UK Technical Advisory Group on the Water Framework Directive

Application of Groundwater Standards to regulation

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.

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1 Purpose

1.1 The purpose of this paper is to describe the links between regulatory regimes and the Water Framework Directive (WFD) and Groundwater Daughter Directive 2006/118/EC (GWDD) objectives for groundwater quality and quantity.

1.2 The key objectives for groundwater quantity in the WFD are to achieve good quantitative status for groundwater bodies and to prevent the deterioration of such status. Equivalent objectives apply to chemical status, but there are two additional quality objectives that apply to all groundwater:

- Prevent or limit the inputs of pollutants into groundwater; and
- Implement measures necessary to reverse any significant and sustained upward trend in pollutant concentrations in groundwater.

Further details on the objectives are set out in the GWDD and associated CIS guidance. Copies of CIS guidance documents are available at http://forum.europa.eu.int.

1.3 The groundwater classification methodologies set out in UKTAG Papers 11b(i) and 11b(ii) describe how the status of groundwater bodies will be assessed. In order to meet good status a combination of regulatory and non-regulatory measures will be incorporated in River Basin Management Plans (RBMPs). These plans must also incorporate measures to meet the other objectives for groundwater noted above. This paper explains the prevent or limit objective noted above, how this is being implemented and how this contributes to meeting chemical status objectives, in particular via the regulatory mechanisms that are available to the agencies.

2 Definitions

2.1 “Regulatory regimes” are instruments which are defined in legislation, under which there are requirements that will support one or more of the following:

- status classification schemes and their application under river basin planning and programme of measures;
- the prevention of pollution; and
- the protection and management of water resources.

They include environmental permitting systems, the planning and contaminated land regimes, and the discretionary powers of responsible bodies.

2.2 "Environmental permitting systems" are: Systems which use environmental permits to set limits (based on the environmental standards) to control the impact of potentially damaging activities (e.g. emissions of pollution, abstraction of water, etc), thereby protecting ecological systems and other legitimate uses of the environment.

2.3 "Limit Value" for a substance is: the concentration and associated compliance regime that, when not exceeded at the source, will prevent an unacceptable release to groundwater, e.g. a concentration included in a permit, an acceptable loading, or a remedial target.

2.4 "Compliance Value" for a substance is: the concentration and associated compliance regime that, when not exceeded at the compliance point, will prevent an unacceptable input of pollutants to groundwater. For example, this could be a resource protection value or minimum reporting value but other values may be used depending on the receptor which needs to be protected.

2.5 "Compliance regime" is: a summary statistic (such as a mean, 95%ile, or an absolute limit), a time period over which compliance is assessed, and, in the case of groundwater, the area over which the criteria are applied (e.g. at a point or as a spatial average). The application of the same numeric value can have dramatically different effects dependent upon the compliance regime.

2.6 "Resource protection value" is a compliance value used to protect groundwater used for human consumption and safeguard the ability of groundwater to support human uses.

2.7 A "Minimum reporting value" (MRV) can be considered to be the lowest concentration of a substance that can be routinely determined with a known degree of confidence, and may not be equivalent to limit of detection.

2.8 An "unacceptable input to groundwater" occurs when there is either an input of hazardous substances to groundwater that is not prevented or there is pollution resulting from an input of non-hazardous substances to groundwater, where these inputs are not exempted by the provisions of Article 6.3 of the GWDD or Article 11.3(j) of the WFD.

2.9 "Groundwater" (WFD): all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil. UKTAG's interpretation of the settings in which groundwater can occur is presented in Annex I.

2.10 "Groundwater body" (WFD): a distinct volume of groundwater within an aquifer or aquifers.

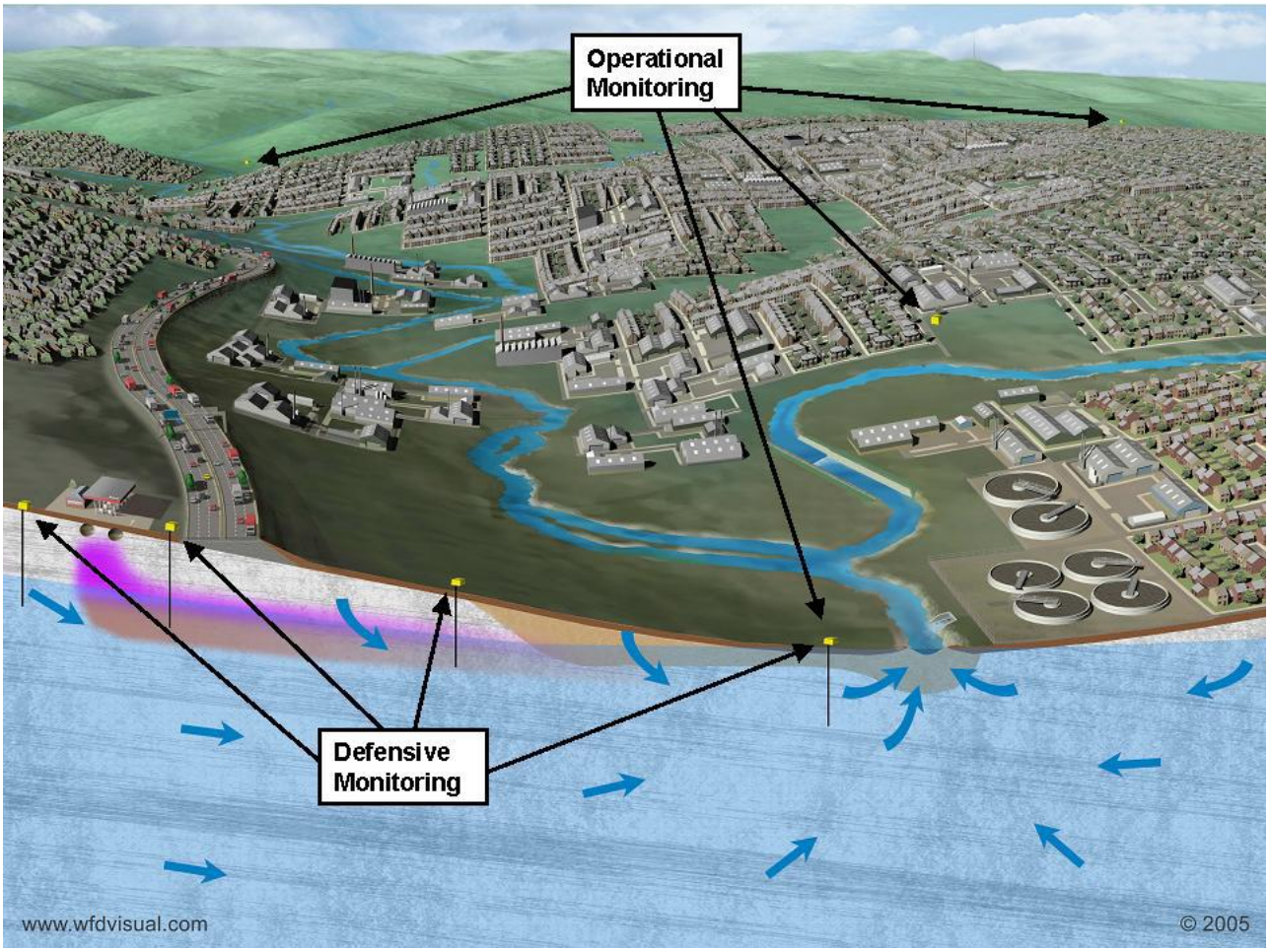
2.11 "Pollution" (WFD): the direct or indirect introduction, as a result of human activity, of substances or heat into the air water or land which may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems, which result in damage to material property, or which impair or interfere with amenities and other legitimate uses of the environment. UKTAG's interpretation of "harm" in the context of potential future uses of groundwater is presented in Section 4.5.2.

2.12 “Input of pollutants into groundwater” (GWDD) means: the direct or indirect introduction of pollutants into groundwater as a result of human activity.

2.13 “Operational monitoring” is undertaken to: (a) establish the status of all groundwater bodies, or groups of bodies, determined as being ‘at risk’, and (b) establish the presence of significant and sustained upward trends in the concentration of pollutants. It can also be used to assess the effectiveness of programmes of measures implemented to restore a body to good status or reverse upwards trends in pollutant concentrations.

2.14 “Defensive monitoring” is undertaken to ensure compliance with an environmental permit. Note: Operational monitoring and defensive monitoring are distinct and usually occur at different locations. Defensive monitoring is undertaken close to an input of pollutants to identify a specific impact from that input. Operational monitoring must be representative of the groundwater body as a whole and specifically of the criteria that define good chemical status. Where there are major inputs that may impact status, defensive monitoring points may also be used for operational monitoring - Figure 1 provides an example.

Figure 1 – Operational (status) and Defensive Monitoring



3 Regulation of Abstractions

3.1 Quantitative status requirements are outlined in UKTAG paper 11b(ii)

3.2 For quantitative status, 'standards[1]' will be set to ensure that during permitting/ licensing for future abstractions, or permit/licence renewal:

- the long-term annual average abstraction from the groundwater body does not exceed the long-term annual average recharge minus an allowance for the ecological flow requirement;
- flows are maintained to dependent surface water bodies such that it does not cause a deterioration in ecological status/ potential.
- enough water remains in the groundwater body to ensure that changes in flow to and levels in identified groundwater dependant terrestrial ecosystems (GWDTEs) do not result in significant damage; and
- no saltwater or other intrusions are induced, resulting in sustained and significant trends, as a result of groundwater abstraction.

3.3 These 'standards' will be applied and used within the regulatory regimes of competent authorities when managing water resources.

3.4 Because the impacts of quantitative pressures (abstractions) can impact on the whole groundwater body, the standards applied to individual permits will tend to closely reflect the standards required to meet good quantitative status.

4 Regulation of Inputs of Pollutants

4.1 Conceptual Background

4.1.1 To affect a receptor an input of a pollutant must physically move through the groundwater system. This movement varies according to the physical and chemical characteristics of the geological strata. Most importantly, the pollutant may be subject to dilution and attenuation along the flow path to a receptor. For this reason many inputs may only have localised effects and may have a reduced or no impact on the receptors noted in definition of good chemical status of groundwater. These inputs may still result in localised pollution. Under the WFD/GWDD it is quite possible to have localised pollution within a groundwater body that is at good chemical status. However, the more widespread the pollution becomes, the more likely the groundwater body will be at poor status.

4.1.2 In contrast to the requirements for good chemical status, the prevent or limit objective in the WFD/GWDD provides protection to all groundwater, to a wider range of receptors (refer to Annex III) and at a more localised scale.

4.1.3 In principle, prevent or limit measures are our first line of defence in preventing unacceptable inputs of pollutants to all groundwater (and thereby avoiding pollution). In contrast our assessment of status provides a six yearly review of the condition of groundwater bodies. The prevent or limit and the status requirements are therefore complementary. Allowing time to enable the historical legacy of prior releases to be degraded or dispersed, if all prevent or limit requirements were met everywhere within a groundwater body, the body would be at good chemical status.

[1] Standards in this context are not necessarily numbers directly related to the groundwater body. They are more usually an assessment of available resource which will take into account recharge to the groundwater body, links to surface waters and conceptual understanding of impacts of the proposed abstraction on GWDTEs and saline or other intrusions

4.2 Regulatory background.

4.2.1 All discharges, disposals or other existing activities that release listed substances to groundwater are subject to controls under the WFD/GWDD and the 1980 Groundwater Directive (80/68/EEC) (GWD). The requirements of the GWD are similar in principle to the prevent and limit requirements of the WFD/GWDD. The GWD will be repealed in December 2013 and until then as far as possible the requirements of the WFD/GWDD and the 1980 Groundwater Directive have to be considered in parallel. Even when the old Directive is repealed the WFD requires that at least the same level of protection is provided (Article 4.9). Annex II highlights the key differences between the old and the new Directives.

4.2.2 The combined requirements of the WFD/GWDD and GWD apply at a Member State level but the agencies do not necessarily have powers to control all the potential inputs to groundwater using existing regulatory regimes. For example, many sources of diffuse pollution are not subject to controls via permits or notices. A wide range of regulatory and non-regulatory measures may be necessary to ensure full compliance with the revised prevent or limit requirements. In some cases these may be operated by other regulatory bodies or third parties.

4.2.3 Subject to enabling legislation, the agencies will apply the revised prevent or limit requirements to all regulatory regimes within their control, e.g. PPC, landfill, discharges to ground etc. However, the requirements of the WFD/GWDD noted in this paper (see Annex II) apply to any other inputs of pollutants to groundwater that may be under the regulatory control of the agencies but not necessarily subject to permits e.g. diffuse pollution, contaminated land etc (where these are not subject to exclusions).

4.2.4 The standards and conditions in regulatory regimes that control inputs of pollutants to groundwater should reflect the objectives outlined in the WFD and now described in more detail in the GWDD.

4.2.5 Threshold values, described in the groundwater Chemical Classification paper, help to assess good chemical status. These values (and associated compliance regimes) are not necessarily appropriate to meet the requirements of the prevent or limit objective, for the reasons given in 4.1.1 and should not be used to set limit values for regulatory regimes where they are not fit for purpose.

4.2.6 Article 6(1) of the GWDD requires Member States to implement measures necessary to: prevent hazardous substances from entering groundwater; and limit inputs of non-hazardous substances into groundwater so as to ensure that such inputs do not cause deterioration [in status] or significant and sustained upward trends in the concentration of pollutants in groundwater.

Note: though deterioration is not specifically linked in Article 6.1 with status, this is clearly specified in Article 1 of the GWDD and has been confirmed by the European Commission as the correct interpretation.

4.2.7 The WFD/GWDD requirement to prevent the entry of hazardous substances is very similar to the requirement to prevent the entry of List I substances under 80/68/EEC. Member States are required to determine which substances are hazardous and this task is undertaken by the agencies in the UK, whose decisions are peer reviewed and confirmed by the Joint Agencies Groundwater Directive Advisory Group (JAGDAG) but may be overridden by Ministerial Direction or decision on a permit appeal. JAGDAG was originally set up to consider substance determination under the 1980 Groundwater Directive. It is now considering the criteria for what should or should not be a hazardous substance and

reviewing the preliminary determinations of the Agencies. As a starting point JAGDAG has agreed that all substances previously confirmed as List I should be considered as hazardous unless new data are brought forward.

4.2.8 Though not explicit in Article 6.1 of the GWDD, it is clear from the rest of the GWDD that the "limit" requirement should be implemented so as to prevent pollution. This is necessary to maintain the existing level of groundwater protection afforded by Directive 80/68/EEC, when it is repealed in December 2013 (in accordance with Recital 51 and Article 4.9 of the WFD). This maintains the position in current regulatory regimes in the UK which already ensure that inputs from discharges, disposals and other activities are controlled to protect receptors, and thereby avoid pollution.

4.2.9 The changes arising from the WFD/GWDD are documented in Annex II.

4.3 Application of exemptions in the GWDD

4.3.1 The broadening of controls on pollutants by the WFD, noted above, is now balanced by a series of "exemptions" introduced by the GWDD (as detailed in Annex II – from a legal viewpoint these are exclusions from the prevent or limit objective). Each exemption applies both to the prevent and the limit objective (both hazardous and non-hazardous substances) but must not override other more stringent requirements in other EC legislation. The detailed application of these exemptions is beyond the scope of this paper, but some key principles are outlined below.

4.3.2 Under GWDD Article 6 (3) (a) and 6 (3) (d) respectively, direct discharges of pollutants to groundwater authorised under Article 11(3)(j) of the WFD and artificial recharges authorised under Article 11(3)(f) are exempted from the requirement to take all measures to prevent or limit, but must otherwise meet the environmental objectives of the groundwater body. The controls on these authorisations must therefore reflect the need to meet the status, trend reversal and protected area objectives of the WFD.

4.3.3 The competent authorities (the Agencies) can apply a general de minimis exemption if they are satisfied that the inputs of pollutants will not result in deterioration of groundwater quality. Although this wording is similar to that in 80/68/EEC the context is different. It is interpreted as allowing an assessment at the water table, taking into account hydrogeological conditions as well as the nature of the input. UKTAG's interpretation of unacceptable inputs of hazardous substances is clarified further in Section 4.4.

4.3.4 Article 6.3(e)(i), enables competent authorities to exempt from the requirement to take all measures to prevent or limit, inputs that are technically feasible but would result in increased risks to human health or the quality of the environment as a whole. This enables a degree of balancing of risks between groundwater and the wider environment. However, the agencies would not apply any lesser degree of protection to groundwater than to other environmental media. The timescales over which impacts may occur and over which risks are assessed would be a particular concern for groundwater.

4.3.5 Where contamination is already in the ground (the release may predate the WFD/GWDD), Article 6.3(e)(ii) enables competent authorities to exempt from the requirement to take all measures to prevent or limit, inputs where it would be disproportionately costly to remove or control the further movement of pollutants. This is consistent with the UK approach to the management and restoration of contaminated land and groundwater. It does not mean that if there is a risk to other WFD objectives (significant and sustained trends, status, protected areas) that measures are not necessary.

4.3.6 Where there is a continuing source that has given rise in the past to ground contamination this must be brought under control to prevent further unacceptable inputs to groundwater.

4.4 Preventing the input of hazardous substances

4.4.1 The WFD defines hazardous substances as: “substances or groups of substances that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances which give rise to an equivalent level of concern”.

4.4.2 Member States are required to determine which substances are hazardous. As described in 4.2.7 above, as a starting point, all those substances previously confirmed as List I substances by JAGDAG should be considered as hazardous. JAGDAG has also confirmed that radioactive substances, which were excluded from the GWD but not the GWDD, should also be considered as hazardous.

4.4.3 The GWDD requires that Member States take “all measures necessary to prevent inputs of hazardous substances into groundwater”, subject to the exemptions noted in Article 6 (3) of the GWDD. As it is not technically feasible to stop all inputs of hazardous substances and a de minimis exemption may be employed, criteria are needed to assess whether this objective has been met in practice.

4.4.4 The detailed assessment of whether an individual input has been prevented is outside the scope of this paper and, for some Agencies, procedures are set out in Government guidance. In general, inputs of hazardous substances that caused pollution or an environmentally significant and sustained increase in concentration in groundwater beyond the immediate point of discharge would be unacceptable. A list of compliance values for the regulation of hazardous substances (minimum reporting values) and further detail on their use is available in Annex IV.

4.4.5 Compliance should be assessed in the immediate vicinity of the input by, for example:

- Calculation of the concentration that will be present in the unsaturated zone immediately before entry; or
- Calculation of the concentration that will be present in the saturated zone immediately after entry into groundwater; or
- Calculation or measurement of the concentration of the substance in groundwater as near to the point of entry as is practically possible.

Details of how assessments are made in practice are available in guidance from the relevant environment agency.

4.4.6 We must also consider whether necessary measures have been applied. Inputs that arise from readily avoidable failure of, or failure to apply, control measures would be unacceptable.

4.4.7 Data may be used to support any determination that a loading of hazardous substances to groundwater falls within the de minimis exemption. However, a high rate of dilution in groundwater or difficulties in monitoring groundwater at the point of input (for example, beneath landfills) should not be used to mask what would otherwise be considered a significant loading and potentially an unacceptable input. In addition, UKTAG considers that the prevent objective is inappropriate for pore waters falling outwith the definition of groundwater (refer to Annex I).

4.5 Limiting the input of non-hazardous substances

4.5.1 The WFD only defines hazardous substances. Although Annex VIII highlights groups of Main Pollutants, the GWDD makes it clear that all other pollutants come within the scope of the "limit" objective. This brings substances that are unlisted and therefore excluded from control under the Groundwater Directive (80/68/EEC) into the scope of the WFD/GWDD, such as non-toxic silicates, nonylphenol, acetone and nitrate.

4.5.2 As noted in sections 4.1 and 4.2, the limit objective requires that the input of non-hazardous substances to groundwater must not cause pollution, significant and sustained upward trends and any deterioration in status. Of these, pollution is in practice the most stringent requirement as it is assessed locally. The mere entry into, or slight deterioration in quality of groundwater, is not in itself pollution. For pollution to occur there needs to be some actual or likely harmful effect to a receptor. UKTAG interprets the definition of harm to include impairment of potential future uses of groundwater.

4.5.3 The range of possible 'receptors' captured in the definition of pollution is described in Annex III. In principle, for each of these receptors it should be possible to derive a compliance value (a numeric value and an associated compliance regime) beyond which harm will occur to the receptor. By working back from this standard to the point of release of the pollutant to groundwater it should be possible to determine what would be an unacceptable input (see Figure 3). Further detail on compliance values can be found in Annex IV.

4.5.4 Therefore, the input of a non-hazardous substance is controlled at the source using a limit value (for example, a numeric limit on a permit), or other control measures that will ensure that pollution does not occur. In practice, in order to provide sufficient protection to a receptor, an intermediate compliance point may be defined (Figure 3) and either monitoring or calculations undertaken at this point to ensure that pollution does not occur.

4.5.5 An intermediate compliance point may also be used as a mechanism to protect the groundwater resource for future use, where there are no immediate existing receptors but where an extensive deterioration of existing groundwater quality is regarded as undesirable. The location of such compliance points and applied standards will vary according to hydrogeological conditions and the perceived value of the groundwater resource. Further detail on the issues to be considered a list of compliance values for the purpose of protecting groundwater used for human consumption and to safeguard the ability of groundwater to support human uses (resource protection values) can be found in Annex I and IV.

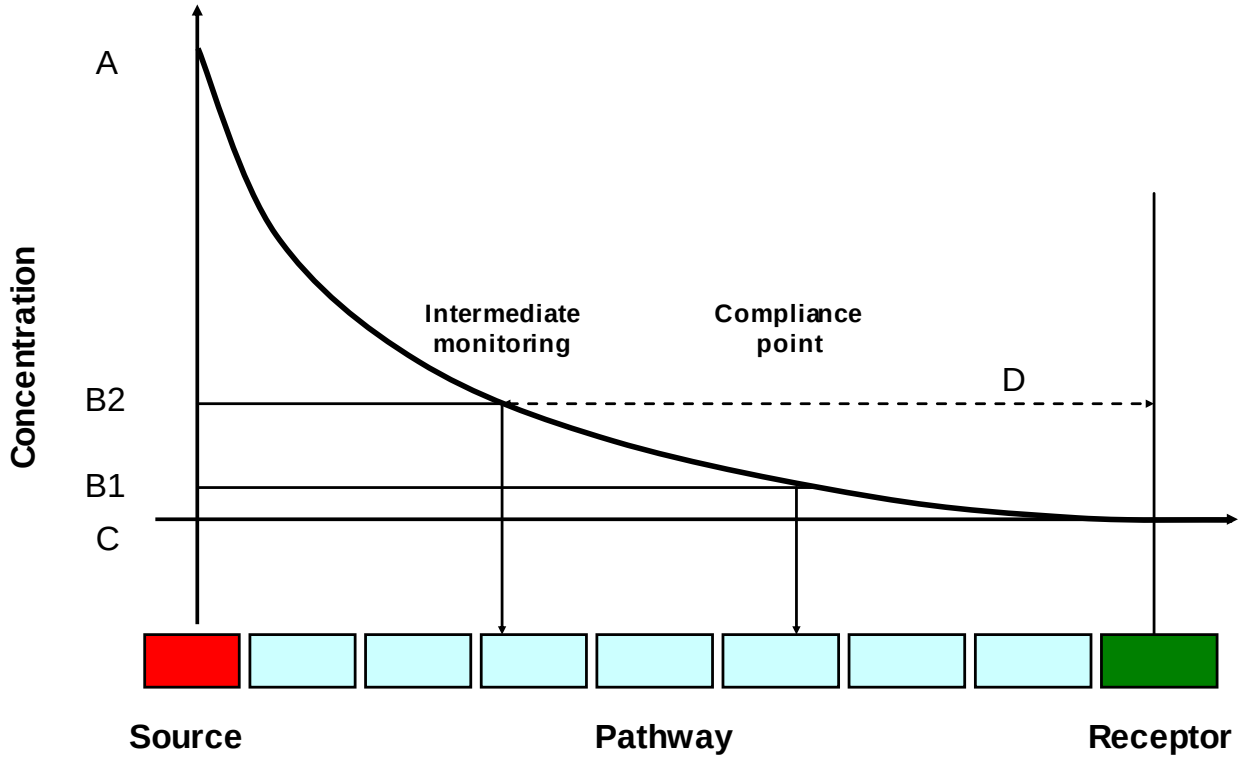
4.5.6 If there is existing pollution, then the limit value for the input may be derived from a theoretical assessment to ensure that there is no additional pollution from the new input and no delay in restoration of any existing pollution. In some cases additional inputs may not be permissible.

4.5.7 In all cases, the limit value should also be set to avoid an increased pollutant loading to the groundwater resource that would cause a deterioration in status. (Whilst no specific receptors are necessarily affected there could be a widespread decline in quality that may affect the General Quality chemical status assessment test.)

4.5.8 In many cases multiple receptors will need to be considered when setting limits on permits etc. The appropriate quality 'standard' should be chosen for each potential receptor. The compliance value for each of these is derived at a common compliance point (if this exists), as in Figure 3. The most stringent value is then selected. In this example, point X has been chosen as an appropriate location to compare 'standards' applicable to: the abstraction at A, the present and future resource at B, the wetland at C and the surface water at D. A

back calculation is made from each receptor to determine the maximum concentration at the compliance point that would allow the standard not to be exceeded at the receptor.

Figure 2 - Receptors, Compliance Points, and Concentrations



C = Quality standard required at the receptor, based on an appropriate environmental standard.

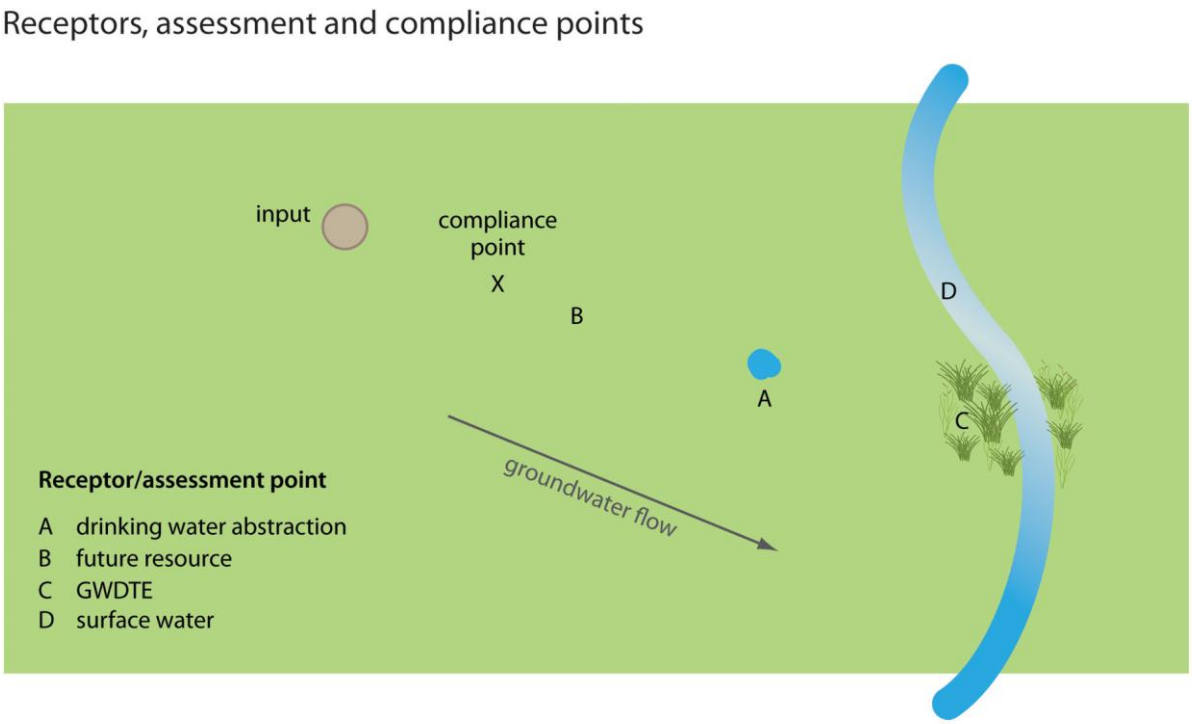
B1 = Compliance Value at a compliance point, set to ensure the quality standard required at the receptor is/will be met (may be physical, i.e. an actual monitoring point or virtual, i.e. a point used for prediction/calculation)

B2 = Quality measurement at intermediate monitoring points to provide advance information.

D = Possible range of compliance point locations according to specific conditions (hydrogeology, resource management) – could be at the receptor itself, or some other point along the pathway.

A = Limit value applied at the source (e.g applied to a permit) to protect the receptor or the resource value of the groundwater and meet other WFD objectives.

Figure 3 – Receptors, Compliance Points and Standards



5 Summary

5.1 In the context of the WFD, regulation of the groundwater quantitative resource is based upon the status, status objectives and protected area objectives. Regulation of groundwater resources also has to be closely linked to status and the status objective of dependent surface water bodies. 'Standards' derived for quantitative status are directly applicable to the regulation of abstractions, though these may be applied at a different scale for regulation.

5.2 Regulation of groundwater quality cannot be based primarily on the requirements to meet good chemical status as there are other, more stringent objectives for groundwater in the WFD/GWDD.

5.3 Regulatory measures for groundwater quality and in particular the conditions on permits will be based predominantly upon the prevent or limit objective, as in practice this is the most restrictive requirement. This is similar to the position under the Groundwater Directive (80/68/EEC).

5.4 Standards derived for chemical status classification, including threshold values, will not necessarily be directly applied to meet the prevent or limit objective as they may not provide sufficient protection to local receptors and will be based on different compliance regimes. In contrast it is a requirement of the "limit" objective that inputs are insufficient to cause any deterioration of good chemical status or any significant and sustained rising trends in pollutants.

5.5 The extension of the prevent or limit requirements by the WFD is now balanced by exemptions within the GWDD.

5.6 Not all inputs that must meet the prevent or limit requirements are, or are likely to be in the future, within the scope of the regulatory duties and powers of the agencies.

5.7 The hazardous substances that should be prevented from input to groundwater under the GWDD initially will be the List I substances determined under the JAGDAG process and all radioactive substances. The input of all other pollutants will be limited to prevent pollution, the deterioration of good chemical status and any significant and sustained upward trends in quality.

5.8 The limits on permits will be normally be back calculated from the ‘standards’ that determine what constitutes an unacceptable input to groundwater, taking into account the hydrogeological processes that may result in attenuation along the groundwater flow path. Intermediate compliance points can also be used to apply standards to protect the resource value of groundwater. This meets the requirements of the WFD/GWDD, is consistent with current UK procedures and a risk-based approach to groundwater protection. In addition, permits must take account of the need to prevent deterioration in good chemical status where there are no immediate receptors but there could be widespread deterioration in groundwater quality.

ANNEX I: Definition of Groundwater

A1.1 "Groundwater" is defined in WFD as "all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil."

A1.2 UKTAG does not consider pore water in low permeability deposits to be groundwater. This is further described in the UKTAG paper on defining and reporting on groundwater bodies. The concept of the zone of saturation is not relevant in these deposits as it is usually not feasible to define a water table where lateral percolation is impeded. The properties and the function of low permeability materials are recognised in existing European Legislation, such as the Landfill Directive, where these materials can be used as geological barriers to support engineering measures for groundwater protection.

A1.3 It is difficult to define precise permeability criteria on which to assess whether retained water is groundwater, not least because geological deposits are often highly variable in permeability and thickness. A site-specific judgement based on multiple lines of evidence may be needed.

A1.4 Where permeability is low, the prevent or limit objective will have limited relevance for groundwater protection as it will be physically difficult for pollutants to enter the geological deposits; surface runoff is the most likely route for contamination to spread. However, any on-going entry or retention of pollutants may still need to be controlled in order to address other issues, such as soil protection.

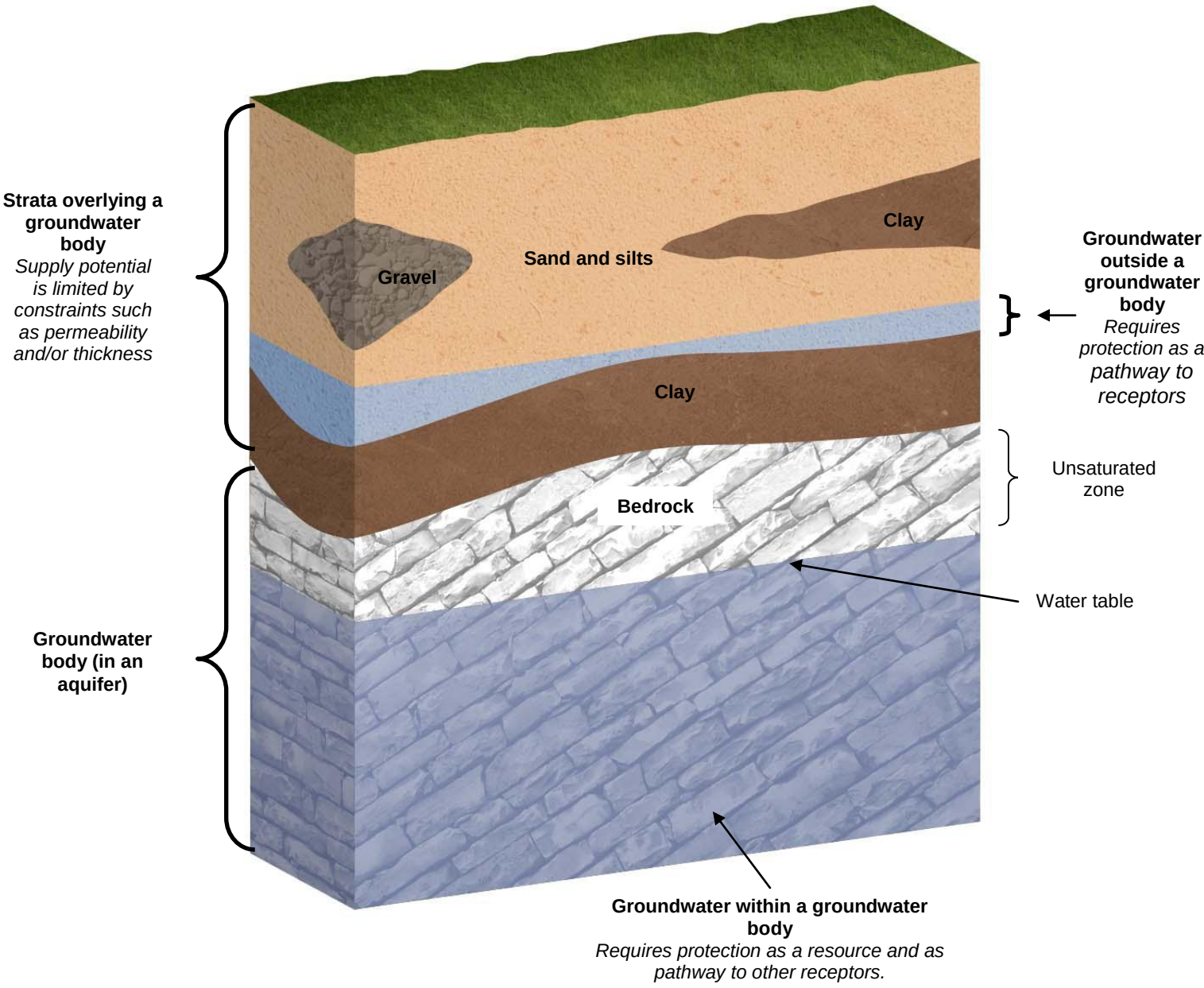
A1.5 Groundwater can occur both within a groundwater body and in other geological strata which do not meet the criteria for designation as a groundwater body (e.g. a small or discontinuous volume of groundwater within a deposit overlying a recognised aquifer).

A1.6 Groundwater lying beyond the boundaries of groundwater bodies requires protection under the "prevent or limit objective" and may act as a pathway for transmitting pollutants to receptors such as ecosystems or to adjacent groundwater bodies. However, status objectives do not apply to these groundwaters, and they will not be considered as a resource for future human use unless there is site specific evidence to the contrary.

A1.7 Figure 5 provides an example. Groundwater occurs within both the groundwater body and permeable strata lying above. In this example, the permeable strata are not sufficiently extensive to comprise a groundwater body in their own right.

Figure 4: Example of Groundwater in Groundwater Bodies and Overlying Strata.

Diagram illustrated by Nathan Fletcher.



ANNEX II Differences between 80/68/EEC and WFD/GWDD

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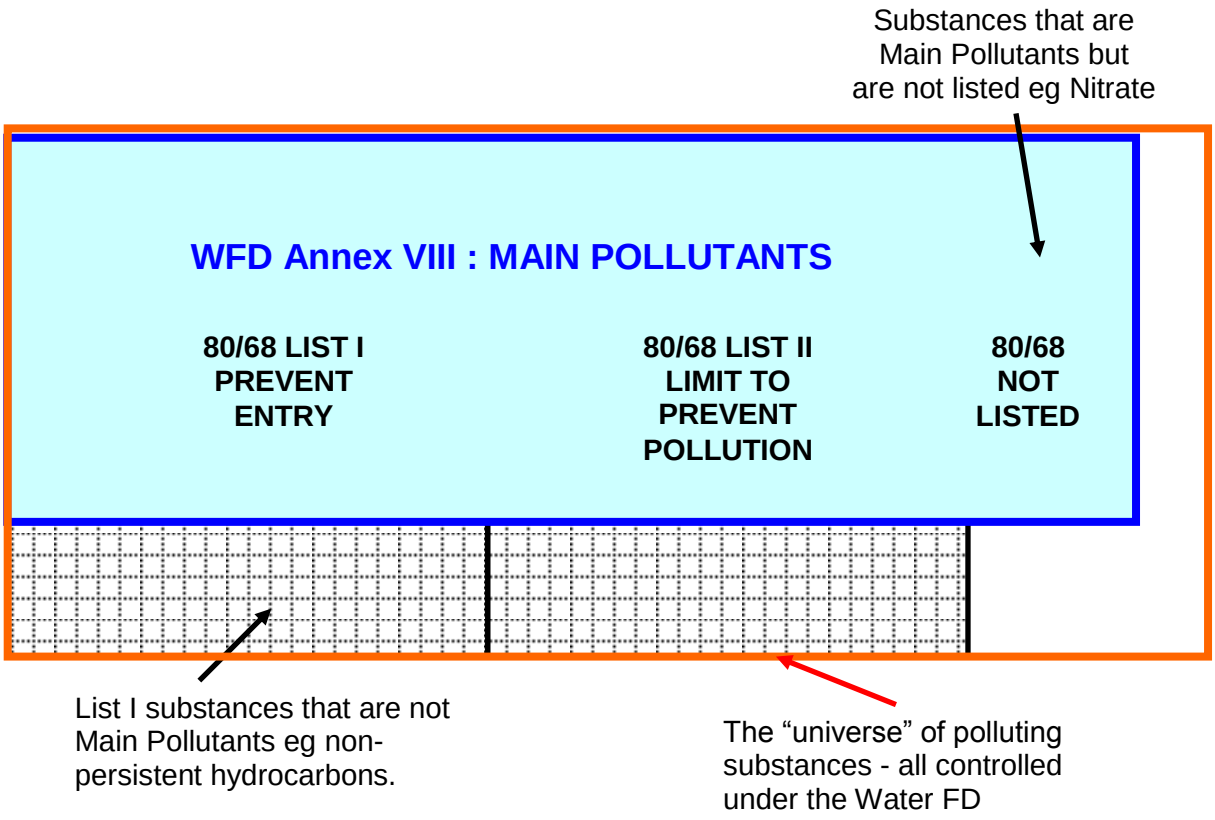
A2.1. 80/68/EEC does not contain any requirements for maintaining good chemical status or reversing significant and sustained upward trends.

A2.2. Radioactive substances are excluded from the scope of 80/68/EEC but are not excluded from the WFD/GWDD.

A2.3. 80/68/EEC only controls releases of listed substances whereas the WFD requires controls to all inputs of all pollutants (substances liable to cause pollution). This represents a potentially much broader range of inputs (not simply current activities) and a broader suite of substances (not just listed substances) than originally defined in, and therefore controlled by, the Groundwater Directive (80/68/EEC).

Note : Though the control mechanism is unspecified, heat, whilst not a pollutant, is defined as a factor that must be controlled to prevent pollution (this maintains the same position as under 80/68/EEC).

Figure 5: Substances listed under the Groundwater Directive (80/68) and 'pollutants' defined under the Water Framework Directive.



A2.4 80/68/EEC refers to disposals, discharges and activities, whereas the WFD seeks to control all inputs of pollutants.

A2.5 There are differences in the way in which direct discharges are considered under 80/68/EEC and the agencies have their own approaches to this issue.

A2.6 The four yearly review period for authorisations noted in 80/68/EEC is not repeated in the WFD/GWDD. It is implicit in the WFD that all measures (including authorisations) should be reviewed every six years in order to assess whether they are contributing effectively to the achievement of WFD objectives.

A2.7 The GWDD contains different exemptions that counterbalance the widening of the scope of controls introduced by the WFD. The exemptions set out in 80/68/EEC are exemptions from the directive itself. The exemptions within the GWDD are exemptions only from paragraph 1 of Article 6, i.e. the prevent or limit requirements, not from the directive as a whole. The following table compares the exemptions in the two directives:

GWDD - Article 6(3	80/68/EEC – Article 2
Inputs of pollutants that are: (a) the result of direct discharges authorised in accordance with Article 11(3)(j) of Directive 2000/60/EC (b) considered by the competent authorities to be of a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater (c) the consequences of accidents or exceptional circumstances of natural cause that could not reasonably have been foreseen, avoided or mitigated (d) the result of artificial recharge or augmentation of bodies of groundwater authorised in accordance with Article 11(3)(f) of Directive 2000/60/EC (e) considered by the competent authorities to be not technically feasible to prevent or limit without using: (i) measures that would increase risks to human health or to the quality of the environment as a whole; or (ii) disproportionately costly measures to remove quantities of pollutants from, or otherwise control their percolation in, contaminated ground or subsoil (f) the result of interventions in surface waters for the purposes, amongst others, of mitigating the effects of floods and droughts, and for the management of waters and waterways, including at international level. Such activities, including cutting, dredging, relocation and deposition of sediments in surface water, shall be conducted in accordance with general binding rules, and, where applicable, with permits and authorisations issued on the basis of such rules, developed by the Member States for that purpose, provided that such inputs do	(a) discharges of domestic effluents from isolated dwellings not connected to a sewerage system and situated outside areas protected for the abstraction of water for human consumption. (b) discharges which are found by the competent authority of the Member State concerned to contain substances in lists I or II in a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater (c) discharges of matter containing radioactive substances

not compromise the achievement of the environmental objectives established for the water bodies concerned in accordance with Article 4(1)(b)(ii) of Directive 2000/60/EC.	

Migration to the new regimes

A2.8 80/68/EEC is to be repealed by the WFD in December 2013, and therefore the regime set out within it will be replaced. Article 11 of the WFD states that programmes of measures shall be established by December 2009, and that all measures shall be made operational by December 2012.

A2.9 The GWDD provides the detail that is missing from the WFD on how the objective to prevent or limit the input of pollutants to groundwater should be applied.

ANNEX III: Receptors

Comparison between the criteria for good chemical status assessment and the receptors encompassed by the definition of pollution:

Pollution Receptors	**Chemical Status criteria**
Aquatic ecosystems (surface waters)	Surface water bodies (ecological and chemical quality)
Groundwater Dependent Terrestrial Ecosystems	Groundwater Dependent Terrestrial Ecosystems
Human health	Groundwater body (general chemical assessment)
Chemical status of groundwater body	Saline or other intrusions
Material Property	Drinking Water Protected Areas
Amenities	
Other legitimate uses of the environment (this may include all present and planned future uses of the groundwater resource).	

Where necessary, compliance points can be set in order to provide protection to groundwater so that it can be maintained as a potential resource for future human uses.

ANNEX IV: Standards to prevent or limit the entry of pollutants to groundwater

These standards are not used in classification. They are typically used to control pollution at point sources and so manage the threat of local impacts. The standards help prevent deterioration in status, and work to achieve the 'prevent and limit' requirements of the Water Framework Directive. The Groundwater (Daughter) Directive requires that Hazardous Substances are prevented from entering groundwater. Substances defined as Non-Hazardous Pollutants must also be limited so as not to cause pollution or a deterioration in status.

For the UK, the Joint Agency Groundwater Directive Advisory Group (JAGDAG) assesses the status of substances, and takes account of any relevant information obtained from public consultation. JAGDAG does not set standards for these substances.

Standards for Hazardous Substances

Hazardous Substances are "toxic, persistent and liable to bio-accumulate"[2] The standards are used mainly to design mitigation for new activities and so control pollution at source. Standards have been derived on the basis of the minimum limits of quantification achieved routinely by competent laboratories. The UKTAG proposes the standards in Table 1 for substances that have been formally identified as Hazardous Substances.

The values have already been consulted on in England and Wales in 2003 as "minimum reporting values". UKTAG is standardising these values across the UK and Ireland in order to provide consistency and transparency. The standards will be reviewed over the next river basin cycle. The standards below represent the limit of quantification. Any concentration below these standards would constitute no input for the purposes of meeting the prevent requirement.

Table 12: Recommended standards for hazardous substances

Column 1	Column 2	Column 3
Substance	**Default standards [a] (µg/l)**	**Alternative water standards[b] (µg/l)**
1,1,1-trichloroethane	0.1	
1,1,2-trichloroethane	0.1	
1,2,4-trichlorobenzene	0.01	
1,2-dichloroethane	1	
2,4-dichlorophenol (2,4-DP)	0.1	
2-chlorophenol	0.1	
4-chloro-3-methylphenol	0.1	
Aldrin	0.003	
Atrazine	0.03	
Azinphos ethyl	0.02	0.05
Azinphos methyl	0.001	0.03
Benzene	1	
Cadmium	0.1	
Carbon tetrachloride (tetrachloromethane)	0.1	1
Chlorfenvinphos	0.001	0.01
Chloroform	0.1	
Chloronitrotoluene [c]	1	
DDT [d]	0.002	
Demeton	0.05	
Diazinon	0.001	0.05
Dieldrin	0.003	
Dimethoate	0.01	0.05
Endosulfan [e]	0.005	
Endrin	0.003	
Fenitrothion	0.001	0.01
Fenthion	0.01	0.01
Hexachlorobenzene (HCB)	0.001	

[2] www.wfduk.org/jagdag

Table 12: Recommended standards for hazardous substances		
Hexachlorobutadiene (HCBD)	0.005	
Hexachlorocyclohexane (lindane / γ-HCH)	0.001	
Isodrin	0.003	
Malathion	0.001	0.03
Mercury compounds	0.01	0.1
Mevinphos	0.005	0.07
Parathion	0.01	0.06
Parathion-methyl	0.015	0.01
Polychlorinated biphenyls (PCBs) [f]	0.001	
Pentachlorophenol (PCP)	0.1	1
Cis-Permethrin	0.001	0.02
Trans-Permethrin	0.001	0.01
Simazine	0.03	
Tetrachloroethylene	0.1	
Toluene	4	
Trifluralin	0.01	
Tributyltin oxide (TBTO) [g]	0.001	
Trichloroethylene	0.1	
Triphenyltin oxide (TPTO) [g]	0.001	
Xylene [h]	3	

Notes:

a. The standards in column 2 are based upon Minimum Reporting Values (MRV) published by the Environment Agency [7]
b. The standards in Column 3 are based upon Minimum Reporting Values (MRV) published by the Environment Agency [11]. They are only to be used when monitoring compliance, where the sample matrix has been agreed with the relevant agency to be technically unsuitable for meeting the normal limits of quantification. In these cases, they apply instead of the standards in Column 2.
c. The standard applies to each of the following individual chloronitrotoluene compounds: 2,4-chloronitrotoluene; 2,5-chloronitrotoluene; 2,6-chloronitrotoluene; 4,2-chloronitrotoluene; 4,3-chloronitrotoluene.
d. The standard applies to the following DDT compounds or breakdown products: o,p-DDT; p,p-DDT; o,p-DDE; p,p-DDE; o,p-TDE; p,p-TDE.
e. The standard applies to α-Endosulfan.
f. The standard applies to each individual polychlorinated biphenyl (PCB) congener.
g. These specific compounds are listed as hazardous by Joint Agency Groundwater Directive Advisory Group (JAGDAG). They are examples of 'tributyltin compounds' and 'triphenyltin compounds'.
h. The standard applies to o-xylene and m+p-xylene.

If there is no standard for a particular substance then a value based on the routine limit of quantification achieved by the laboratory can be applied.

Activities need to be designed so as to prevent the input of hazardous substances. Values in Table 1 are used for this purpose. This is commonly undertaken via modelling / quantitative risk assessment. When assigning site-specific controls (e.g. permit values) and assessing compliance with these controls (e.g. comparing monitoring with values in a permit), higher values can be used. These increased values are set depending on:

- whether the sample matrix is suitable for sensitive analytical methods[3],
- elevated upgradient concentrations,
- elevated natural background,
- and any relevant exemptions. These exemptions can be applied with reference to Article 6.3 of the Groundwater (Daughter) Directive and as specified in agency-specific guidance.

How these values are set on a site specific basis, and location of the compliance point, is described in 4.4.4 and 4.4.5 and in agency-specific guidance.

The prevent and limit requirements also apply in principle to contaminated land within the confines of domestic legislation and guidance. The standards are one of a number of factors that inform the identification of on-going inputs of hazardous substances, as described in agency-specific guidance. Remediation may be needed in some cases to remove the source of the inputs or to otherwise prevent the pollutants from percolating into groundwater. However, land remediation can be very expensive. This is why Directive 2006/118/EC provides for an exemption where preventing further inputs would require "disproportionately costly measures" to remove quantities of pollutants from, or otherwise control their percolation in, contaminated ground or subsoil. For further information on the application of the prevent or limit requirement to contaminated land please see agency-specific guidance.

In the case of radioactive substances, consideration should be given to the significance of any input in respect of the radiation dose which might be received by people and non-human species. The approach for radioactive substance is referred-to in agency-specific guidance.

Standards for Non-Hazardous Pollutants

The Water Framework Directive requires that inputs of Non-Hazardous Pollutants must be controlled such that there is no significant and sustained upward trend, and no deterioration in status. UKTAG interprets this as meaning that inputs to groundwater should not cause pollution. The mere entry of a non-hazardous substance into groundwater, or a slight deterioration in the quality of the groundwater, is not in itself regarded as "pollution". There must be a risk to a "receptor". UKTAG consider receptors to include all existing groundwater uses (active and passive) and all plausible future uses of the groundwater. This therefore includes groundwater abstractions for drinking water, wetland ecosystems and surface water ecosystems dependent on groundwater. It also includes groundwater bodies that form part of a drinking water protected area. Where more than one receptor requires protection, the most stringent standard will apply.

The standards included in this section are set so as to limit point source inputs of Non-Hazardous Pollutants so as to avoid "pollution". The standards will vary depending on the relevant receptor:

- Where the receptor is a river, groundwater dependent wetland or a particular abstraction from groundwater for drinking water, standards are dictated by the relevant EQS or Drinking Water Standard. Where an abstraction is used for purposes other than drinking water, the relevant standards will apply.
- Where there is no abstraction but where there is potential for future development because a groundwater body forms part of a Drinking Water Protected Area, standards are based on current available standards for protecting human health in drinking water supplies. In this case, the standards apply directly to the groundwater body. For each pollutant, the standard is selected by going through the following hierarchy, in sequence:

[3] Values agreed with the Landfill sector in England and Wales in 2008 can be used where the matrix is unsuitable, and these are also subject to review over the next river basin cycle.

a) a national drinking water standard for the pollutant established under domestic legislation, including legislation implementing the Drinking Water Directive;
b) if no standard is available via (a), a standard specified in World Health Organisation (WHO) Guidelines for Drinking Water Quality;
c) if no standard is available via (a) or (b), a standard established following peer review by a national authority in another country;
d) if no suitable standard is available via any of the above, an operational value adopted by the agencies based on the best available scientific information on the pollutant concerned.

Where no abstraction or ecosystem receptor requires more stringent protection, the standards derived using this hierarchy would normally apply at a distance of 50 metres from the source of the inputs in the direction of groundwater flow. This distance may be extended up to a maximum of 250 metres where there other constraints on the future development of the local groundwater resource. Any sample of groundwater at this point, whose quality exceeds the relevant standard derived from the hierarchy, is followed up as follows. Extra controls on the input may be required unless:

- a sequence of measured concentrations in the groundwater describes an improving trend as a result of action taken at the site; or
- the exceedance is shown to be short term. Evidence here may include a check that an annual 95-percentile of sampling results does not exceed the standard with statistical confidence[4]; or
- it is demonstrated that concentrations are elevated by natural background or other sources of pollution. In which case the standards applied may be elevated to avoid penalising one site because of pollution from a neighbour[5]; or
- an exemption from the requirements to prevent and limit can be applied [6].

If there is no standard for a particular substance then a value can be derived and agreed on a case-specific basis using the sequence described above.

It is important to stress that the standards are not discharge limits. Limits on discharges and other point source pollutant inputs are set with reference both to the standards and to the properties of the sub-surface, such as dilution and attenuation capacity. These properties are site-specific, and the setting of limits on inputs is therefore a site-specific process.

This approach been used for many years in England, Wales and Scotland as part of agreeing compliance values and regimes on permits and licences for landfills, discharges to ground, and other activities that need to be controlled in order to protect groundwater.

[4] The degree of additional sampling depends on the required level of confidence which in turn depends on site specific variability, and on the costs of the action being proposed. For example, where it is clear that groundwater quality does not vary, this may require one or two additional samples.
[5] Using guidance specific to the agency. The degree of adjustment will depend on the extent of natural attenuation expected in the groundwater at the site.
[6] Exemptions can be applied with reference to Article 6 of the Groundwater (Daughter) Directive or as set out in agency-specific guidance.