (e.g. wetlands) or pressures with altered standards. For existing pressures, review the appropriate targetting of the monitoring network using Tier 2 assessment of risk using monitoring results from the previous cycle.
- **Year 3/4** –Re-assessment at the level of tier 2 or 3 using monitoring & modelling undertaken since start of cycle. Review the monitoring network in accordance with these risk assessments and report results of the risk assessment in the Article 5 report (next due December 2013).
- **Year 5/6**. Assess status and trends. Set target objectives and design appropriate action. Note that measures do not necessarily need to be introduced until the results of further characterisation deem that there is a risk of failing a WFD objective. Report in RBMP (next due 2014/2015) and WISE (next due 2016).

5.3 For each groundwater body the following characterisation information is required:

- Body ID
- Activity type (e.g. mining)
- Pressure (e.g. nitrates)
- Test (e.g. Chemical Test 4)
- Status from previous cycle: good/poor

- Risk of deterioration in status: At risk / not at risk
- Trend: pass/fail (or not applicable)
- Starting point for trend reversal: default 75% (or not applicable) for the next RBC
- Confidence on the assessment of the state of the GW body: High/Low.
- Target objective for good status (year)

5.4 Along with this information on pressures and risks, significant amounts of underpinning information on physical characterisation (e.g. groundwater recharge rates) are also required. This aspect is provided in separate guidance on groundwater bodies (UKTAG 2012e).

6 Implementation – Implications for Measures

6.1 Outline guidance on the implications of Article 5 risk characterisation for measures can be found in table 5.

Table 5. Example scenarios to demonstrate implications of Article 5 risk characterisation for measures

Status (last cycle)	Risk	Trend Objective Failed?*	Threshold exceeded in at least 1 mon. point?*	Evidence of pressure?	Predicted capacity to assimilate pressure?	Confidence	Typical Measures Required
Poor	At risk	Yes	Yes	Yes	None	High	Restoration, changes to operational practice or land use planning restrictions. Modelling to design measures & monitoring to assess their effectiveness.
Poor	At risk	No	Yes	Yes	None	Low	Monitoring & modelling to improve confidence in the state of the GW body
Poor	At risk	No + Improving trend	Yes	Yes	None	High	Pressure requires ongoing management measures. Continue monitoring to assess their effectiveness
Poor	Not at risk	No + Improving trend	Yes	No	None	High	Pressure has been removed. Continue monitoring to assess improvement
Good	At risk	Yes	Yes or No	Yes	Very little	High	Changes to operational practice or land use planning restrictions. Modelling to design measures & monitoring to assess their effectiveness.
Good	At risk	No	Yes	Yes	Limited	High or low	Continue actions. Continue monitoring to assess their effectiveness
Good	At risk	No	Yes or No	Yes	Limited	Low	Monitoring and modelling to improve confidence in the state of the GW body
Good	At risk	No	Yes	Yes	Limited	High	Changes to operational practice or land use planning restrictions. Modelling to design measures & monitoring to assess their effectiveness.
Good	Not at risk	No	Yes	Yes	Some	Low	Monitoring and modelling to improve confidence in the state of the GW body.
Good	Not at risk	No	No	No	Not applicable	High	No action, other than surveillance monitoring of selected bodies.

**These aspects are not explicitly required for quantitative characterisation but the overall principle applies.*

6.2 Implications for monitoring: Risk is a key driver for the design of operational and surveillance monitoring programmes, as described in Section 5. It is a matter for individual agencies to

develop monitoring strategies on the basis of risk and available resources. However, in general, it is recommended that the monitoring effort be focussed in the following areas:

- Poor status groundwater bodies where the confidence is not sufficient to justify appropriate control measures
- Poor status bodies where particular measures require intensive monitoring to demonstrate their effectiveness.
- Good status bodies that are at the greatest risk of deterioration but where confidence is not sufficient to justify appropriate control measures.

In these situations, operational or quantitative monitoring should be at an intensity sufficient to deliver a level of confidence appropriate to the required measures. As with all groundwater monitoring, it is important that monitoring points are representative of the pressure-pathway-receptor scenario under investigation. More guidance on representative monitoring is available from UKTAG (UKTAG 2007b).

6.3 Implications for controls on activities: In contrast to monitoring, the link between Article 5 risk characterisation and regulation or other control measures is less straightforward. It is important to understand that groundwater bodies do not mix in the same manner as rivers. The capacity to assimilate pressure at one point of a groundwater body may not be affected in any way by a new pressure at another point, for example if the point pressures are separated by a geological flow boundary or a river acting as a groundwater discharge zone. Therefore UKTAG recommends that the concept of body-scale capacity is most relevant where pressures are widespread across all parts of a groundwater body:

- Abstraction, diffuse pollution, and widespread small point sources: Results of characterisation may be used to identify areas where additional preventative control is required; for example controls to limit the leaching of agricultural fertilisers, or the volume of new consumptive abstractions. They may also influence the degree of site-specific investigation required for larger abstraction licenses.

- Larger point source pollution pressures: The prevention of pollution at a local scale is a more significant driver. Results of groundwater body scale characterisation in these instances may be used to identify areas of concern and influence, for example, the degree of site-specific investigation required. However, licensing decisions will generally be driven by the result of modelling and monitoring local to the site. This aspect is covered further in separate UKTAG guidance on the application of regulatory standards (UKTAG 2012c).

7 Summary

7.1 Risk is defined for the purposes of this document as the risk of deterioration in status of a water body / protected area, or the risk that improvement objectives will not be met on target.

7.2 The assessment of risk involves the same receptors and same form of assessment as those for status and trends. The characterisation requirements of Article 5 can be undertaken for all 5 groundwater objectives using the assessment of risk and status, alongside the physical characterisation requirements of groundwater bodies.

7.3 Assessing the risk of deterioration in status involves:

- An assessment of the capacity remaining within the groundwater body to assimilate new pressures. This "*potential capacity*" is the difference between the current condition of the water environment and the applicable status criteria.
- An assessment of trends in relation to the potential capacity.
- An assessment of improvement measures. Whether they are being implemented effectively or are suitable to deliver the target improvement objectives

7.4 Specific criteria for the assessment of status are based around the concept of potential capacity and are described in tables 2 and 3.

7.5 Whilst using the same form of assessment as status, the characterisation of risk involves a greater element of prediction whilst status is based on monitoring. The intensity of both predictive and monitoring work depends largely on the degree on confidence required.

7.6 For groundwaters, Article 5 risk characterisation is a forward prediction over a maximum of 2 river basin cycles, whilst status is an assessment of the state of the water body over the previous river basin cycle. The assessment of status is a driver for restorative action, whilst risk characterisation is a crucial driver for designing monitoring for the next river basin cycle. Risk characterisation will obviously play a role in driving preventative control measures, but the degree to which it influences decision-making depends on the nature of the pressure. In general, the concept of potential capacity at a groundwater body scale is most relevant where pressures are widespread across all parts of a groundwater body; for example abstractions, diffuse pollution and the cumulative impact of smaller point source pressures. Permitting decisions for larger point source pressures will generally be driven by the result of predictive assessment and monitoring local to the site.

8 References

CIS (2010): "*Guidance Document No.26. Guidance on Risk Assessment and the Use of Conceptual Models in Groundwater*". European Communities Common Implementation Strategy Technical Report 2010-042
http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/assessment_conceptual/_EN_1.0_&a=d

UKTAG (2012a): Paper 11b(i): "*Groundwater Chemical Classification for the purposes of the Water Framework Directive and the Groundwater Directive*." UK Technical Advisory Group.

UKTAG (2012b): Paper 11b(ii) : "*Groundwater Quantitative Classification for the purposes of the Water Framework Directive*." UK Technical Advisory Group.

UKTAG (2012c): "*Application of Groundwater Standards to regulation*". UK Technical Advisory Group.

UKTAG (2012d): "*Groundwater Trend Assessment*". UK Technical Advisory Group.

UKTAG (2012e): "*Defining & Reporting on Groundwater Bodies*". UK Technical Advisory Group.

UKTAG (2007b): "*UKTAG Task 12(a) Guidance on Monitoring Groundwater*". UK Technical Advisory Group.