

# UK Technical Advisory Group on the Water Framework Directive

## Guidance on abstraction and flow regulation pressures on surface waters (Final)

<b>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 working draft amended accordingly.</b>			
<b>Working Paper Version:</b>	(v3) 21/01/04 Article 5; Annex 2	<b>Status:</b>	Public Working Draft (edited for release)
<b>WFD Requirement:</b>	Characterisation: risk & pressures analysis	<b>UKTAG Review:</b>	5 June 2003 Edited for risk categories 12/03

### 1. Purpose of this Paper

The paper sets out UKTAG's guidance on the framework for the **identification of, and assessments of risks from, abstraction and flow regulation pressures** on river, lake, transitional and coastal water bodies as required by Article 5 of the Directive. This approach will be adapted by responsible agencies in context of their programmes, methods and available data to ensure the best outcomes for WFD implementation.

### 2. The Directive's requirements

2.1 As part of a review of the impact of human activity on the status of surface waters (the pressures and impacts analysis), Article 5 and Annex II of the Water Framework Directive require Member States to:

- a. collect and maintain information on the type and magnitude of the significant pressures to which surface water bodies in each River Basin District are liable to be subject; and
- b. carry out an assessment of the risk that surface water bodies will fail to meet the Directive's environmental objectives.

2.2 Member States must complete the first reviews of the impact of human activity by 22<sup>nd</sup> December 2004, and report the results to the Commission by 22 March 2005. The reviews are therefore urgent priority tasks in the implementation of the Directive.

### 3. Background & relationship to other UK TAG guidance documents

3.1 This guidance is related to and should be read in association with, other guidance documents produced by UKTAG drafting groups, specifically the following:

- Task 7.a Guidance on the general principles of pressures and impacts analyses.
- Task 7.h Guidance on abstraction and recharge pressures on bodies of groundwater.
- Task 7.c Morphological pressures on surface water.
- Task 7.e Guidance on point source discharges pressures on surface waters

3.2 The principles identified in Task 7.a *Guidance on the general principles of pressures and impacts analyses* apply with regards to its use, consistency, risk management & local decision-making within agencies and has been applied to the method outlined in this guidance.

#### 4. Content of this guidance paper

- Common definitions and requirements including:
  - common description of pressure types (Section 5)
  - common specification on data needs (Section 6)
- Approach to risk assessment and assigning of significant pressures including
  - hydrological risk characterisation categories (Section 7.1)
  - common criteria for defining significant pressures (Section 7.2)
  - risk assessment and pressure identification process (Section 7.3)

#### 5. Common description of pressure types

5.1 Abstraction and flow regulation pressures need to be defined consistently across the UK.

Therefore this section identifies these pressures and associated activities by:

- (a) **pressure type** (e.g. abstraction, impoundment, discharge).
- (b) **source type** (e.g. borehole, spring, well, river, canal, natural standing water, reservoir, estuary or coastal).
- (c) **economic driver, activity or driving force** behind the use (e.g. industrial group or sector, agricultural activity, recreational use, etc.). *(Note: IMPRESS guidance uses the equivalent terms 'driver' and 'activity or driving force' in tables. In IMPRESS table 2.2 Driver is defined as 'an anthropogenic activity that may have an environmental effect (e.g. agriculture, industry)')*
- (d) **purpose of use** (e.g. public potable supply, private potable supply, spray irrigation, trickle irrigation, etc.). This should also allow reporting based on the 'consumptiveness' of the particular use.

**Comment [A1]:**

**Comment [A2]:** IMPRESS guidance uses the equivalent terms 'driver' and 'activity or driving force' in tables. In IMPRESS table 2.2 Driver is defined as 'an anthropogenic activity that may have an environmental effect (e.g. agriculture, industry)'

5.1.2 To assist collation of data, standard codes will be used to describe each pressure and associated activities according to the table below:

Element	Driver (Activity driving use)	Purpose Of Use	Pressure Type	Source Type
<b>Codes &amp; Descriptions</b>	Standard Industrial Classification (SIC) codes  Refer Annex A for most relevant SIC Codes	Refer Annex B for uses and associated codes	Abstraction (Ab)  Impoundment (Im)  Discharge (Ds)  Catchment Transfer (Ce export, Ci import)	Borehole (Gb) Spring (Gs) Well (Gw) Other groundwater (Go) River (Ri) Natural standing water (Ns) Reservoir (Re) Canal (Ca) Estuary /transitional (Es) Coastal / marine (Co)
<b>Comment</b>	Enable data to be more easily linked to existing economic information for industry groups and / or sectors  If additional codes are required, these should be agreed by UK agencies	Based on existing coding systems (such as NALD)	<b>Ab:</b> Removal of water from a source <b>Im:</b> Structure enabling regulation of flow <b>Ds:</b> Addition of water to a source <b>Ce, Ci:</b> Bulk export or import of water resource between catchments	

*Examples*

<i>public water supply from a reservoir</i>	4100-	PWS-	Ab-	Re
<i>dam creating the reservoir</i>	4100-	PWS-	Im-	Re
<i>direct river abstraction for spray irrigation of wheat</i>	0111-	SIR-	Ab-	Ri
<i>borehole supplying a brewery</i>	1596-	PRO-	Ab-	Gb

## 6. Common specifications on data needs

- 6.1 UK Agencies will be responsible for the collection of data recognising that data quality & quantity should be sufficient to:
- undertake the assessment of risk appropriate to the pressures acting upon and, the ecological sensitivity of, a water body;
  - estimate the natural flow at a fluvial site, or flushing/level change regime (eg for a lake); and
  - assess the change from the natural condition due to the pressures.

6.2 The assessment of data confidence and type and its acceptability to be used in the characterisation process will depend on the assessed risk/pressure, data availability and methods adopted by the UK agencies. Guidance 7a identifies the principles with respect to this assessment. Low resolution or low confidence data may be sufficient where there is a low risk of hydrological impact but increasing confidence and resolution will be required as the level of risk increases.

6.3 Specific data descriptors that may be used to support the risk assessment and pressure identification process are described below.

Subject	Data Form/Requirement	Explanatory Note
<b>Natural flows</b>	<ul style="list-style-type: none"> <li>relate to reaches or water bodies</li> <li>measured at some point upstream or downstream and extrapolated to the point of interest</li> <li>derived by modelling long-term catchment characteristics which may include calibration by comparison with an analogous catchment or short-term monitoring</li> <li>derived by more advanced modelling techniques eg rainfall-runoff modelling, or flow naturalisation by decomposition</li> </ul>	
<b>Pressures</b>	<ul style="list-style-type: none"> <li>relate to specific points or areas</li> <li>location referenced to the UK National Grid</li> <li>requirements for pressure data will depend upon the pressure type</li> </ul>	<ul style="list-style-type: none"> <li>will be part of information required for any regulation of the associated pressure but may not, necessarily, include details such as owner/operator</li> </ul>
	<ul style="list-style-type: none"> <li>where a particular pressure type is known to exist but there is insufficient data pertaining directly to the operation at that point, generic data related to the industry sector/usage may be used to enable the risk assessment to be completed</li> </ul>	<ul style="list-style-type: none"> <li>the level of confidence in, and effort exerted in collecting, such data should reflect the level of risk to which the water body may be subject</li> </ul>
<b>Impoundment</b>	<ul style="list-style-type: none"> <li>location referenced to the UK National Grid</li> </ul>	
	<ul style="list-style-type: none"> <li>nature of the structure (dam/weir, etc)</li> </ul>	
	<ul style="list-style-type: none"> <li>describe the quantity and pattern of any artificially-controlled releases from the structure</li> </ul>	<ul style="list-style-type: none"> <li>the risk of impact from such releases being dependent upon the deviation above or below natural conditions</li> </ul>
	<ul style="list-style-type: none"> <li>an estimated rate of abstraction and variability of the level (where known)</li> </ul>	<ul style="list-style-type: none"> <li>this can impact the status of the water body upstream of the impoundment</li> </ul>
	<ul style="list-style-type: none"> <li>define the point of intended discharge from the impoundment</li> </ul>	<ul style="list-style-type: none"> <li>which may impact the status of the receiving water</li> </ul>
	<ul style="list-style-type: none"> <li>identify the presence of any fish pass and or other means of maintaining the ecological and sedimentological continuum</li> </ul>	

Subject	Data Form/Requirement	Explanatory Note
Abstraction	<ul style="list-style-type: none"> <li>the peak rate</li> </ul>	
	<ul style="list-style-type: none"> <li>maximum daily &amp; maximum annual rate of abstraction</li> </ul>	
	<ul style="list-style-type: none"> <li>indication of the pattern of usage (including seasonality)</li> </ul>	
	<ul style="list-style-type: none"> <li>use to which the abstracted water is put</li> </ul>	Will relate to the net loss/impact upon the donor water body
	<ul style="list-style-type: none"> <li>Abstraction rate from a cluster of private potable abstractions = no of properties x typical occupancy rate x 200 (l/h/day)</li> </ul>	
	<ul style="list-style-type: none"> <li>Water use for agricultural and industrial activities should be estimated according to optimum use figures given EA R&amp;D report W6-056/TR2</li> </ul>	
Discharge Data	<ul style="list-style-type: none"> <li>the permit limits (where the discharge is controlled); or</li> </ul>	Required in order to complete any water balance for each water body
	<ul style="list-style-type: none"> <li>best estimate of the rate of flow</li> </ul>	
	<ul style="list-style-type: none"> <li>a measure of total annual quantity</li> </ul>	
	<ul style="list-style-type: none"> <li>pattern (including seasonality) of the discharge</li> </ul>	

## 7.0 Approach to Risk Assessment and Assigning of Significant Pressures

### 7.1 Hydrological Risk Characterisation

7.1.1 The purpose of screening is to characterise water bodies (or groups of waterbodies) into one of three risk categories based on the combined hydrological effect of all abstraction, discharge and flow regulation pressures. Each waterbody will be characterised as one of the following:

- Not At Significant Risk on the basis of available information**

Water bodies with no or very minor abstraction or flow regulation pressures acting on them, according to available information. Confidence in the available information may be high or low.
- Probably At Significant Risk**

Water bodies thought to be At Significant Risk from abstraction or flow regulation pressures but for which further information will be needed to make sure this view is correct. Available pressure data indicates that hydrological risk thresholds are exceeded but confidence in the pressure information is not considered sufficiently reliable. Ecological impact data if available appears to confirm a significant risk probably exists  
*(ie it is assessed as likely that there are one or more abstractions or flow regulation structures that may be acting as pressures on the water body but the location or magnitude of these is undetermined)*
- At Significant Risk**

Water bodies where the magnitude of abstraction and/or flow regulation pressures are much greater than the relevant hydrological risk threshold or there is otherwise high confidence that the hydrological risk threshold has been exceeded. Ecological impact data if available clearly confirms that a significant risk exists.

## **7.2 Common criteria for defining 'significant' pressures**

7.2.1 UK agencies will define at what magnitude and in what circumstances a pressure should be regarded as 'significant' for the purposes of Annex II, Section 1.4 of the Directive. Any identified abstraction and flow regulation pressures will be coded as described in Section 5. of this guidance.

7.2.2 The table below describes significant pressures that will need to be defined as part of the risk assessment and pressure identification process. Further information specific to each waterbody type (i.e. rivers, lakes & transitional waterbodies) is outlined in Annex D.

<b>Significant Pressure</b>	<b>Explanatory Note</b>
Where a 'significant hydrological change' to a water body or group of water bodies has been identified from risk assessment process identified in Section 7.3 of this guidance.	<ul style="list-style-type: none"> <li>Record data in accordance with Annex II of the Directive</li> <li>Minimum: record magnitude and type</li> </ul>
Significant abstraction and flow regulation pressures include: <ul style="list-style-type: none"> <li>groups of abstractions</li> <li>groups of flow regulation structures</li> <li>a single abstraction with large potential impact</li> <li>a single flow regulation structure with large potential impact</li> <li>combinations of the above</li> </ul>	<ul style="list-style-type: none"> <li>Abstraction pressure on its own may in some cases present risk of failure of a chemical or ecological objective or it may contribute to failure if combined with other pressures on a water body.</li> </ul>
Long term changes in pressures that may result in risk of failure of ecological objectives by 2015 including: <ul style="list-style-type: none"> <li>pressures not currently presenting a risk of failure of ecological objectives because they are adequately controlled by existing legislative arrangements, including flow constraints</li> <li>Future increases in abstractions/flow regulation where forecast from population/land-use data.</li> </ul>	<ul style="list-style-type: none"> <li>Levels of existing controls on pressures (licensed volumes, flow constraints etc) may in some cases be inadequate to prevent risk of failure of ecological objectives in 2015.</li> <li>Economic information may be required in order to forecast changes in demand in major sectors (data for industry sectors is available by SIC code refer Annex A)</li> </ul>

## **7.3 Risk Assessment Process**

7.3.1 A simple two (2) tier approach for identifying abstraction and flow regulation pressures and characterise risk has been adopted as consistent with Guidance 7a.

7.3.2 UK agencies may chose to adopt more comprehensive screening methods that incorporate the concepts outlined. Various tools have been adopted for risk assessment or aspects of the risk assessment process (as outlined by Annex C) by the various agencies and will be used as appropriate to support the characterisation process.

7.3 **Other** guidance documents identify specific pressures and thresholds (e.g. morphology, point source pollution pressures, etc). UK agencies will a) assess all pressures types for significance independently; and then b) combine risks to assess if a number of different pressure types are acting in combination on a water body to cause likely failure of objectives as per Guidance 7a.

**Comment [A3]:** This should be para 7.3.3

<b>1. Preparation for Screening</b>		
	<b>Description</b>	<b>Explanatory Notes</b>
Step 1.1	<b>Conceptualise the catchment</b>	May undertake: <ul style="list-style-type: none"> <li>• Simple mapping of provisional water bodies, typology and the location of known pressures; or</li> <li>• Conceptual modelling of interactions between groundwater, surface water and wetland areas</li> <li>• See IMPRESS guidance section 3.7.</li> </ul>
Step 1.2	<b>Determine scale and sites for screening assessments, considering:</b> <ul style="list-style-type: none"> <li>• <b>Likely hydrological impact</b></li> <li>• <b>Water bodies to be assessed (size, individual/group assessment, types of pressures)</b></li> </ul>	Size of water bodies: <ul style="list-style-type: none"> <li>• Group smaller water bodies of the same category and type with similar scale of pressures (refer IMPRESS guidance (Section 2.3.4) for grouping water bodies).</li> <li>• Larger water bodies should equal individual units</li> </ul> Basis of hydrological impact: <ul style="list-style-type: none"> <li>• Define location of points on a river system where impacts are assessed</li> <li>• Default position to be at or near the downstream end of a water body or group of water bodies</li> </ul> Assessment sites may be appropriate: <ul style="list-style-type: none"> <li>• downstream of major abstractions or flow regulation structures</li> <li>• at gauging stations</li> </ul>
Step 1.3	<b>Review data availability &amp; coverage</b>	<ul style="list-style-type: none"> <li>• Refer Section 6 and 7 of this guidance.</li> </ul>



<b>Step 2: Tier 1 - Initial Screening of water bodies into 'Risk' Categories</b>		
	<b>Description</b>	<b>Explanatory Notes</b>
Step 2.1	<b>Define whether due to the combined hydrological effect of all abstraction, discharge and flow regulation pressures, the waterbody is:</b> <ul style="list-style-type: none"> <li>• <b>Not At Significant Risk on the basis of available information;</b></li> <li>• <b>Probably At Significant Risk; or</b></li> <li>• <b>At Significant Risk</b></li> </ul> using Annex E, Section 1: 'Tier 1. Pressure Thresholds for Rivers, Lakes (flow sensitive), Lakes (level sensitive), Transitional Waters.	<ul style="list-style-type: none"> <li>• Tier 1 thresholds are defined for when the pressures do/do not present a risk focusing on                             <ul style="list-style-type: none"> <li>○ Abstraction pressures</li> <li>○ Flow regulation pressures</li> </ul> </li> <li>• Abstraction and flow regulation points acting as pressures may be:                             <ul style="list-style-type: none"> <li>○ local to the water body;</li> <li>○ located upstream; and/or</li> <li>○ include groundwater abstractions.</li> </ul> </li> </ul>
Step 2.2	<b>Scope pressures associated with waterbodies as listed in Section 7.2.</b>	<ul style="list-style-type: none"> <li>• Document according to Section 5 and Annexes A &amp; B of this guidance with supporting magnitude and type pressure</li> </ul>
<b>Product</b>	<b>Initial lists of water bodies broadly characterised with associated pressures identified.</b> <b>Note: The 'Probably At Significant Risk' category will be very broad at this stage</b>	



<b>Step 3. Tier 2 Screening of water bodies in 'Probably At Significant Risk' category</b>		
	<b>Description</b>	<b>Explanatory Notes</b>
Step 3.1  (Maybe reverse step 3.1 and 3.2)	<b>Screen 'Probably At Significant Risk' list of water bodies (or groups of water bodies) from Step 2.1 against Tier 2 thresholds for 'significant hydrological change' for Rivers, Lakes &amp; Transitional Waters (listed in Annex E, Section 2)</b>  Note: No thresholds have been set for coastal waters as no information exists to link measurable hydrological changes to abstraction and flow regulation pressures.	<ul style="list-style-type: none"> <li>• Tier 2 thresholds have been defined for type of waterbody (where possible) with respect to:                             <ul style="list-style-type: none"> <li>• The magnitude of abstraction &amp; flow regulation pressures on surface water bodies</li> <li>• The sensitivity of surface water bodies to those pressures</li> <li>• Interaction with dependent wetlands and groundwater</li> </ul> </li> <li>• Sensitivity bands will be described by UK agencies according to risk assessment tools used.</li> </ul>
Step 3.2	<b>Identify and document significant abstraction and flow regulation pressures and assess level of</b>	<ul style="list-style-type: none"> <li>• Use relevant information relating to the sensitivity of areas designated under EU Habitats Directive or Birds Directive to inform the risk assessment for these areas.</li> </ul>

	<b>confidence in data.</b>	
Step 3.3	<b>Review need for further information or investigations</b>	<p>Further investigations may be required depending on:</p> <ul style="list-style-type: none"> <li>• Risk due to other pressures acting in combination on the ecology of the water body</li> <li>• Sensitivity of the water body to abstraction/flow regulation pressures</li> <li>• Confidence in the risk screening exercise (refer UKTAG Guidance 7a Annex 1 for levels of confidence in assessments)</li> </ul>
Step 3.4 Common step with guidance for other pressures	<b>Assign a final risk category to waterbodies, based on individual screening assessments and pressures acting in combination</b>	<ul style="list-style-type: none"> <li>• Results of all individual screening assessments brought together</li> <li>• Expert opinion and local knowledge will be required to support producing final list of screened water bodies.</li> <li>• Levels of confidence in individual assessments will be taken into account when assigning final risk category</li> <li>• Refer UKTAG Guidance 7a for general principles of risk assessment</li> </ul>
<i>Product</i>	<b>Final list of water bodies categorised as Not At Significant Risk on the basis of available information; Probably At Significant Risk; At Significant Risk with supporting significant pressures and confidence levels.</b>	

**Annex A****Sub-set of Standard Industrial Classification (SIC) codes used for describing economic drivers/activities associated with pressures on waterbodies**

<i>Economic Driver/Activity</i>	<i>Sub-group</i>	<i>Code</i>
<b>Agriculture</b>	<i>Grow cereals &amp; other crops</i>	<i>0111</i>
	<i>Grow vegetables &amp; nursery products</i>	<i>0112</i>
	<i>Grow fruit, nuts, beverage &amp; spice crops</i>	<i>0113</i>
	<i>Farming of cattle, dairy farming</i>	<i>0121</i>
	<i>Farm sheep, goats, horses, etc.</i>	<i>0122</i>
	<i>Farming of swine</i>	<i>0123</i>
	<i>Farming of poultry</i>	<i>0124</i>
	<i>Other farming of animals</i>	<i>0125</i>
	<i>Forestry &amp; logging</i>	<i>0201</i>
<b>Fishing</b>	<i>Operation of fish hatcheries and fish farms</i>	<i>0502</i>
<b>Water Services</b>	<i>Collection, purify etc. of water'</i>	<i>4100</i>
	<i>Sewage and refuse disposal / sanitation</i>	<i>9000</i>
<b>Mining &amp; Quarrying</b>	<i>Opencast coal working</i>	<i>10102</i>
	<i>Deep coal mines</i>	<i>10101</i>
	<i>Quarrying of stone</i>	<i>1410</i>
<b>Manufacturing</b>	<i>Manufacture of food products and beverages</i>	<i>1500</i>
	<i>Meat processing and preserving</i>	<i>1510</i>
	<i>Dairy products</i>	<i>1550</i>
	<i>Distillers</i>	<i>1591</i>
	<i>Brewers</i>	<i>1596</i>
	<i>Mineral waters and soft drinks</i>	<i>1598</i>
	<i>Manufacture of textiles</i>	<i>1700</i>
	<i>Wood pulp</i>	<i>2111</i>
	<i>Manufacture of refined petroleum products</i>	<i>2320</i>
	<i>Chemicals and chemical products</i>	<i>2400</i>
<i>Pharmaceuticals &amp; medicinal products</i>	<i>2440</i>	
<b>Recreation &amp; Tourism</b>	<i>Camping sites</i>	<i>5522</i>
	<i>Sporting activities</i>	<i>9260</i>
<b>Transport</b>	<i>Sea and coastal water transport</i>	<i>6110</i>
	<i>Inland water transport</i>	<i>6120</i>
<b>Public Service</b>	<i>Hospital activities</i>	<i>8511</i>
	<i>Defence activities</i>	<i>7522</i>



**Annex B****Purpose of Use Codes**

<b>Purpose</b>	<b>Code</b>	<b>NALD ref.</b>
<b><i>Agriculture</i></b>		
Animal / stock watering	StW	010
Horticultural use	HoR	210
Dilution - effluent / slurry	DIL	070
Fish farm	FFm	090
Spray irrigation	SIR	400
Trickle irrigation	TIR	
<b><i>Industrial</i></b>		
Process water	PRO	350
Cooling – evaporative	CEv	080
Cooling - non-evaporative	COt	310
Hydro-electric generation	HEP	240
Milling / water power other than electricity generation	HDP	290
Gas suppression / scrubbing	GSu	110
Dust suppression	DSu	060
Washing – food	WFd	460
Washing - general / process	WGn	190
Washing – mineral	WMn	300
Washing - laundry use	WLn	270
Heat pump	HPu	200
Conveying materials	CMa	030
<b><i>Potable Supply</i></b>		
Public potable water supply	PWS	330
Private potable water supply	TWS	050
<b><i>Domestic use at commercial property</i></b>		040
Bottled water	BTW	470
Raw water supply	RWS	360
<b><i>Recreation / Environment</i></b>		
Fish / Canoe pass	FCp	100
Pollution remediation	Pol	320
River recirculation	RRe	370
Lake / pond throughflow	LRe	250
Large garden watering	LGa	260
Make up or top up water	MKU	280
Flood defence	FDf	
<b><i>Navigation</i></b>		
Navigation – canal	NvC	430
Navigation – other	NvO	

**Annex C****Hydrological tools that may be used by UK Agencies  
to support implementation of this Guidance**

<b>Name</b>	<b>Title</b>	<b>Description</b>	<b>Agency (Location)</b>
DHRAM	Dundee Hydrological Regime Assessment Method	<ul style="list-style-type: none"> <li>A set of methods for the assessment of anthropogenic impacts on the hydrology of Scotland's rivers and lochs</li> <li>Practical approach enables classification of impact on ecology (5 classes)</li> </ul>	Scottish Environment Protection Agency (Scotland only)
RAM Framework	Resource Assessment and Management	<ul style="list-style-type: none"> <li>Framework for management with accompanying spreadsheets and presentation tools.</li> <li>Current version 3.0 in use as technical basis for Environment Agency's CAMS programme</li> </ul>	Environment Agency (England & Wales)
(Under development)	Risk Assessment Methods for Abstraction and Flow Regulation Pressures on Surface Water Bodies	<ul style="list-style-type: none"> <li>Development of aspects of the RAM framework for specific application to 'fit for purpose' assessment of quantitative pressures on surface waters in England and Wales</li> </ul>	Environment Agency (England & Wales)
Low Flows 2000	National flow network mode	<ul style="list-style-type: none"> <li>Enables estimation of naturalised flow and flow statistics for any reach on the river system</li> </ul>	Designed by CEH for the EA and SEPA (UK)
	Rainfall-Runoff models	<ul style="list-style-type: none"> <li>Region specific models allowing estimation of river flows and recharge to aquifers on the basis of rainfall data, soil properties, aquifer characteristics etc</li> </ul>	Agency/region specific
	IGARF Software	<ul style="list-style-type: none"> <li>Relatively simple to use spreadsheet tools, designed to predict the impact of groundwater abstraction on river flows.</li> <li>Require input of estimated aquifer properties, river dimensions and abstraction details</li> </ul>	
	Numeric GW Models	<ul style="list-style-type: none"> <li>Individual digital models constructed to simulate the behaviour of groundwater and associated river systems.</li> <li>May be data intensive and time consuming</li> <li>Can give quite reliable results for aquifers such as chalk and sandstone</li> </ul>	

**Annex D Factors to be considered when identifying pressures for Rivers, Lakes & Transitional Waters**

Pressures	Rivers	Lakes	Transitional Waters
<b>Abstraction Pressures</b>	<ul style="list-style-type: none"> <li>Magnitude of abstraction pressures on rivers may be expressed in terms of their net hydrological impact (measured or estimated) at the assessment point for a water body or group of water bodies</li> <li>Net impacts should include any reliable resource returned to the river above assessment point including transfers from another catchment.</li> <li>Discharge quantities should be included if there is reasonable confidence these will not be reduced or relocated in the near future</li> <li>Tier 2 net impact thresholds (Annex E, Section 2.1) are proposed as greater than % of QN95, QN70, QN50, and QN5.</li> </ul>	<ul style="list-style-type: none"> <li>Abstraction and flow regulation pressures on lakes could cause significant water level fluctuation and changes to hydraulic retention time.</li> <li>An estimate of the net hydrological change as a result of pressures on the lake will be needed to support the screening process.</li> <li>Base reference could equal either:                             <ol style="list-style-type: none"> <li>the long-term effective precipitation to the catchment of the lake; or</li> <li>long-term natural outflow from the lake if available).</li> </ol> </li> <li>Refer Annex E, Section 2.2 for specific thresholds.</li> </ul>	<ul style="list-style-type: none"> <li>Assumption: the impact of abstraction and flow regulation pressures will be related to the reduction in freshwater flow to the transitional water body, (recognising that the overriding freshwater flow input to a transitional water body will be from the main river or rivers feeding it).</li> <li>The magnitude of pressures on the transitional water body is best expressed in terms of their net hydrological impact (measured or estimated) at the downstream freshwater point of each river system.</li> </ul>
<b>Flow Regulation with respect to impoundments</b> <i>(Impoundments are most likely to impact on morphology. Refer Guidance 7c on morphological pressures)</i>	Options to be applied as relevant: <ol style="list-style-type: none"> <li>Use threshold for flow reductions at QN5 (refer Annex E, section 2.1) to capture effects of flood flows on sediment transport which in turn may impact on river ecology; <u>or</u></li> <li>If volume data is readily available, define threshold related to:                             <ul style="list-style-type: none"> <li>volume of storage behind impoundments; or</li> <li>volume of storage as a percentage of mean annual flow.</li> </ul> </li> </ol>	<ul style="list-style-type: none"> <li>If a lake has been created or modified by an impoundment then the risk to the lake itself should be assessed first according to the Tier 1 Pressure Thresholds outlined in Table 1.1 and 1.2 of Annex E under the sub-heading: <i>Flow regulation pressures from impoundments.</i></li> </ul>	N/A
<b>Groundwater abstraction</b>	<ul style="list-style-type: none"> <li>Abstraction pressures should include groundwater abstractions unless these are clearly not connected to the river system.</li> </ul>	<ul style="list-style-type: none"> <li>A screening methodology is proposed to identify lakes where groundwater abstraction impacts could be significant. Reference drafting group 7h guidance</li> </ul>	<ul style="list-style-type: none"> <li>Abstraction pressures should include groundwater abstractions unless these are clearly not connected to the river/transitional water system.</li> </ul>
<b>Sensitivity of the ecology of the water body</b>	<ul style="list-style-type: none"> <li>Tier 2 thresholds should relate to the sensitivity of the ecology of the water body (under reference conditions) to changes in flow</li> </ul>	<ul style="list-style-type: none"> <li>A single set of thresholds is proposed for lakes because little is understood about their sensitivity to changes in flow</li> </ul>	<ul style="list-style-type: none"> <li>Application of thresholds for high/medium/low sensitivity should primarily relate to the sensitivity of the ecology of the water body (under reference conditions) to changes in salinity.</li> <li>Information is available on the MARlin website <a href="http://www.marlin.ac.uk">www.marlin.ac.uk</a> about the distribution and sensitivity of biotopes in estuaries and coastal waters. From these it may be possible to define sensitivity categories for transitional waters.</li> </ul>

**Comment [A4]:** No need for a separate box – this is all part of abstraction pressures

## Annex E

### **Provisional thresholds for identification of significant abstraction and flow regulation pressures.**

Annex E specifically refers to identifying significant abstraction and flow regulation pressures with thresholds split into two tiers:

- Tier 1 Pressure Thresholds for Rivers, Lakes (flow sensitive), Lakes (level sensitive), Transitional Waters and Coastal Waters
- Tier 2 Thresholds for 'significant hydrological change' for Rivers, Lakes & Transitional Waters

These thresholds **do not** take into account the effects of other major pressures on a water body. It is recognised that:

- Abstraction pressure may contribute to failure of a chemical or ecological objective combined with other pressures on a water body.
- Particularly, pressures from point source pollution and diffuse pollution may act in combination with abstraction and flow regulation pressures. Thresholds (at Q95 gauged flow) for point source discharge pressures on the quality of rivers and transitional waters are given in the report of Guidance 7e.
- A potential impact related to abstraction is the entrainment of fish on intakes of large abstractions. It is important that such pressures are reported. UK Agencies should set appropriate thresholds for screening based on size of abstraction.
- Pressures that cause morphological change may also act in combination with hydrological pressures on surface waters. For example these could be flood-protection structures, weir structures or an activity such as dredging.

#### **1. Tier 1 Pressure Thresholds for Rivers, Lakes (flow sensitive), Lakes (level sensitive), Transitional Waters and Coastal Waters**

*For each waterbody type, provisional thresholds have been established to initially screen water bodies, ie 'Probably at Significant Risk due to hydrological changes' from a) Not At Significant Risk on the basis of available information; and b) At Significant Risk categories (refer Tables 1.1 and 1.2 below respectively).*

*There is likely to be a large number of water bodies that fall between these two categories including water bodies 'Probably at Significant Risk' but for which further information will be needed to make sure this view is correct.*

The thresholds applied at Tier 1 are designed to assess pressures quickly but measurably, in the main drawing on expert opinion and local knowledge. Tier 2 screening will improve the certainty with respect to waterbodies being assigned into the 'At Significant Risk' or Not at Significant Risk on the basis of available information' categories (refer Step 3 of Guidance 7b).

**Table 1.1 Tier 1 thresholds for where pressures do not present a Significant Risk**

Water body	Threshold (provisional)	When	Ref *
<b><i>Combined abstraction and flow regulation pressures</i></b>			
Rivers	<10% hydrological change relative to natural flow conditions	At all times	Expert Opinion
Lake (flow sensitive)	<10% change in outflow relative to natural flow conditions	At all times	Expert Opinion
Lakes (level sensitive)	<0.1m change in level relative to natural level	At all times	Expert Opinion
Transitional Waters	<10% change in total freshwater flow input relative to natural flow conditions	At all times	Expert Opinion
Coastal Waters	N/A		
<b><i>Flow regulation pressures from Impoundments</i></b>			
Any water body affected by an impoundment	Hydrological thresholds above are not crossed		

**Table 1.2 Tier 1 thresholds for where abstraction or flow regulation pressures place a waterbody at Significant Risk**

Waterbody	Threshold (provisional)	When	Ref *
<b>Combined abstraction and flow regulation pressures</b>			
Rivers	>40% hydrological change relative to natural flow conditions	At Significant Risk if crossed at Q5 or Q50 or Q70 or Q95	RAM @low sensitivity
Lake (flow sensitive)	>40% change in outflow relative to natural flow conditions	At Significant Risk if exceeded on annual average	Expert Opinion
Lakes (level sensitive)	>5m change in level relative to natural level	At Significant Risk if exceeded on annual average	DHRAM
Transitional Waters	>50% change in total freshwater flow input relative to natural flow conditions	At Significant Risk if exceeded on annual average	Expert Opinion
Coastal Waters	N/A		
<b>Flow regulation pressures from impoundments</b>			
Any water body directly above or below an impoundment	Flow regulation presents a Significant Risk unless the physical alterations are too minor for the water body to be considered as heavily modified		
Any water body lying between a cascade of linked impoundments	Flow regulation presents a Significant Risk unless the physical alterations are too minor for the water body to be considered as heavily modified		

## **2.0 Tier 2 Thresholds for 'significant hydrological change' for Rivers, Lakes & Transitional Waters**

The section below outlines the sensitivity thresholds for 'flow reduction' for each: water body type

- Rivers (Section 2.1)
- Lakes (Section 2.2)
- Transitional Waters (Section 2.3)

***Under these thresholds, water bodies will be characterised the 'At Significant Risk' if they are greater than the percentiles listed in the tables.***

Where a single threshold is chosen, this would be considered the primary criterion. Where a combination of thresholds is used, then simple rules may be required and should be documented by each Agency. Where possible, hydrological change thresholds should:

- combine effects of abstraction and flow regulation pressures; and
- include the effects of reliable discharge quantities.

Tier 2 thresholds for flow increases in rivers, lakes and transitional waters have **not** been defined, although UK agencies may set thresholds as part of localised risk assessment approaches.

### **2.1 Tier 2 Sensitivity thresholds For 'Flow Reduction' with respect to Rivers**

Sensitivity to flow	% hydrological impact relative to natural flow <sup>1,2,4</sup>				Ref <sup>3</sup>
	@ QN5	@ QN50	@ QN70	@ QN95	
High **	20%	20%	15%	10%	RAM
Moderate	25%	25%	20%	15%	RAM
Low	40%	40%	30%	25%	RAM

Note:

1. UK Agencies may decide to add further categories and thresholds eg for very high and very low sensitivity. Sensitivity definitions should primarily relate to the sensitivity of the ecology of the water body (under reference conditions) to changes in flow.

- 2. Risk Assessment Method (RAM): where thresholds are derived approximately from RAM ecological flow objective rounded to the nearest 5%
- 3. Tier 2 thresholds are proposed as a % of QN95, QN70, QN50, and QN5. Local decisions will be needed as to which percentile or combination of percentiles is appropriate for a specific river system and the pressures on it. For example in some river systems potential hydrological impacts at Q95 are likely to be masked by flow constraints, therefore thresholds at Q70 or Q50 would be more appropriate. The thresholds at QN5 could be used if abstraction impacts at high flows were a concern

**2.2 Tier 2 Sensitivity thresholds for ‘Flow reduction’ in Lakes**

Two thresholds have been set (as described in tables below):

- a) Relating to % change in hydraulic retention time; and
- b) where it possible that marginal ecology or associated wetland is sensitive to water level fluctuations

Where both tests are applied and only one threshold is exceeded, the water body should be assessed at Significant Risk (with low confidence) and prioritised for further investigation

Sensitivity to flow	% hydrological impact relative to natural flow			Ref *
	@ QN50	@ QN70	@ QN95	
All categories <sup>1</sup>	25%	20%	15%	Expert Opinion

**Note:**

- 1. Use threshold at QN50 if long term average natural flow or effective precipitation is used as reference

Sensitivity to level	% increase in average annual range of lake level	Ref *
All categories <sup>2</sup>	>30%	Expert Opinon

**Note:**

- 2. The thresholds set are based on expert opinion (in accordance with the Guidance 7f). The use of existing environmental monitoring data and other information for Risk Assessment of Lakes.

**2.3 Tier 2 Sensitivity thresholds for Flow Reduction in Transitional Waters**

Sensitivity of main river contributing to transitional water	% hydrological impact relative to natural flow <sup>1,2,3</sup>			Ref
	@ QN50	@ QN70	@ QN95	
High	35%	30%	25%	Expert Opinion
Moderate	35%	30%	25%	Expert Opinion
Low	50%	40%	35%	Expert Opinion

**Notes:**

- 1. Thresholds are proposed as a % of QN50, QN70 and QN95.
- 2. If potential hydrological impacts at Q95 are likely to be masked by flow constraints it is recommended that QN70 is used, in this case a simple comparison of gauged and naturalised flow at Q70 would be sufficient. However if large abstractions exist in the tidal section of the river an estimate of the additional impact of these on freshwater flows may need to be included.
- 3. Provisional thresholds are based on the assumption that the transitional water body will be less sensitive to changes in freshwater flow than the main river feeding it. Thresholds are proposed relating to high, moderate or low sensitivity contributory rivers. Thresholds need to be trialled and results should be treated with low confidence at this stage.