

North South Shared Aquatic Resource (NS Share)

Water Framework Directive

A Directive establishing a new framework for Community action in the field of water policy (2000/60/EC) came into force in December 2000. This Water Framework Directive (WFD) rationalises and updates existing legislation and provides for water management on the basis of River Basin Districts (RBDs). The WFD was transposed into national law in Northern Ireland by the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003 and in the Republic of Ireland by the European Communities (Water Policy) Regulations 2003. The primary objective of the WFD is to maintain the “high status” of waters where it exists, prevent deterioration in existing status of waters and to achieve at least “**good status**” in relation to all waters by 2015.

NS Share Study Area

NS Share is a cross border project and incorporates three River Basin Districts as set out in the joint North/South Consultation paper *Managing our Shared Waters*:

1. North Western International River Basin District (NWIRBD);
2. Neagh Bann International river Basin District (NBIRBD);
3. North Eastern River Basin District (NERBD).

The NW and NB are International River Basin Districts as they share their waters between Northern Ireland (NI) and Republic of Ireland (ROI). The NERBD is contained wholly within NI.

NS Share Project

The overall objective of the project is to strengthen inter-regional capacity for environmental monitoring and management at the river basin district level, to improve public awareness and participation in water management issues, and to protect and enhance the aquatic environment and dependent ecosystems. The NS Share project aims to facilitate delivery of the objectives of the WFD within the project area between August 2004 and March 2008.

The NS Share project is funded by the EU INTERREG IIIA Programme for Ireland / Northern Ireland. The Department of the Environment (NI) and the Department of the Environment, Heritage and Local Government (ROI) are implementing agents for the project. Donegal County Council is the project promoter. Technical support is provided by the Environment and Heritage Service an agency within the Department of the Environment (NI), and the Environmental Protection Agency (ROI). RPS Consulting Engineers in association with Jennings O'Donovan are the principal consultants.

Assistance was also provided by the Marine Institute, Central Fisheries Board, Geological survey Ireland, Geological survey Northern Ireland, Loughs Agency, North West Regional Fisheries Board, and Cavan, Leitrim, Longford, Louth, Meath, Monaghan, and Sligo County Councils.

Project publications are available at www.nsshare.com/publications

PREFACE

The work presented in this paper was carried out as part of the NS SHARE project, which is funded by the European Union INTERREG IIIA programme for Ireland/Northern Ireland. The implementing agents for the NS SHARE project are the Department of Environment (DOE), Northern Ireland, and the Department of Environment Heritage and Local Government (DEHLG), Republic of Ireland. Donegal County Council (DCC) is the project promoter.

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FINAL

This is a report on the different approaches to risk assessment adopted by the competent authorities in Northern Ireland and the Republic of Ireland. It documents the different approaches and datasets used in implementing Article 5 of the Water Framework Directive in the Island of Ireland.

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For & On Behalf of the National Risk Assessment Working Group					
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Executive Summary

This report documents the approaches adopted for the risk assessment within the North South Share study area by the competent authorities responsible for the implementation of the Water Framework Directive. Risk Assessment is undertaken in accordance with the requirement, under Article 5 (1) of the Water Framework Directive (WFD), for Member States to undertake, for each river basin district, “a review of the impact of human activity on the status of surface waters and on ground waters”.

Within the island of Ireland there are three international River Basin Districts; the North Western IRBD, Neagh Bann IRBD and the Shannon IRBD which straddle the border between Northern Ireland (UK) and the Republic of Ireland (RoI). It is therefore essential, under Article 3 of the WFD that the competent authorities in both Member States attempt to harmonise, as far as is possible, the approaches adopted in the implementation of the Directive.

The pressure and impact analysis has been carried out in each jurisdiction of the NS SHARE study area.

The pressures and impacts analysis assesses impacts using where available:

- (a) Direct measurements of impacts from existing environmental monitoring (e.g. water quality monitoring data); and
- (b) Predictions of impacts based on an assessment of the likely effects of identified pressures.

This report has assessed the methodologies employed and documents any differences in the risk assessments employed. This process will assist in the harmonisation of the risk assessment for the NS SHARE project.

Surface Water Bodies

Abstraction and flow regulation – The methodology employed to assess the risk in relation to abstraction and flow regulation in both jurisdictions was an assessment of the deviation from natural flows. In Northern Ireland the Micro Low Flows software was used to estimate both the natural annual mean flow and low flows (Q95) whilst in the Republic of Ireland low flows were derived from gauged flows. For lake water bodies the low flow statistic used was different in both jurisdictions, Northern Ireland used the mean annual flow to assess lake and impounded river water body flow deviation whereas the Republic of Ireland used the Q95 statistic.

Morphology – In relation to the morphological risk assessment, River Habitat Surveys were used to determine the impact on the morphology of rivers, where this information was not available or inadequate it was supplemented by national datasets and land use information. In the Republic of Ireland, river habitat surveys were not available so national datasets and land use information were employed to carry out the risk assessment. Both jurisdictions used the impact on feeder streams to inform the risk assessment for lakes. In relation to coastal waters aquaculture and commercial fishing

was included in the Northern Ireland morphological risk assessment, this is proposed for the Republic of Ireland through further characterisation.

Point Source Pollution – The differences in the risk assessment for point source pollution relate mainly to dataset availability. Northern Ireland included priority substances and water/wastewater treatment plants with a population equivalent of 250 or higher. In the Republic of Ireland an assessment of the priority substances was not considered in the point source pollution assessment and a population equivalent of 500 was the threshold for the consideration of water/wastewater treatment plants. The smaller treatment plants have been incorporated into the diffuse assessment.

Diffuse Source Pollution – In Northern Ireland the Diffuse Pollution Screening Tool was used to predict the impact of diffuse pollution where impact data was not available, in the Republic of Ireland empirical relationships were developed based on land-use information, topography, soil types and pressure datasets.

A precautionary approach was used when considering the risk assessment in Northern Ireland in that if either the impact data or the pressure data showed the water body at risk then this risk category was applied. In the Republic of Ireland the Q values impact data took precedence over all pressure assessments and other impact data, i.e. if Q values indicated a water body had good status then this risk category was assigned regardless of what the pressure assessment suggested.

In Northern Ireland catchments draining into Lough Neagh and Lough Erne were considered as sensitive under the UWWT Directive and assigned a 1b category, with the Loughs themselves assigned an “at risk” (1a) category. In the Republic of Ireland specific water bodies have been designated as sensitive and not entire catchments.

In relation to agricultural diffuse pollutants Northern Ireland assumed that a probability between 0.5 and 0.8 of an agricultural pollutant being less than a predefined threshold placed the water body in the “probably at risk” category. In the Republic of Ireland the probability range for agricultural pollutants was between 0.25 and 0.6.

Groundwater Risk Assessment – Both assessments used the simple pressure, pathway, receptor model to identify the impacts on groundwaters are likely to occur. In Northern Ireland point source pollution can place the entire water body at risk whereas in the Republic of Ireland significant point source pressures have been identified and where necessary local groundwater bodies defined to target specific problems.

Other Assessments – In Northern Ireland, alien species and protected areas were assessed as part of the pressure and impacts analysis under other assessments. In the Republic of Ireland alien species, protected areas and commercial fishing were assessed in the pressure and impacts analysis. In Northern Ireland the commercial fishing pressures were assessed under the morphological risk

assessment. In the ROI these assessments are used as shadow assessments to inform the development of a programme of measures whereas in Northern Ireland those pressures considered under “other assessments” were included in the overall risk assessment.

The risk assessment review of the approaches taken in both jurisdictions of the NS SHARE has highlighted some differences in the risk assessments. These differences vary with some resulting from data availability and dataset differences whilst others are a result of the interpretation of the risk assessment guidance and higher level policy decisions. The NS SHARE project will address these issues as part of the further characterisation process.

List of abbreviations

AADT	Annual Average Daily Traffic
AER	Annual Environmental Returns
AWB	Artificial Water Body
BRC	Background Reference Conditions
CFB	Central Fisheries Board
CIS	Common Implementation Strategy
CORINE	Co-ordination of Information on the Environment
CSO	Combined Sewer Overflow
DARD	Department of Agriculture and Rural Development
DCMNR	Department of Communications, Marine and Natural Resources
DPSIR	The Driver, Pressure, State, Impact and Response framework for environmental analysis
DPST	Diffuse Pollution Screening Tool
EA	Environment Agency
EAC	Ecotoxicological Assessment Concentration
EHS	Environment and Heritage Service
EPA	Environmental Protection Agency
EQS	Environmental Quality Standards
EU	European Union
FEPA	Food and Environment Protection Act
GB	Great Britain
GIS	Geographic Information Systems
GQA	General Quality Assessment
GWDTE	Groundwater Dependent Terrestrial Ecosystems
GWVG	Groundwater Working Group
HMI	Habitat Modification Index
HMS	Habitat Modification Score
HMWB	Heavily Modified Water Body
IMPRESS	an informal working group dedicated to the identification of pressures and assessment of impacts within the characterisation of water bodies
IPC	Integrated Pollution Control
IRBD	International River Basin District
IWAI	Inland Waterways Association of Ireland
IUCN	International Union for the Conservation of Nature
LCM	Land Cover Map
MF	Mean Flow
NI	Northern Ireland
NPWS	National Parks and Wildlife Service

NS SHARE	North South Shared Aquatic Resource
OPW	Office for Public Works
OS	Ordnance Survey
OSPAR	Oslo Paris Convention
PAH	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PE	Population Equivalent
Q95	95 percentile flow (low flow statistic)
RBD	River Basin District
RBMP	River Basin Management Plan
RHS	River Habitat Survey
RoI	Republic of Ireland
SAC	Special Area of Conservation
SEPA	Scottish Environmental Protection Agency
SPA	Special Protection Area
TAG	Technical Advisory Group
TBT	Tributyltin
UK TAG	UK Technical Advisory Group
UWWT	Urban Waste Water Treatment
VDSI	Vas Deferens Sequence Index
WB	Water Body
WFD	Water Framework Directive
WTW	Water Treatment Works
WWTW	Waste Water Treatment Works

1.0 Introduction

Risk Assessment is undertaken in accordance with the requirement, under Article 5 (1) of the Water Framework Directive (WFD), for Member States to undertake, for each river basin district, “*a review of the impact of human activity on the status of surface waters and on ground waters*”. Annex II provides technical specifications for the identification of significant pressures to which water bodies in each River Basin District are subjected to and requires that an assessment of the degree to which they are at risk of failing to meet the environmental quality objectives for each water body under Article 4.

The coordination of administrative arrangements within river basin districts is critical to the successful implementation of the Water Framework Directive as discussed in Article 3 of the Directive, “*Member States should ensure that the requirements of the Directive for the achievement of environmental objectives established under Article 4 are coordinated for the whole of the river basin district. For international river basin districts the Member States concerned shall together ensure this coordination...*” Within the island of Ireland there are three international River Basin Districts; the North Western IRBD, Neagh Bann IRBD and the Shannon IRBD which straddle the border between Northern Ireland (UK) and the Republic of Ireland (RoI). It is therefore essential that the competent authorities in both Member States attempt to harmonise, as far as is possible, the approaches adopted in the implementation of the WFD. The co-ordination and harmonisation of the environmental objectives for the international River Basin Districts are objectives of the NS SHARE project and will be developed through this project.

This report deals specifically with the risk assessment applied to both surface waters and groundwater in both jurisdictions.

Guidance

Guidance documents relevant to the pressure and impact analysis task of the characterisation process have been produced at a European Level by the IMPRESS working group under the Common Implementation Strategy (CIS) and at UK level through the UK Technical Advisory Group (UK TAG). The CIS and UK TAG Guidance documents were reviewed in the development of the risk assessments for both jurisdictions. Both Northern Ireland and the Republic of Ireland have produced Risk Assessment summary documents and these have been listed in Table 1.1. Further information can be obtained from the Environment and Heritage Service website (for Northern Ireland):

(<http://www.eh.sni.gov.uk/environment/waterManage/wfd/characterisation.shtml>)

and the WFD Ireland website (for Republic of Ireland):

(<http://www.wfdireland.ie/>)

Table 1.1 Risk Assessment Summary Documents

Risk Assessment Category	Guidance Document (version)
Northern Ireland	
General	Pressure and Impact Analysis Summary (13/12/04)
Groundwater	Groundwater Risk Assessment Summary (13/12/04)
Surface Water	Water Abstraction and flow Regulation risk Assessment Summary (13/12/04)
	Water Resources Methodology for the Assessment of Abstraction and Flow Regulation Pressures on Surface Waters and Transitional Waters in Northern Ireland (10/12/04)
	Morphology Risk Assessment Summary (13/12/04)
	Risk Assessment Methodology for Morphological Pressures (16/12/04)
	Point Source Pressures Risk Assessment Summary (13/12/04)
	Draft Risk Assessment Methodology for: Pressures from Point Source Pollution (version 4)
	Diffuse Pollution Risk Assessment Summary (13/12/04)
	Draft Risk Assessment Methodology for: Pressures from Diffuse Pollution (14/12/04)
	Draft Risk assessment methodology for use of impact data to assess freshwater water bodies 'at risk' (version 5, 26/08/04)
	NI Lakes impact data risk assessment methodology (version 1, 27/05/04)
	Impacts (Freshwater) Assessment Summary (13/12/04)
	Draft Risk Assessment Methodology for Alien Species (11/05/04)
	Other Human Pressures Risk Assessment Summary (13/12/04)
	Draft Risk Assessment Methodology for Natura Protected Areas (15/12/04)
Coastal and Transitional Waters Risk Assessment Summary (13/12/04)	
Progress on the implementation of the Water Framework Directive in Coastal and Transitional waters of Northern Ireland (Final report, Nov 04)	
Republic of Ireland	
Groundwater	Guidance on pressures and impacts methodology (August 04)
	Guidance on the assessment of the impact of groundwater abstractions (March 05)
	Advice on the implementation of guidance monitoring groundwater (March 05)
	Point source pressure risk assessment for groundwaters (March 05)
	Methodology for risk characterisation Ireland's groundwater (March 05)
	Guidance on the assessment of pressures and impacts on groundwater dependent terrestrial ecosystems (March 05)

Risk Assessment Category	Guidance Document (version)
Surface Water	WFD Surface Water Hydrology Risk Assessment Methodology (12 Nov 04)
	WFD Surface Water Morphological Risk Assessment Methodology (12 Nov 04)
	WFD Surface Water Point Source Discharges Risk Assessment Methodology (12 Nov 04)
	WFD Rivers Diffuse Pollution Risk Assessment Methodology (12 Nov 04)
	WFD Surface Water Lakes Risk Assessment Methodology (March 05)
	WFD Marine Direct Impact Risk Assessment Methodology (March 05)
	WFD Fresh Water Pearl Mussel (Margaritifera) Risk Assessment Methodology (March 05)
	WFD Fishing & Aquaculture Risk Assessment Methodology (March 05)
	WFD Bathing Waters Impact Data Risk Assessment Methodology (March 05)
	WFD Alien Species Risk Assessment Methodology (March 05)

2.0 Aims and Scope

The aim of this document is to summarise the methodologies used in the risk assessment process in Northern Ireland and the Republic of Ireland and to identify differences in:

- Dataset availability and structure;
- Interpretation of risk assessment guidance; and
- Higher level policy decisions that are fundamental to the assessment of impacts and pressures.

This report records and documents the different methodologies used in the Article 5 risk assessment process within both Member State's jurisdictions in the NS SHARE study area. The report will facilitate the identification of any additional work required through further characterisation and will assist in the harmonisation of the approaches to the implementation of the Water Framework Directive throughout the NS SHARE.

3.0 General Risk Assessment Methodology

3.1 Overview

The purpose of the risk assessment is to identify surface water bodies and groundwater bodies at risk of failing the objectives of the directive due to the effect of human activities. The risk relates to the probability of a water body failing to achieve good status or suffering deterioration in status.

The WFD originally required reporting of water bodies under two categories **at risk** or **not at risk**. In December 2004 the EU Commission's Reporting Sheets refined the reporting categories to at least one of three following categories, namely **at risk**, **risk uncertain** or **not at risk**. This recognised that further characterisation was necessary for some water bodies to determine risk with certainty. This was due to information gaps.

The categories adopted to describe the water body's degree of risk are presented in Table 3-1. It was considered that use of four categories (**at significant risk**, **probably at significant risk**, **probably not at significant risk** and **not at significant risk**) improved the prioritisation of follow-up actions and recognised the uncertainties associated with the analysis and/or datasets. These categories were developed by the UK WFD Technical Advisory Group (UK TAG). The adoption of the same system in Ireland assisted with harmonising assessment and reporting between Ireland and its ecoregion neighbours and counterparts therefore facilitating the characterisation of Irish international RBDs.

The assessment of pressures and impacts is described in the Common Implementation Strategy (CIS) Pressures and Impacts Guidance Document (IMPRESS) guidance. The approach adopted in the IMPRESS guidance is the DPSIR framework (Driver, Pressure, State, Impact, and Response) where:

- Driver = an anthropogenic activity that may have an environmental effect;
- Pressure = a direct effect of the driver;
- State = the condition of the water body as a result of natural and anthropogenic factors;
- Impact = the environmental effect of the pressure;
- Response = the measures taken to improve the state of the body including those to reduce pressures.

Table 3-1 Risk Assessment Reporting Categories

WFD Risk Category	European Commission Reporting Sheet Risk Categories (Dec. 2004)	Reporting Risk Categories
Water bodies at risk of failing to achieve an environmental objective	Water bodies for which it is already clear without the need for further characterisation or additional monitoring data, that the objectives will be failed	<p>(1a) Water bodies at significant risk</p> <p>Action: Identifies water bodies for which consideration of appropriate measures to improve status can start as soon as practical</p>
	Water bodies where, due to insufficient data , further characterisation and operational monitoring are necessary for a clear assessment of to be made	<p>(1b) Water bodies probably at significant risk but for which further information will be needed to confirm that this view is correct</p> <p>Action: Focus for more detailed risk assessments (including, where necessary, further characterisation) aimed at determining whether or not the water bodies in this category are at significant risk in time for the publication of the interim overview of significant water management issues in 2007</p>
Water bodies not at risk of failing to achieve an environmental objective	Water bodies for which it is already clear, without the need for further characterisation or additional monitoring data, that the achievement of the objectives are not at risk	<p>(2a) Water bodies probably not at significant risk on the basis of available information for which confidence in the available information being comprehensive and reliable is lower</p> <p>Action: Focus for more detailed risk assessments aimed at determining whether or not the water bodies in this category are not at significant risk in time for the publication of the draft River Basin Management Plan due to be completed in 2008</p>
	Water bodies for which it is already clear, without the need for further characterisation or additional monitoring data, that the achievement of the objectives are not at risk	<p>(2b) Water bodies not at significant risk on the basis of available information for which confidence in the available information being comprehensive and reliable is high</p> <p>Action: Identifies water bodies for which consideration of appropriate measures to ensure no deterioration in status can start as soon as practical</p>

In assessing the impact of human activity it is important to have a thorough understanding of the **driving** forces behind **pressures** that **impact** on water bodies leading to their current **state** so that the an appropriate **response** can be implemented and its effectiveness reviewed.

The risk assessment process draws on the DPSIR model by incorporating both top-down (pressure driven) and bottom-up (impact driven) approaches. The pressures analysis uses predictive techniques and available information on the extent of human activities, such as land use mapping, to identify water bodies experiencing significant pressures and, therefore, potentially at the greatest degree of

risk of failing to achieve their objectives. The impacts analysis incorporates knowledge provided by existing monitoring activities, for example biological monitoring data or chemical concentrations in the water environment. The impact assessment identifies any water bodies that exhibit what is currently judged as deteriorated water status. However, it should be noted that new comprehensive status classification schemes are still under development and will not be finalised until 2006.

The risk assessment for both surface water and groundwater bodies have been considered individually under the main anthropogenic pressures identified for the respective water bodies. Details of the approaches adopted for the risk assessment required under Article 5 of the Directive are summarised in this report.

3.2 Trend Analysis / Future Changes considered in the Risk Assessment

The first pressures and impacts analysis is essentially an initial characterisation. The findings of this first analysis represent the best attempt at the assessment of current human activities and are based on the best available information. The availability and detail of information will improve in future planning cycles ensuring greater confidence in further characterisation assessments. The RBMP process will ensure that the implications of future changes in pressures and management measures are taken into account in future planning cycles.

3.2.1 Northern Ireland

In Northern Ireland the majority of risk assessments were based on currently available information, however, where possible, an attempt was made to address future changes. The point source risk assessment considered, amongst other pressures, Water Service discharges from Water Treatment Works (WTW) and Waste Water Treatment Works (WWTW). Any WWTW that is identified for upgrade under the Water Service Capital Works Programme and the upgrade is either completed by or starting on or before December 2005 was considered probably not at risk regardless of its compliance history. This assumption is based on a trend towards better water quality where upgrade works are proposed for a WWTW.

3.2.2 Republic of Ireland

The assessment of risk is based on pressures as they are currently distributed and does not address future changes for example those due to implementation of the National Spatial Strategy, investment in wastewater treatment facilities or agricultural sector reform.

4.0 Surface Water Risk Assessment

As the purpose of the risk assessment is to identify surface water bodies at risk of failing the objectives of the directive due to the effect of human activities, the first step required is the identification of the main human pressures on a water body. For surface waters pressures from water abstractions, water flow regulations, morphological alterations, point sources and diffuse sources have been identified and their relative significance assessed.

4.1 Water Abstraction and Flow Regulation

4.1.1 Northern Ireland

Tier 1 Risk Assessment

In Northern Ireland the risk assessment for water abstraction and flow regulation is consistent with UKTAG guidance WP7B. A two tier approach was used with Tier 1 using the presence of a significant abstraction ($>100\text{m}^3/\text{day}$) or impoundment (presence of any significant structure on a water body traversing the whole width of the river or lake outlet that can impound upstream and regulate downstream) to classify the water body as 'probably at risk' (1b). This automatically placed the water body (lake or river) upstream and downstream at risk in accordance with UKTAG guidance. The Tier 1 assessment methodology was applied to rivers, lakes and transitional water bodies.

Those water bodies that do not include a significant abstraction ($>100\text{m}^3/\text{day}$) were classified as 'probably not at risk' (2a). A further category was used for those water bodies that do not contain any water abstractions or impoundments, 'not at risk' (2b).

The Tier 1 assessment is an initial assessment that identifies those water bodies that are probably at risk by use of a simple presence or absence tool. It is useful in the initial visualisation of water bodies probably at risk.

Tier 2 Risk Assessment

Further refinement of the risk assessment was carried out under the Tier 2 assessment giving a higher confidence to the risk assessment as the magnitude of pressures on a water body and the sensitivities of that water body to those pressures are assessed. The risk assessment is based on the calculation of water balances (i.e. total abstractions less total discharges) to determine the deviation from natural flows.

River Water Bodies – The 95 percentile low flow (Q95) was used to assess natural low flow and estimates of this parameter were based on the Micro Low Flow model which was developed by the Institute of Hydrology to generate natural Mean Flows and Q95 (low flow) estimates. The tier 2 assessment looked at deviation from natural Q95 (low flow) due to net abstraction effect (abstractions less discharges) in accordance with UKTAG guideline thresholds and risk category applied. Sources of abstraction information included Water Service Strategy Document, Water Service Waterweb GIS Server, Drinking Water Inspectorate database (EHS) and Geological Survey (NI) Borewell Survey.

Lake Water Bodies – A similar methodology to that used for river water bodies was applied to the lake water bodies, however the thresholds for the categorisation of risk assessment are based upon Mean Flow (MF), with natural flow estimates derived from the annual average outflow, calculated using effective precipitation and catchment area at the downstream point of the water body. The deviation from the estimated natural flow was noted and the risk category assigned according to UK TAG guidance. Q95 thresholds were not considered because of the uncertainty of estimating the natural and impacted Q95 of lake outlets.

Transitional Water Bodies – Water abstraction and flow regulation upstream of a transitional water body has the potential to reduce the natural flows within an estuary. The tier 2 assessment determined the deviation from natural freshwater input to transitional waters rather than flow within the transitional water body itself. The percentage deviation from the estimated natural flow was assessed based on high sensitivity thresholds as per the river water body assessment.

Impoundments – River and lake water bodies containing significant impoundments were automatically assigned risk category 1b in the tier 1 risk assessment. This was further refined in the tier 2 assessment with impoundments assessed at mean flow and not Q95 due to the difficulty associated with accurately estimating lake and impoundment Q95 outflows. The risk category was increased to 1a if the relevant threshold was exceeded.

Both surface water and groundwater abstractions were considered in the hydrological risk assessment with the groundwater abstractions treated in a similar manner to surface water abstractions, i.e. directly impacting upon surface waters. This was considered appropriate under the precautionary approach.

The EHS have established that the information on abstraction and discharge locations, including volumes extracted and discharged, require further validation work to increase confidence. The datasets are relatively new, with estimated rather than measured methods used to inform the impact on flows. In addition the databases are not complete and the locations and magnitudes of many abstractions in Northern Ireland are still unknown. This is partly due to the fact that abstractions in Northern Ireland are not regulated. The datasets have therefore been qualified as provisional in status.

4.1.2 Republic of Ireland

The risk assessment methodology for the impact of water abstractions and impoundments does not include a screening assessment equivalent to the tier 1 assessment used in Northern Ireland. However the risk assessment does follow the same principles as the Northern Ireland assessment and applies the same thresholds provided in the UKTAG guidance document 'Abstraction and Flow Regulation Pressures on Surface Waters'. The principal difference is the method by which the low flow estimate was derived.

River Water Bodies

As was the case in Northern Ireland, the Irish methodology involves the compilation of a database of abstractions, discharges and major impoundments and the preparation of a model to derive an estimation of low flows. The low flow statistic used was the 95th percentile flow which was calculated for each water body at the furthest downstream point of the water body. The Q95%ile flows were estimated from a normalised Q95%ile flow map based on hydrometric summary data for 471 gauging stations on rivers throughout the EPA and Rivers Agency hydrometric networks.

Each RBD was responsible for the compilation of the various pressure databases, i.e., discharges, abstractions and major impoundments. These databases sourced information from Local Authorities, EPA, industry and the National Drinking Water Survey. Only surface water abstraction data was used, surface water springs and groundwater abstractions were excluded from this assessment as these pressures are accounted for in the groundwater risk assessments.

The discharge and abstraction databases were used to derive a water balance and the deviation from the estimated natural low flow was established. The same thresholds used for the Northern Ireland risk assessment were applied and are consistent with UK TAG guidance.

Lake water bodies – The assessment for lakes required the use of the risk assessment data for those river water bodies that are located within the catchment area of the lake. The low flow data, discharge and abstractions are summed so that lake water bodies that are located in more than one river water body are considered. The risk assessment thresholds for lakes are then applied as per the Northern Ireland assessment and UK TAG guidance.

Transitional water bodies - The risk of abstraction for transitional water bodies is assessed by considering the water flowing into the transitional water body from the river water bodies and the total abstraction from and discharge to river water bodies and the transitional water body itself. The thresholds used are the same as the Northern Ireland assessment.

The datasets used in the assessment are not complete, e.g., lack of information on small industries, or contain values that are based on assumptions, e.g. discharge estimates from Section 4 licences are

assumed to be half the discharge licence limits. An assessment of data confidence has been carried out by each RBD.

Impoundments – The presence of a major impoundment in the river water body results in an automatic categorisation as ‘at risk’ (1a). Major impoundments are those that are classified as those used for a hydro-electric scheme or containing a major dam. Impoundments which are used to control water level in lakes result in the lake being placed in the 1b category unless they were previously classed as major impoundments.

4.1.3 Comparison of Risk Assessment Methodologies

The risk assessment methodologies employed in the two different jurisdictions within the NS SHARE for the water abstraction and regulation risk assessment are very similar.

Dataset differences

The main differences result from the different approaches used to establish the low flow estimates for rivers within the RBDs. The Northern Ireland assessment makes use of software developed by the Institute of Hydrology, Micro Low Flows, which estimates low flows based on certain variables and catchment descriptors. The Republic of Ireland methodology makes use of measured flows and generates low flow contours from flows recorded at gauging stations distributed around the hydrometric network on both sides of the border. Both methodologies would benefit from the further development of flow estimation models and both jurisdictions have identified the need for new gauging sites to provide more accurate estimates of flow regimes.

The discharge and abstraction registers used in the assessments are incomplete in both cases and uncertainties in abstraction volumes and a general lack of information in smaller discharges and abstractions has resulted in a reduced confidence in the risk assessment. Further characterisation should result in a more complete assessment for both risk assessments.

Risk Assessment Interpretation

The lake water bodies assessments differ in both jurisdictions in that the methodology in Northern Ireland uses an estimate of Mean Flows to assess the deviation from predicted natural flow whilst that in the Republic of Ireland assess those river water bodies within the lake catchment and sums the impact based on the deviation from the Q95 flow.

The uncertainty of Q95 flows at the downstream extent of the lake water body was the determining factor in using the mean flows in the Northern Ireland assessment. Given the discrepancies identified in the use of the Q95 statistic in the assessment of natural flows in lake water bodies, sensitivity testing to establish the effect of using the alternative methods in each jurisdiction should be investigated.

4.2 Morphology Risk Assessment

In the morphological risk assessment both jurisdictions have used the same principals in applying methods for the determination of risk. The methodology comprises of two stages (Figure 4.1):

- Stage 1: determination of risk magnitude;
- Stage 2: adjustment based on data confidence.

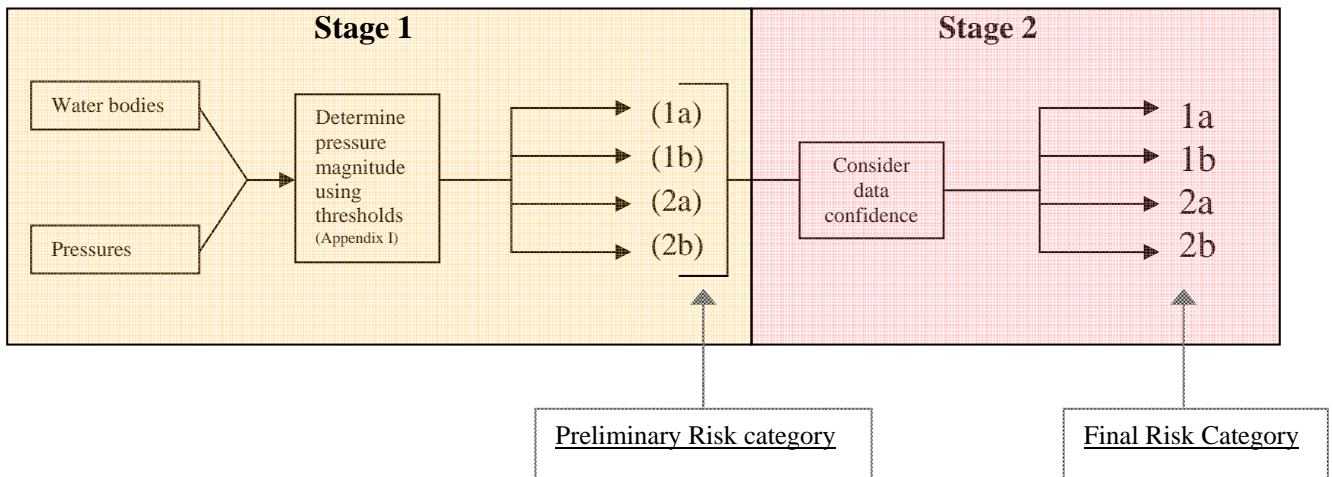


Figure 4.1: Determination of Water Body Risk Category

Stage 1: The application of the thresholds to pressure datasets compiled for water bodies in the River Basin Districts will place each individual water body in one of four preliminary risk magnitude categories.

Stage 2: Each pressure assessment should include an estimate of data confidence (high confidence, medium confidence, and low confidence). Determination of final risk category (1a, 1b, 2a, or 2b) should be conducted considering the data confidence for each pressure. Data confidence is dictated by factors such as completeness, spatial coverage, degree of temporal information and dataset age.

4.2.1 Northern Ireland

River Water Bodies - In Northern Ireland, and throughout the UK, River Habitat Surveys (RHS) have been carried out on selected rivers. It is estimated that approximately 50 % of the river network in Northern Ireland has been subject to RHS. For the morphological risk assessment of rivers the Habitat Modification Score (HMS) of the RHS has been used to assess the risk. The HMS reflects the degree to which a natural stream channel and its banks have been altered. The Habitat Modification Index (HMI) can be assigned based on the HMS and the risk to a water body determined from this. The level of confidence is dependent on the frequency of the RHS along a water body. The risk categories are then based on the risk classification and the level of confidence associated with the data.

Where RHS were not available or where the frequency of RHS sites was less than 0.25 per km the risk assessment was based on the use of various different datasets including:

- Rivers Agency's datasets - flood embankment and culverts dataset. Threshold values are based upon the bank length affected or the overall length of culverts and have been classified as high risk, medium risk and low risk (>15% of either bank – 1a,);
- Datasets on the location of impoundments – the presence, and significance of an impounding structure on a water body determines the level of risk as high, medium and low (major impoundment present on water body line – 1a, impoundment present but not on water body line – 1b).

In the event where there are no datasets relating to a water body a map screening tool was used as outlined in the UKTAG guidance document WP7c, '*Guidance on Morphological Alterations.*' This screening tool is based principally on the manual interpretation of 1:50,000 scale OS maps, and land use maps. The different pressures considered include:

- River straightening (>15 % length affected - 1b);
- Bed and bank reinforcement (>15% of either bank - 1b);
- Presence of flow manipulation structures (>3 - 1b);
- Land use pressures – five land use classifications have been used to assess the risk from intensive land use; coniferous woodland, improved grassland, arable and horticultural, suburban and rural development and continuous urban. The LCM 2000 dataset has been used to determine the land use percentages (>30% intensive land-use - 1b).

The confidence level assigned to these datasets is low for the OS map risk assessment and medium for the land use mapping. The level of risk determined from set thresholds are reviewed based on the level of confidence assigned to the dataset and a risk category applied in accordance with UKTAG guidance.

Lake water bodies – The risk assessment for lakes considered the significant morphological pressures on each lake water body. The risk assessment adopts two methods, the use of the impoundment dataset and a map screening tool similar to that associated with the river water body risk assessment. The map screening tool assessed feeder streams entering the lakes and includes:

- Land-use pressures;
- Built development on the shore zone;
- Alterations to feeder streams within 500m.

For the map based approach each of the pressures are considered individually and a combined risk is then calculated based on weighted significance to give an overall risk category for the map screening assessment. As was the case with the river water bodies a risk category is applied to a water body based on risk thresholds and a confidence level is assigned to the datasets.

Coastal and transitional water bodies – The risk assessment methodology for coastal and transitional water bodies adopts the following criteria when assigning a risk category to the respective water bodies:

- >15% impact areas to water body area – 1b;
- <15% impact area to water body area – 2a;
- No pressure in water body – 2b

The pressures assessed are listed below:

- *Dredging* – Food and Environment Protection Act 1985 (FEPA) records of areas of sea bed regularly dredged were transferred to GIS and the % impact to area of water body was determined.
- *Dredge Spoil Disposal* – FEPA records as above;
- *Land Reclaim* – OS mapping and expert opinion
- *Shoreline Reinforcement* – Roads Service records and expert opinion used to determine % distance of coastline impacted;
- *Aggregate extraction* – Lough Foyle and Foyle estuary are subject to this unregulated activity. Classified as 2a until further information becomes available.
- *Commercial Fishing* – Fishing pressures arise from trawling and dredging of fish or shellfish that are associated with the seabed. The risk assessment is based on the percentage of a coastal water body impacted by this type of fishing. With the categories assigned as below:
 - >15% impact areas to water body area – 1b;
 - <15% impact area to water body area – 2a;
 - No pressure in water body – 2b
- *Aquaculture* – Aquaculture pressures arise from both suspended and bottom culture shellfish. In the Northern Ireland assessment bottom culture of *Mytilus edulis* was considered as a significant pressure to morphology. Areas that were licensed for shellfish culture were mapped on GIS and water bodies classified accordingly.;
- *Morphological Barriers* – Presence or absence of tidal barrages (1b) or weir structure that limit the tidal range were identified (2a).

4.2.2 Republic of Ireland

River Water Bodies – Five datasets are used in assessing the morphological risk to river water bodies, these are sourced from a number of different organisations. The pressure dataset and information sources are detailed below;

- *Channelisation and Dredging* – OPW dataset
- *Flood Protection and Embankments* – OPW dataset
- *Impounding* – ESB impoundments for power generation and Local Authority Information;
- *Water Regulation (locks and weirs)* – OPW weirs and sluices layer, Central Fisheries Board impassable barriers, IWAI navigation maps, Locks layer from OS mapping, mill weirs from local knowledge;
- *Intensive Land-use* – CORINE land use dataset layers; peat extraction, coniferous forests, arable land, urban fabric.

The same impact thresholds were applied to the pressure datasets as those used in Northern Ireland where the datasets are similar. Confidence limits were assessed by each individual RBD depending on the completeness and reliability of the datasets used and is RBD specific.

Lake Water Bodies – the risk assessment for lake water bodies used the same datasets as those for the river water bodies, with the exception of water regulation (locks and weirs). For the Channelisation and Dredging dataset a 500 metre buffer is selected around the lake water body to take account of the pressures acting on the feeder streams entering the lake water body. The thresholds applied to the pressure datasets are consistent with those used in the Northern Ireland lake morphology risk assessment. The impact of channelisation on lake water bodies was assessed as 2a unless specific evidence indicates that such works have had a major impact on the water body.

Transitional Water Bodies – As was the case with the river and lake water bodies the risk assessment for the transitional water bodies is based on various national and RBD specific datasets. The thresholds applied were the same as those used in the Northern Ireland risk assessment however the use of the 1a “at risk” category was included in this assessment for pressures except dredging, which was capped at 1b due to uncertainty in frequency and the impact of maintenance works. The Northern Ireland assessment did not classify any water bodies within transitional waters in the 1a category for the morphological risk assessment.

- *Channelisation & Dredging* - OPW Drainage Channels; DCMNR dredging location information from Applications to Dump at Sea, BIM Aquaculture Licensed areas (bottom culture shellfish dredging)
- *Deposition of Dredge Spoil* - DCMNR Permits to dump at sea, applications for Permits to dump at sea, Marine Institute OSPAR-reported sea dumping locations.
- *Coastal defence, Flood Protection & Embankments* - OPW Embankments, Coastal defence information from DCMNR National Coastline Survey images;

- *Impounding (tidal barrages)* - Local Authority Information & local knowledge re: tidal barrages, CFB Impassable Barriers (man made)
- *Built Structures* - Ports / Harbours - Structural information from DCMNR National Coastline Survey images, CSO port and harbour statistics (cargo tonnage)
- *Industrial / Power Station Intakes* - EPA IPC Register, RBD characterisation abstraction register & info gathered from Local Authorities, Power Stations
- *Intensive land use* - CORINE land use dataset layers; peat extraction, coniferous forests, arable land, urban fabric.

Coastal Water Bodies – The datasets used in the transitional water body risk assessment were used for the coastal water body risk assessment with the exception of the impounding (tidal barrages) dataset as coastal water bodies cannot be impounded. The intensive land use assessment is restricted to the use of the urban fabric layer for coastal water bodies as the remaining intensive land use types are not considered as sources of pressure for coastal water bodies. The thresholds applied were the same as those used in the Northern Ireland risk assessment however the use of the 1a at risk category was included in this assessment whereas the Northern Ireland assessment did not classify any water bodies within coastal waters in the 1a category for the morphological risk assessment.

4.2.3 Comparison of Risk Assessment Methodologies

Dataset Differences - The main differences between the two assessments results from dataset availability. In Northern Ireland the Habitat Modification Score (HMS) of the River Habitat Surveys was used to assess morphological pressure. A similar dataset is not available in the Republic of Ireland hence there is a fundamental difference in the assessments.

Where RHS are not available or where their frequency is inadequate to establish a satisfactory risk assessment the use of national datasets and map analysis was used in Northern Ireland. These datasets were consistent with those used in the Republic of Ireland with Rivers Agency's and the Office of Public Work's datasets on flood protection used in the assessment.

In relation to the mapping assessment, and in particular the land use pressures, the LCM 2000 dataset was used in Northern Ireland, whilst in the Republic of Ireland the CORINE dataset was used. Whilst both datasets are created from satellite imagery they represent different cover/use classification. The LCM2000 dataset is not available in Republic of Ireland.

Both assessments made use of the feeder streams to assist in the assessment of the morphological impact on lakes. In Northern Ireland OS mapping and Land Cover 2000 data was used to determine the morphological alterations to the inflowing streams within 500m of a lake water body including channelisation, bank reinforcement and the presence or absence of flow regulation, e.g. weirs and sluices. In the Republic of Ireland a 500 metre buffer was also selected around the boundary of the

water body and an assessment of channelisation and dredging was carried out based on the OPW channelisation dataset. In relation to embankments a 50 metre buffer zone was used to assess the morphological impact of flood embankments on the lake water body. The use of a national dataset that has been verified and updated by the OPW provides a greater level of confidence in this element of the assessment.

Built development on the shore zone was considered in the Northern Ireland assessment however this was not considered in the Republic of Ireland Assessment.

In Northern Ireland the morphological risk assessment for the transitional and coastal water bodies made use of aquaculture and fishing datasets from DARD which record the locations of these activities through-out the marine waters in Northern Ireland. Similar datasets were not available for the Republic of Ireland during the initial characterisation in the NS SHARE, however maps provided by the Marine Institute will be digitised into the GIS for the project and it is proposed to integrate these pressures into the risk assessment during further characterisation. See section 6.3.

Shoreline reinforcement in Northern Ireland was restricted to the use of Roads Service information on roads reinforcement and expert opinion. In the Republic of Ireland the Irish Coastal Strategy commissioned by the Department of the Marine, Communications and Natural Resources was used to assist in the assessment of shoreline protection and also built development. The Irish Coastal Strategy had aerial photography prepared for the entire coast line and this information was transferred to a GIS allowing for identification of the percentage of marine waters impacted by coastal defence or built structures.

Risk Assessment Interpretation – The risk assessment includes an assessment of land use pressures. In Northern Ireland the inclusion of improved grassland use over an area greater than 30% of the water body as ‘probably at risk’ was consistent with the guidance offered by the UKTAG guidance. This was applied to both river and lake water bodies. It was felt that this was a potential pressure to the morphological character of adjacent water bodies particularly when considered in the context of habitat improvement schemes and the provision of buffer strips as remediation measures in these areas. The inclusion of this pressure under the land use pressures in the morphological risk assessment results in a more precautionary approach to the risk assessment.

In the Republic of Ireland the use of improved grassland in the land use assessment was not assessed as it was felt that this was over precautionary and did not represent a true risk to the morphological characteristics of a water body, particularly when considered in the context of coniferous, arable, urban and peatland land uses. The EHS Water Management Unit had initially proposed sensitivity testing on the use of improved grassland during the further characterisation process to establish if the threshold of 30% should be adjusted based on verification using impact data from the RHS information. However it has been agreed that the 30% threshold is a suitable limit and does not need to be verified as it is a UKTAG guidance threshold.

The impact of channelisation of feeder streams on lake water bodies in the Republic of Ireland was assessed as 2a unless there was specific evidence to suggest that such works have had a major impact on the water body.

Land use pressures are included in the assessment of the marine water bodies in the Republic of Ireland but were omitted from the Northern Ireland Assessment. Table 4.1 summarises the differences in the approach to the morphological risk assessment for Northern Ireland and the Republic of Ireland.

Table 4.1 Differences in the approach to the morphological risk assessment for Northern Ireland and the Republic of Ireland

Water Body	Northern Ireland	Republic of Ireland
River Water Body	Habitat Modification Score (HMS) of River Habitat surveys used to assess risk. National datasets used where RHS not available. LCM2000 land use dataset used to determine intensive land use Use of improved grassland as an intensive land use pressure	No RHS available for Republic of Ireland. National datasets used in determining risk CORINE dataset used to determine intensive land use Improved grassland was not classified as an intensive land use for morphological risk assessment
Lake Water Body	Assessment of feeder stream impacted by morphological pressures was carried out using LCM2000 and OS Mapping Assessment of built development on shore zone	Feeder stream morphological pressures were assessed using OPW datasets, with buffer zones applied around the water body. Built development on the shoreline not considered.
Coastal and Transitional Water Bodies	Aquaculture and Fishing included in risk assessment Built development considers the shoreline reinforcement information from Roads Service Land use pressures not included in assessment	Fishing not considered in the assessment however will be included in further characterisation. Built development determined from National Irish Coastal study Land use pressure included in the assessment

4.3 Point Source Pollution Risk Assessment

The risk assessment for the point source discharges is consistent throughout all surface water categories hence this chapter discusses the methodology used and does not make specific reference to the different water body types. In the Republic of Ireland the point source risk assessment has not been applied to coastal non embayments. Risk assessment methodologies in both jurisdictions use the approach suggested in the UKTAG guidance document 7d (01), Draft Guidance on Point Source Discharges. Additional Guidance was sourced from the Common Implementation Strategy IMPRESS Guidance.

4.3.1 Northern Ireland

In Northern Ireland the point source pollution risk assessment was based upon compliance history data of various point source discharges and an assessment of Combined Sewage Overflows (CSOs) from available data and expert opinion.

There were numerous point source discharges considered including: Water Service discharges, industrial discharges, groundwater discharges, contaminated land and waste disposal sites, quarries and mines, septic tanks and oil depots. After consideration of the datasets and their completeness and reliability the assessment was refined to include those discharges listed below:

- Water Treatment Works (WTW) (PE>250);
- Waste Water Treatment Works (WWTWs) (PE>250);
- Industrial Consent Licences with compliance history;
- Combined Sewage Overflows (CSOs);
- Priority Substances consented discharges.

Where a water body had no recorded point source discharge the precautionary approach was adopted with the water body assigned 'probably not at risk' (2a) because of the many unknown variables such as the presence of septic tanks, waste disposal sites and WWTWs with a PE<250.

Each point source discharge was linked to the water body that it resides in or may cause risk to. The risk applied to the point source discharge was therefore assigned to the water body it was associated with. If there was more than one point source discharge then the worst risk category was applied to the water body.

Water Service Discharges (WWTWs/WTW/CSOs) – The Water Service Regulations (WSR) team maintain the discharge database for both WWTWs and WTW throughout Northern Ireland. To qualify as a WWTWs/WTW that passes the discharge standards, the 95 percentile method was applied. Compliance with the 95 percentile limit standard requires 95% certainty that the discharge complies with the standard 95% of the time.

The reporting categories for the risk assessment are detailed below in Table 4.2

Table 4.2 Reporting Categories for Water Service Discharges

WFD Category	UKTAG Category	Agreed Analysis
1. Water body at risk of failing an environmental objective	(1.a)	Water bodies at significant risk <ul style="list-style-type: none"> • WWTW or WTW that has failed its consented discharge each year for the past three years • An unsatisfactory sewer system.
	(1.b)	Water bodies probably at significant risk (but for which further information will be needed to make sure this view is correct) <ul style="list-style-type: none"> • WWTW or WTW that has failed its consented discharge 2 years in past 3years • 1 or 2 highly unsatisfactory CSO discharges based on expert opinion of the WSR team.
2. water body not at risk of failing an environmental objective	(2.a)	Water bodies not at significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is low) <ul style="list-style-type: none"> • WWTW or WTW that has failed its consented discharge 1 year in the past 3 years • Any complaints about CSO discharges with no drainage area plan • Any WWTW or WTW passing its consented discharge with suitable treatment • A satisfactory sewer system
	(2.b)	Water bodies not a significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is high) <ul style="list-style-type: none"> • N/A

Industrial Consents – All industries discharging more than 5m³ of effluent have consented discharge standards. To pass the discharge standards the 95 percentile method is also applied as per the Water Service discharges. The reporting categories are detailed below;

Any compliant consenting discharges were categorised as not putting the water body at significant risk, except those considered by expert opinion to be putting the water body at risk mainly due to inadequate treatment levels. All non compliant consenting discharges were assessed using expert opinion to categorise the risk associated with the water body.

Priority Substances – Water bodies receiving discharges consented for priority substances, where the discharge has exceeded twice the Environmental Quality Standards (EQS), were identified as 'probably at risk' (1b).

Table 4.3 Reporting Categories for Industrial Consent Discharges

WFD Category	UKTAG Category	Agreed Analysis	
1. Water body at risk of failing an environmental objective	(1.a)	Water bodies at significant risk	All failing discharges analysed using expert opinion to categorise risk to the associated water body
	(1.b)	Water bodies probably at significant risk (but for which further information will be needed to make sure this view is correct)	
2. water body not at risk of failing an environmental objective	(2.a)	Water bodies not at significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is low)	<ul style="list-style-type: none"> Any non-failing discharges, discharges with no compliance data, or failing discharges with a volume of flow < 0.5 m³/day Any point source with no discharge data
	(2.b)	Water bodies not a significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is high)	N/A

4.3.2 Republic of Ireland

A similar approach to that used in Northern Ireland was applied to the point source risk assessment in the Republic of Ireland. The datasets upon which the risk assessment was based are detailed below.

- Waste Water Treatment Works (WWTWs) (PE>500)
- Combined Storm Overflows (CSOs)
- Industrial discharges – IPC Licensed facilities
Section 4 Discharge Licences
- Water Treatment Works (WTW)
- Fish Farms

Waste Water Treatment Works - The risk assessment for WWTWs was undertaken by assessing the compliance with discharge standards and compliance with monitoring requirements as stipulated in the Urban Waste Water Treatment Regulations 2001. A combination of the Local Authority returns to the Environmental Protection Agency, detailing WWTWs with secondary treatment, and Local Authority records for WWTWs with preliminary and/or primary treatment were used to assess compliance history based on the criteria provided in the EPA publication, 'Urban Waste Water Discharges in Ireland (2000-2001)'. The Table below details the risk categories used in the WWTWs risk assessment.

Table 4.4 Risk categories assigned to WWTWs risk assessment

WFD Category	UKTAG Category	Agreed Analysis	
1. Water body at risk of failing an environmental	(1.a)	Water bodies at significant risk	Does not comply with discharge standards and is monitoring compliant

objective	(1.b)	Water bodies probably at significant risk (but for which further information will be needed to make sure this view is correct)	Does not comply with discharge standards and is monitoring non compliant
2. water body not at risk of failing an environmental objective	(2.a)	Water bodies not at significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is low)	Complies with discharge standards and is monitoring non compliant
	(2.b)	Water bodies not a significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is high)	Complies with discharge standards and is monitoring compliant

Combined Storm Overflows – The CSO risk assessment is determined using the “traditional” design standard for combined storm overflows of 6 spills per annum; a CSO with discharges in excess of this number is considered to be at risk. Where the number of spills is unknown the precautionary principle is applied and the ‘1b’ category is given to the CSO, as detailed in the table below.

Table 4.5 CSO Risk Assessment

WFD Category	UKTAG Category		Agreed Analysis
1. Water body at risk of failing an environmental objective	(1.a)	Water bodies at significant risk	CSO operates > 6 times per year
	(1.b)	Water bodies probably at significant risk (but for which further information will be needed to make sure this view is correct)	CSO operation frequency unknown
2. water body not at risk of failing an environmental objective	(2.a)	Water bodies not at significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is low)	CSO operates < 6 times per year
	(2.b)	Water bodies not a significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is high)	No CSOs

Industrial Discharges – The Environmental Protection Agency has provided national data on check audits carried out for each licensed activity. Annual Environmental Returns (AER) were not available to the Project. Where the data on compliance with discharge standards and monitoring is incomplete, expert judgement was applied following consultation with the local EPA inspector.

Section 4 discharge licences are the responsibility of the Local Authorities who are required to maintain a register of licences granted and monitor their compliance history. Data from each of the Local Authorities was sourced and formed the basis of the risk assessment. This dataset was incomplete as the section 4 monitoring data often was unavailable or inadequate.

As was the case with WWTWs the compliance history was used to establish the risk associated with the industrial discharges. The risk categories detailed in Table 4.4 for WWTWs are consistent with the industrial discharges risk assessment.

Water Treatment Works - Discharges from Water Treatment Plants are not currently licensed or monitored. The location of Water Treatment Plants and the population equivalent served has been obtained from the National Drinking Water Monitoring Programme. As with the risk assessment for WWTWs, a threshold of 500 PE is adopted. As there is no monitoring data readily available the precautionary approach has been used in that if a water body has a WTW located within it then the water body is classified as 'probably at risk' (1b).

Fish farms – For coastal embayments an assessment of fish farms and suspended shellfish culture was assessed as part of the point source risk assessment. Where a coastal embayment contains a fish farm or suspended aquaculture it has been assigned a 2a risk category.

4.3.3 Comparison of Risk Assessment Methodologies

For the most part the point source risk assessment in both jurisdictions was consistent with the UKTAG guidance and approaches used were similar, adopting the same principles. However there were some minor differences that are evident from the comparison and these have been detailed below.

Dataset Differences – In Northern Ireland priority substances were specifically assessed within the risk assessment, and a discharge containing a priority substance at twice the EQS was considered 'probably at risk'. This was not carried out in Republic of Ireland although the IPC and Section 4 Licences would have dealt with these pressures indirectly. The lack of data in relation to dangerous substances in RoI will be addressed by additional data collection and monitoring for the first river basin management plan.

In Northern Ireland the datasets for the WWTWs/WTW and industrial consent discharges included three and four years of data respectively. In the Republic of Ireland NS SHARE Urban waste water returns for 2003 were used for WWTWs, there was no compliance data for WTW and industrial

discharge data varied depending on the availability of EPA and Local Authority monitoring. The Northern Ireland assessment would therefore be considered as more robust and precautionary given the more extensive compliance data used.

In the Republic of Ireland fish farms and suspended aquaculture were considered in the point source risk assessment in marine waters. In Northern Ireland fish farms were also considered in the point source risk assessment of coastal water bodies; aquaculture and fishing activities that involve bottom culture and dredging were considered in the morphology risk assessment.

Risk Assessment Interpretation – The Northern Ireland Risk Assessment considered all WWTWs/WTW with a PE of >250, in the Republic of Ireland the threshold for the inclusion of a WWTW/WTW in the risk assessment was a PE of >500. The smaller treatment plants have been incorporated into the Diffuse Risk Assessment in the Republic of Ireland. The incorporation of smaller WWTW in Northern Ireland has resulted in a more robust analysis of the pressures associated with WWTW discharges as the locations of discharges from these smaller plants will have been assessed and a better analysis of the quality and flow of the effluent to specific water bodies has been achieved.

4.4 Diffuse Source Pollution Risk Assessment

The diffuse risk assessment was carried out for river and lake water bodies. The diffuse source pollution to marine water bodies, i.e. the transitional and coastal water bodies is assessed in the marine direct impacts assessment which is discussed in Section 4.5.

In both jurisdictions the diffuse source pollution risk assessment uses both predictive modelling techniques and impact data. Impact data has been used where available and the predictive models have been used where there is no impact data or the information is inadequate. UKTAG guidance was not produced in this area, but the general principles of risk assessment have been followed in both jurisdictions.

4.4.1 Northern Ireland

The diffuse pollution risk assessment is based primarily on impact data, where available, supplemented by a screening tool method that identifies water bodies at risk from significant diffuse pollution pressures. The screening tool was used to predict the risk only for areas without a broad suite of impact data.

The screening tool method uses a series of models to assess the risks from diffuse pollution. This method was applied to freshwater surface waters. Table 4.6 details the different pressures considered and the models used. For lakes, only phosphorus and acidification were considered. The screening tool method inputs currently available environmental and agricultural data into the models. This includes intrinsic landscape factors such as land cover, climate, geology and topography, along with specific management practice information, for example, pesticide usage survey data and agricultural census data.

Table 4.6 Key Screening Tool Models

Pollutant	Model	Comments
Nitrate	NIRAMS*	Developed by SEPA to provide a model for prediction of agricultural pollution by Nitrates
Phosphorus, Sediment, BOD	PSYCHIC*	Developed by DEFRA, EA, and English Nature as a pragmatic catchment-based decision support system to reduce transfer of particulates and phosphorus from agricultural land to water
Pesticides	SWAT and AQUAT Models*	Models components of POPPIE (Prediction of Pesticide Pollution In the Environment) a GIS tool to predict the potential for pesticide pollution developed for the Environment Agency
Metals	PSYCHIC* and Soil metal conc.	PSYCHIC comments as per Phosphorus, Soil metal concentration from DARD
Acidification	Critical load exceedance	National critical load exceedance for freshwater acidification
Urban/Roads	Event Mean Concentrations	EMCs Derived from Scientific Literature

*Modified model structure

The polluting substances considered by the screening tool are listed in Table 4.7.

Table 4.7 Pollutants and Sources

Pollutants	Source
<ul style="list-style-type: none"> • Phosphorus • Nitrates • Metals • Pesticides (including Priority substances) • BOD • Sediment • Acidification 	<ul style="list-style-type: none"> • Septic tanks • Roads • Urban runoff • Agriculture, forestry

A database in which the key data sets were integrated and summarised on a regular grid with a resolution of 1km² was created for the Diffuse Pollution Screening Tool. A series of model calculations were performed on the environmental data for each 1km² to provide a measure of pollution load. Pollution loads for a water body catchment were calculated by the addition of 1km² values contained within it. By combining a load value with an estimate of surface water discharge, or flow, pollutant concentration was calculated. This allowed load values to be converted to concentration values. Pollutant concentration values were calculated for each water body.

The project included a validation stage in which monitoring and flow data from 7 Northern Irish and 13 Scottish catchments were compared against predicted values. The output of the project was a database that contained tables of both the input data to the models and pollutant values predicted by the models. Modelled pollutant concentration values were compared with threshold values above which it was considered that water bodies may be at risk of failing to meet good ecological status.

The various pollutants modelled were allocated a risk category depending on their threshold exceedance likelihood values as detailed in the tables below.

Table 4.8 UKTAG Risk Categories for Nitrate, Phosphorus, BOD and Suspended Solids

Likelihood below threshold	UKTAG Risk Category
≥0.8	2.b Water bodies not at significant risk on the basis of available information and for which confidence in the available information being comprehensive and reliable is high
0.8 - 0.5	1.b Water bodies probably at significant risk but for which further information will be needed to make sure this view is correct
≤0.5	1.a Water bodies at significant risk

Table 4.9 UKTAG Risk Categories for Pesticides and Metals

Above/ below threshold	UKTAG Risk Category
Above	2.a Water bodies not at significant risk on the basis of available information and for which confidence in the available information being comprehensive and reliable is low
Below	2.b Water bodies not at significant risk on the basis of available information and for which confidence in the available information being comprehensive and reliable is high

Table 4.10 UKTAG Risk Categories for Acidification

Above/ below threshold	UKTAG Risk Category
Above	1.a Water bodies at significant risk and for which confidence in the available information being comprehensive and reliable is high
Below	2.b Water bodies not at significant risk on the basis of available information and for which confidence in the available information being comprehensive and reliable is high

Each water body was assigned a risk category for each pollutant and the overall risk category was taken to be the worst case scenario from all the pollutants considered.

Risk categories derived from impact data were compared with those from the screening tool methodology. The impact data classification was given a higher precedence over the screening tool methodology classification when considering water bodies at risk. However, if there was no impact data available or the impact data had a lower level of risk, the precautionary approach was adopted and the higher risk assessment from the screening tool was assigned to the water body. The sector that had the highest percentage loading to a particular water body was considered to be the main source of this risk.

Lough Erne and Lough Neagh are both designated as Sensitive areas under UWWTD. Nutrient budget studies suggest at least 50% of the nutrient inputs are due to diffuse sources. These lake water bodies were therefore assigned 1a for diffuse source pollution. In addition, the catchments draining into Loughs Erne and Neagh are also designated under UWWTD. In this case the following rules were applied;

- All designated catchments were assigned a minimum of 1b for diffuse source pressures. The DPST was used as an indicator of the sector giving rise to the nutrient pollution.
- All designated catchments downstream of 'at risk' point source pressures were assigned a minimum score of 1b for point source pressures.

4.4.2 Republic of Ireland

The diffuse risk assessment for the Republic of Ireland has also considered a range of potential sources of diffuse pollution. Table 4.11 summarises the different assessments undertaken to establish the risk associated with diffuse source pollution. Where impact data was available, this was used to inform the risk assessment process and was given precedence over the pressure risk

assessments. The table below gives a brief summary of what was used in the respective risk assessments.

The predictive assessment for diffuse pollution makes use of a series of empirical relationships to establish the likely risk associated with the pressure. For each of the respective diffuse pollution assessments relevant impact data used is listed in Table 4.11. Where impact data indicates that the risk to the water body is greater than that for the predictive assessment then the risk category is revised. Where the impact data suggests that the water body is at less risk than the pressure assessment would suggest the precautionary approach is adopted and a water body is assigned the higher level of risk based on the pressure impacts, however this does not apply when Q values are being considered as the water body will be deemed at risk (1a) if $Q < 4$ or not at risk (2b) if $Q \geq 4$, regardless of the results from other risk assessments.

Table 4.11 Key Screening Tool Models

Pressure	Model	Comments	Impact Data
Agricultural & Urban Diffuse	SD1	Uses EPA model which assesses the likelihood of a water body of attaining a Q value ≥ 4 using Corine land cover classes- pasture, arable and urban.	Q values
Road Transport (road drainage)	SD2	Roads where Annual Average Daily Traffic (AADT) > 30,000 were assessed. CIRIA and NRA research indicates that road run-off is unlikely to pose a risk below this threshold. Model simulates the discharge of substances from roadways into a WB in low flow condition	Soluble Copper EQS levels
Transport (railways)	SD3	Expert judgement used to assess impact of marshalling yards within a water body	n/a
Forestry (acidification)	SD4a	Spatial analysis of critical forestry overlying acid sensitive geology.	pH, Q values
Forestry (suspended solids)	SD4b	Spatial analysis of critical forestry overlying erosion sensitive soils on a critical slope (>15%) within 60 m of a water body.	Suspended Solids
Forestry (Eutrophication)	SD4c	Spatial analysis of commercial forestry on sensitive soils (high leaching potential for P)	Annual Average "max" MRP
Un-sewered areas (septic tank clusters)	SD5	Septic tank cluster test – Spatial analysis identifying WB where there is a concentration of unsewered properties.	n/a
Priority Substances from Agriculture (arable land)	SD6a	Spatial Analysis of proportion of WBs under certain crop types from normalised Central Statistics office data.	Toxicity element of Q system
Priority Substances from Agriculture (sheep dip)	SD6b	Livestock units (sheep) to area farmed used to generate pressure magnitude for potential sheep dip pollution. Spatial analysis then carried out to determine WB area with high risk	Toxicity element of Q system

All the above assessments were used for river water bodies. In the case of lakes the diffuse risk assessment is based on the percentage catchment area of the lake categorised as 1a, 1b, 2a, and 2b as determined by the surface diffuse assessment SD1. Impact data from the lakes risk assessment is subsequently used to qualify the diffuse risk assessment (chlorophyll, Total P & acidification).

4.4.3 Comparison of Risk Assessment Methodologies

Dataset and model differences – The two risk assessments have used a modelling approach and empirical relationships to establish the diffuse risk assessment where sufficient impact data was not available. This will inherently lead to different approaches based on the information required by the model and the quality of the datasets used. In terms of the diffuse pressures analysed the two jurisdictions looked at similar pressures. Septic tanks and forestry were included as part of the Republic of Ireland assessment. In relation to the Northern Ireland assessment the risk assessment associated with septic tanks was covered by the screening tool and although there was not adequate data on locations of septic tanks, the model was able to estimate loads based on the percentage of dwellings not connected to the public sewerage system. In Northern Ireland an assessment of the contribution of nutrients, acidification and suspended solids from forestry was completed by the screening tool, however harvesting cycles were not accounted for.

The approaches adopted for the pressure assessment in both jurisdictions made use of land-use data, topography, soil types, geology and agricultural data. In this respect both approaches use the same principals, however the Northern Ireland Diffuse Pollution Screening Tool is more quantitative and can be considered as a computational modelling tool. The Republic of Ireland pressure assessment makes use of empirical relationships to predict the risk associated with certain pressures.

Risk Assessment Interpretation – The use of impact data was similar for both jurisdictions except where Q values were used in the Republic of Ireland. In Northern Ireland there was a wider use of impact parameters when compared to that in the Republic of Ireland. In both jurisdictions impact data was used to increase the risk category if the modelling assessment gave a lower level of risk. However the precautionary approach was adopted in Northern Ireland in cases where there was no impact data available or when the impact data gave a lower level of risk than the predictive assessments from the screening tool. In both these cases the risk established by the tool was assigned to the water body. For the most part this was the case in both jurisdictions, however in the Republic of Ireland there is a major exception to this. Where Q values were used as the impact data and if the Q value was good then this over-ruled the pressure assessments, and was reported as 2b regardless of the category predicted through the pressure assessments.

The agricultural risk assessment in ROI can be compared with assessment for nutrients (Nitrates and Phosphorus) in Northern Ireland. Both assessments use the likelihood of a water body attaining a certain threshold, a Q value ≥ 4 in ROI and a predefined Nitrogen concentration based on statutory regulations for Northern Ireland and phosphate thresholds derived from UKTAG guidance and typology. The ranges used in both assessments differ, in Northern Ireland water bodies were assigned “at risk” if the probability of being below the threshold concentration was less than 0.5. If the probability of being below the threshold value was between 0.5 and 0.8 the water body was categorised as “probably at risk”. In the ROI the water body was assigned “at risk” if the probability of

achieving a Q rating of ≥ 4 was less than 0.25. If the probability of being below the threshold value was between 0.25 and 0.6 then the water body was categorised as “probably at risk”. The more stringent standard for the Northern Ireland assessment will result in more water bodies being placed at risk. However as the model has been calibrated with monitoring data and the risk categories were assigned based on a best match to the impact data available the more stringent standards in NI were felt to be justified.

In Northern Ireland critical load was used as the criterion for assessing the impact of acidification whilst in the Republic of Ireland acid geology was used to determine the risk associated with acidification.

Policy Decision - The assignment of a risk category of 1a for diffuse source pollution to Lough Erne and Lough Neagh was adopted in Northern Ireland as these lake water bodies are designated as sensitive under the UWWT Directive. In addition any catchment draining into these water bodies are also designated under the Directive and have been assigned a minimum of 1b for diffuse pollution. As the designation of sensitive areas was carried out on a catchment basis the application of the risk assessment to the water bodies located within these catchments was felt to be consistent with the Directive and the EHS policies in this area.

In the Republic of Ireland sensitive areas have been assigned to specific water bodies as opposed to whole catchments. This will have implications when the shared water bodies risk assessments are combined in that there will be significant inconsistencies in the respective risk assessments. The Northern Ireland approach is more precautionary in its approach and has resulted in a higher portion of water bodies being classified as at risk or probably at risk from diffuse pollution.

4.5 Impact Data Risk Assessment

The impact data in both jurisdictions were used for diffuse and point source pollution pressures. Where the impact data were available and adequate this formed the basis of the risk assessment, where the impact data were not available or were not robust, predictive assessments of identified pressures were used.

4.5.1 Surface Freshwaters

Impacts data comes in the form of monitoring that is carried out by each jurisdiction. The monitoring data consists of the water quality assessments in both jurisdictions, the chemical and biological GQA classifications, trophic status surveys in Northern Ireland and the Q system and distribution of the freshwater pearl mussel (*Margaritifera sp*) in the Republic of Ireland. These monitoring datasets are supplemented by various monitoring programmes established to assess specific legislative requirements. Where available, monitoring data is indicative of water pollution from diffuse or point sources only, and other pressures such as flow regulation and morphological pressures do not have a classification method that readily determines their impact. For surface waters, the freshwater impact data was based on the use of the respective chemical and biological monitoring systems in both jurisdictions.

The Q System in the Republic of Ireland is used to over-ride the results from the diffuse and point source pollution risk assessments. In Northern Ireland the precautionary principal was adopted in that the worst case of either pressure assessment or impact score was applied in the risk assessment.

4.5.2 Marine Waters

Marine water bodies are assessed using the marine direct impact data. The assessment includes nutrients/organic enrichment/eutrophication and hazardous substances.

Nutrients/organic enrichment/eutrophication – Both risk assessments use the OSPAR Common procedure to assess the impacts of nutrients and eutrophication. This data is supplemented by the designation, under the UWWT Directive, of sensitive areas as “at risk” (1a).

Hazardous substances - Two similar methodologies were used in both jurisdictions. The development of imposex in dog whelks caused by Tributyltin (TBT) and the concentrations of Polyaromatic Hydrocarbons (PAHs) and Polychlorinated Biphenyls (PCBs) in sediments, water and common mussels (*Mytilus edulis*). Both assessments were refined through the use of expert judgement.

For the imposex assessment the use of the Vas Deferens Sequence Index (VDSI) was employed with an index > 4 considered to be “at risk”. In the Republic of Ireland there was no water bodies assigned to the “at risk” category as a result of the imposex assessment.

The concentration of the various trace elements was compared to Background Reference Conditions (BRCs), Ecotoxicological Assessment Concentrations (EACs) and proposed Environmental Quality Standards (EQS). Risk categories were then applied based on the exceedance of EACs, EQS or twice the BRC.

4.5.3 Comparison of Risk Assessment Methodologies

Risk Assessment Interpretation - For the assessment in Northern Ireland, if the impact data shows the water body at risk then this will take precedence over the pressure assessment.

The precautionary approach is used in Northern Ireland, in that if either the impact assessment or the pressure assessments show the water body at risk then equal weight is given to each assessment. This means that if a water body is categorised as not at risk from the impact data but the pressure data is predicting that it is at risk then the pressure risk assessment category will be used. However, if the Diffuse Pollution Screening tool (DPST), i.e. the pressure assessment has a higher score than the impact data it does not make the overall risk assessment for the water body higher. The different approaches have therefore led to the NI reporting more water bodies as “at risk” than ROI.

In the Republic of Ireland the Q values are given precedence over both other impact data and the pressure assessment. This means that if a Q value is available for a water body and the classification is good, i.e. not at risk (2b), then this category is assigned to the water body regardless of the information provided by the other assessments. It is important to state that this is an assessment of the current risk to a water body and that it is felt that the Q value is the best and most accurate representation of how that water body is behaving currently. The risk assessment does not consider future risks and this will be considered during further characterisation and development of the RBMP.

The assessments for marine impact data in both jurisdictions are similar in their methodology, however there are some minor differences in relation to the interpretation of the monitoring data and in particular the risk category interpretation.

In Northern Ireland those water bodies that are assessed as “potential problem areas” under the OSPAR classification system have been assigned a risk category of 2a, in the Republic of Ireland this has been assigned a risk category of 1b.

For the trace elements the chemical concentrations in water, sediment and biota that exceed the EQS or EAC are assigned a risk category of 1a or 1b. The view was taken that as EACs are not specific to Northern Ireland coastal sediments and it is not known at present how the approach relates to ecological status; those water bodies whose concentrations are above the EAC have been designated as 1b until further information becomes available. In addition chemical concentrations between twice the BRC and EAC were assigned a risk category of 1b. In the Republic of Ireland marine expert input

resulted in the removal of the 1b category (probably at risk) from the risk classification scheme for the hazardous substances risk assessment. It was considered that the EAC and BRC limits are sufficiently high that any exceedance indicates a definite risk to the water body.

In relation to the “not at risk” classification for trace elements, in Northern Ireland it was considered that if concentrations were below twice the BRC the water body was not at risk. There was no “probably not at significant risk” (2a) classification in Northern Ireland. In Republic of Ireland if a water body had a compliance history of no failures over the last 4 years it was placed in category “2a”, if it had a compliance history of no failures over a period greater than four years it was considered to be class “2b”.

5.0 Groundwater Risk Assessment

The pressures considered in the groundwater risk assessment included abstractions, artificial recharge, saline intrusion, point source pollution and diffuse source pollution.

The groundwater assessments use a simple pressure, pathway, receptor model to identify where the impacts on groundwaters are likely to occur. The overall approach is illustrated in Figure 5.1. The assessments developed in both jurisdictions draw on the methodologies applied by SEPA (Scottish Environmental Protection Agency) and EA (Environment Agency) through UK TAG, and ensure compatibility throughout the ecoregion. Groundwater experts from both jurisdictions worked closely to ensure a high level of co-ordination and consistency in the groundwater risk assessment. A Ground Water Working Group (GWWG) was established to assist in the characterisation of groundwater bodies and the formulation of a methodology for risk assessment.

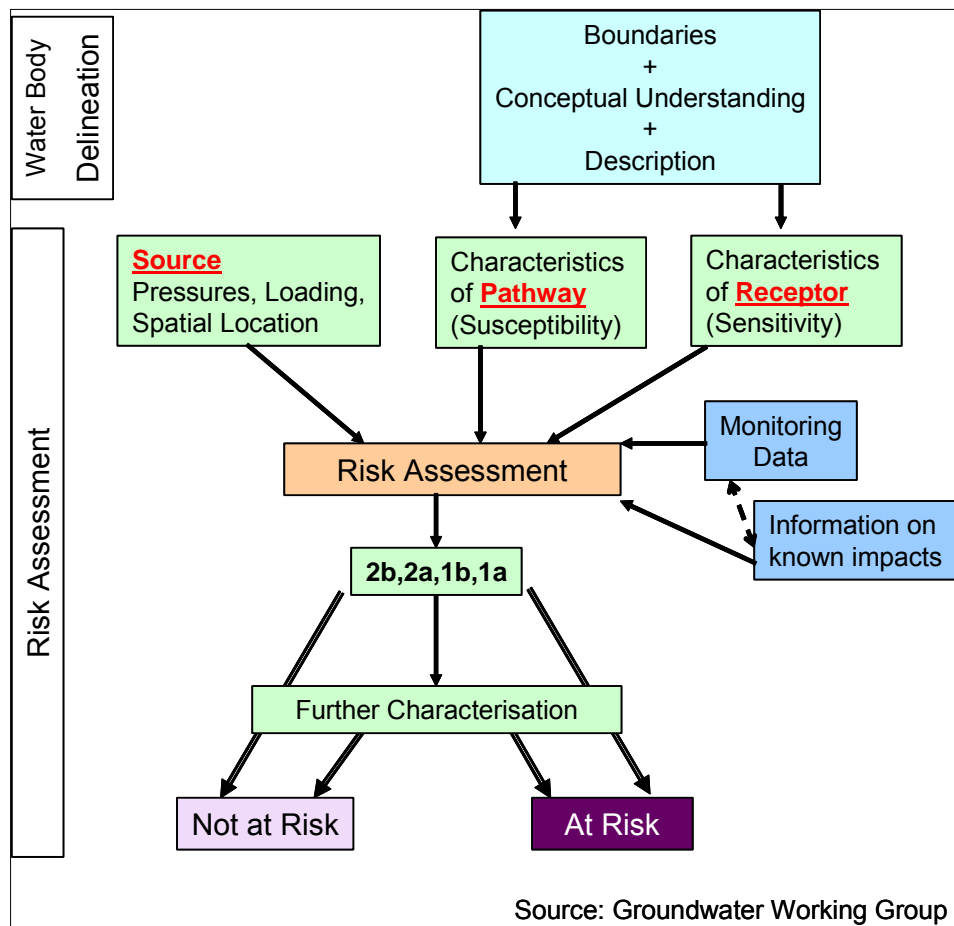


Figure 5.1 Groundwater Risk Assessment Approach

5.1 Northern Ireland

Quantitative Risk Assessment - The following assessments were carried out to determine the risk of failing to achieve good quantitative status:

- An overall water balance assessment for the groundwater body (i.e. the level of water abstraction such that it can be met by the amount of water entering the groundwater body (recharge) without impacting on the water requirements of dependent waters, such as rivers and lakes and Ground Water Dependent Terrestrial Ecosystems (GWDTEs), e.g., fens and turloughs).
- An assessment of individual abstractions or groups of abstractions impacting on sensitive ecosystems such as river headwaters or GWDTEs due to local lowering of water levels; and
- An assessment to determine if abstraction is causing alterations to natural flow directions such that saline or other intrusions are resulting.

The above assessments were carried out for each groundwater body and significant dependent surface water and/or terrestrial ecosystems.

Chemical Risk Assessment – The assessment of the quality of the groundwater is based on the concept of pathway susceptibility (i.e. the likelihood of pollutants being transmitted to a receptor). This describes the movement of pollutants vertically and horizontally and is a product of factors including soil, subsoil and aquifer type and vulnerability. Figure 5.1 illustrates the process.

Diffuse Source Assessment - the following diffuse pollutant types were considered in the risk assessment of the impact of groundwater bodies and associated ecosystems:

- Nitrates
- Phosphorus
- Selected pesticides
- Urban land use

The assessment area across which the analysis was undertaken ranged from the whole groundwater body surface area to individual river body and lake catchments, depending upon the receptor type.

Point Source Assessment - For the purposes of initial characterisation, available datasets were examined to identify activities or specific land uses that could represent point source pressures to groundwater, such as sheep dip disposal or landfill. For most potential point sources, some form of regulatory control already exists, and so the threat from them is limited. The presence of a potential point source of pollution within the relevant assessment area was the main criterion used when considering the risk posed. Limitations in the datasets restricted the detail of assessments undertaken and influenced the final risk categories assigned.

In NI less rigorous analysis of point source pressures was undertaken due to time and resource pressures and this risk needs reviewed during further characterisation. Presence/absence of potential point sources within buffer zones of 'groundwater-dependent' rivers was used to define risk to rivers with most assessments coming out as 2a for NI.

5.2 Republic of Ireland

Table 5.1 summarises the groundwater risk assessment carried out in the Republic of Ireland.

Table 5.1 WFD Groundwater Risk Assessment for Relevant Receptors and Pressures

Receptor	Groundwater Body	Groundwater dependent rivers, lakes & estuaries	Groundwater Dependent Terrestrial Ecosystems	Abstraction points
WFD Objective	Status, trends	Status	Status	Drinking water protected areas
Pressure				
Groundwater Abstraction				
Water balance	GWB1	SW1	GWDTE1	-
Intrusion	GWB2	-	-	-
Diffuse Source Pollutants				
Mobile nutrients (e.g. NO ₃)	GWB3	SW2		DWPA1
Less mobile nutrients (e.g. PO ₄)	-	SW3	GWDTE2a GWDTE2b	-
Mobile chemicals	GWB4	SW4		DWPA2
Clustered on-site systems & leaking urban sewerage systems	GWB5	SW5	GWDTE3	
Sheep dip	D	D	D	D
Less mobile chemicals	-	-	-	-
Microbial organisms	-	-	-	D
Point Source Pollutants				
Mining	GWB6	SW6	GWDTE4	
Quarries	GWB7		GWDTE5	
Landfills	GWB8		GWDTE6	
Oil industry infrastructure	GWB9		GWDTE7	
Contaminated land	GWB10		GWDTE8	
Trade effluent discharges	GWB11			
Urban wastewater discharges	GWB12		GWDTE9	

Codes GWB1, SW1, GWDTE1, and DWPA1 refer to risk assessment methodologies D refers to deferred procedures

Source: Groundwater Risk Assessment Sheets

Quantitative Risk Assessment – The risk assessment procedures for the quantitative assessment of good status considered the water balance for groundwater bodies as well as the impact of salt water intrusion. The impact assessment relates to both groundwater and their dependent terrestrial ecosystems.

Chemical Risk Assessment - The chemical pollutants from diffuse and point sources have been grouped into four sectors which typify their behaviour as they move through groundwater pathways. The pathway models take account of whether the substance decays or is conservative (organic or inorganic, respectively) and whether the substances is adsorbed within the structure of the soils, subsoils and aquifer (mobile or less mobile). The pathway groups are as follows;

- Mobile inorganic substances – such as nitrate;
- Less mobile inorganic substances – such as phosphate;
- Mobile organic substances – such as certain pesticides and PAH (hydrocarbons);
- Less mobile organic substances – for example other agrochemicals which bind to soils.

To determine relevant impact thresholds for water bodies in the diffuse risk assessment the GSI undertook trialling and verification of the methodology. This was undertaken by comparing the risk assessment output with representative monitoring data in water bodies representing a range of hydrogeological settings. The risk category is refined where monitoring data are available for the pollutant under consideration.

Point influences were considered unlikely to exert a significant influence on an entire groundwater body, as water bodies are relatively large units (generally over fifty square kilometres). Consequently, small water bodies were delineated around each point pressure assigned at risk or probably at risk category to better represent the likely zone of influence of the pressure. This splitting of water bodies dependent on pressures is consistent with WFD guidance.

5.3 Comparison of Risk Assessment Methodologies

Dataset Differences - In terms of datasets analysed there are some differences in the groundwater assessments particularly in the chemical assessment. In particular the “vulnerability” / vertical pathway layers used North and South have been developed independently and differ in some elements including the scale of the data used (in Northern Ireland broadbrush 1:250,000 was used, whereas, a more detailed scale was generally used in the Republic of Ireland, 1:50,000). Northern Ireland also carried out an assessment of urban land uses on the groundwater bodies.

The approach taken to defining the groundwater / surface water interaction has not been co-ordinated between both jurisdictions.

Risk Assessment Interpretation - The groundwater risk assessment in both jurisdictions are similar and adopt the same principals in the implementation of the risk assessment, i.e. the pressure, pathway, receptor model. Guidance has been drawn from the approach taken by SEPA and the EA and both assessments offer a level of consistency that has allowed easy integration of the risk assessments. The delineation of groundwater bodies in the border areas has been carried out through consultation with the respective geological experts in both areas. This has established common groundwater bodies along the border areas.

The majority area rule has been applied to cross border groundwater bodies. The risk assessment score for cross border groundwater bodies will depend on the area of that water body within each jurisdiction. The risk assessment for the jurisdiction with the largest portion of the groundwater body will be applied to the water body.

In Republic of Ireland significant point source pressures have been identified and where necessary local groundwater bodies defined to target specific problems. In Northern Ireland less rigorous analysis of point source pressures was undertaken and this pressure risk will be reviewed during further characterisation. Presence/absence of potential point sources within buffer zones of 'groundwater-dependent' rivers was used to define risk to rivers with most assessments coming out as 2a for Northern Ireland. Hence for cross-border bodies, risk assessment for the area of water body within Republic of Ireland is uniformly 2b. For the Northern Ireland area of the body the RA (when including the river assessment) is mostly 2a with a few 2b.

6.0 Other Risk Assessments

6.1 Alien Species

Northern Ireland

The risk assessment focuses on the 10 high impact alien species listed below as established in the *Guidance on the Assessment of Alien Species Pressures* prepared by the UK Technical Advisory Group (TAG). These have been selected because (a) of the known severity of their impact, and (b) it is likely that information will be available for the water bodies in which they occur.

UK List of 10 known high impact Alien Species

Australian swamp stonecrop	<i>Crassula helmsii</i>
Floating pennywort	<i>Hydrocotyle ranunculoides</i>
Water fern	<i>Azolla filiculoides</i>
Parrot's feather	<i>Myriophyllum aquaticum</i>
Common cord-grass	<i>Spartina anglica</i>
Japanese weed	<i>Sargassum muticum</i>
Zebra mussel	<i>Dreissena polymorpha</i>
Chinese Mitten Crab	<i>Eriocheir sinensis</i>
Slipper limpet	<i>Crepidula fornicata</i>
North American signal crayfish	<i>Pacifastacus leniusculus</i>

As three of the named species occurring in Great Britain (GB), Chinese mitten crab, slipper limpet and North American signal crayfish, are currently not recorded from Northern Ireland (or ROI) the working list is effectively made up of seven species with the provision for the addition of other alien species of concern at a regional site-specific level. The task is greatly facilitated by the known distribution of the various species within Northern Ireland from records deposited at CEDaR (Centre for Environmental Data and Recording).

In addition to this initial site identification, Natural Heritage also identified sites of nature conservation importance that were either linked directly to or in close proximity to a water body which has one of the 10 alien species listed above.

As the risk assessment is based on the presence of species any water body with no record of alien species was categorised as 'not at risk' (2b) except for some lakes which are considered to be 'probably at risk' (1b) because of the possible introduction of Zebra mussels, *Dreissena polymorpha*. Water bodies where any species from the list were found to be present were categorised as "probably at risk (1b). The exception to this rule occurred where a water body contained water fern *Azolla filiculoides*. This species is regarded as a localised problem in Northern Ireland and has not become

established here in the same way as in Great Britain. Also, those lakes with Zebra mussels were assigned a category of 'at risk' (1a) because of the known ecological effects of this species. All Transitional and Coastal waters were classified as 2a unless firm evidence proved the existence of an alien species (1b).

Republic of Ireland

The following eight aquatic alien species were identified as those posing most threat to the attainment of the environmental quality objectives of the WFD within Republic of Ireland:

RoI List of 10 known high impact Alien Species

Australian swamp stonecrop	<i>Crassula helmsii</i>
Floating pennywort	<i>Hydrocotyle ranunculoides</i>
Water fern	<i>Azolla filiculoides</i>
Parrot's feather	<i>Myriophyllum aquaticum</i>
Japanese weed	<i>Sargassum muticum</i>
Zebra mussel	<i>Dreissena polymorpha</i>
Nuttall's waterweed	<i>Elodea nuttallii</i>
Dace	<i>Leuciscus leuciscus</i>

Species data sheets have been prepared for these eight aquatic species as well as for *Ceratophyllum submersum* (Soft hornwort) in coastal lagoons and for the riparian species *Heracleum mantegazzianum* (Giant hogweed), *Fallopia japonica* (Japanese knotweed) and *Impatiens glandulifera* (Himalayan or Indian balsam) when these pose a risk to high ecological quality water bodies or protected sites. Expert judgement will have to be used to assess the impacts of alien species on specific water bodies, both to enable an accurate assessment of ecological status and to design appropriate programmes of measures.

Risk assessment for alien species was conducted according to the following steps:

- Using the EPA Alien Species GIS layer, assign a 1a: At Risk class to water bodies with records of alien species.
- The national map was reviewed by experts to allocate 1b category to water bodies and systems where alien species are probably present, or where records are questionable or known to be isolated.
- "No risk" category will be assigned to other water bodies under the alien species risk assessment.

For most species, whilst High Ecological Status may not be attainable with a recorded occurrence, Good Ecological Status can be achieved. It is considered, therefore, that the presence of alien species should not lead to a change in risk category overriding other risk assessments, but rather that the Alien Species Risk Assessment should give rise to a 'risk comment' assigned to the water body for incorporation into the programme of measures. Risk assessment is an iterative process. Where

distribution information is missing with respect to alien species it will require collection and analysis before risk can be assessed with confidence.

Comparison of Risk Assessment Methodologies

Dataset Differences - Both risk assessments use the document, *Guidance on the Assessment of Alien Species Pressures* prepared by the UK Technical Advisory Group (TAG). The species lists are slightly different with Northern Ireland retaining the species listed as invasive alien species in the UK despite there being no record of three of the species in Northern Ireland, i.e. Chinese mitten crab, slipper limpet and North American signal crayfish. In the Republic of Ireland there are a total of eight species selected for the risk assessment. Dace (*Leuciscus leuciscus*) and Nuttall's waterweed (*Elodea nuttallii*) are included in the Republic of Ireland but not in Northern Ireland, likewise cord grass (*Spartina anglica*) is included in the Northern Ireland list. There are therefore six common species used in the Northern Ireland and Republic of Ireland assessment.

Risk Assessment Interpretation - The methodology in Northern Ireland only classifies those water bodies containing alien species from the list as "probably at risk" with the exception of the Zebra mussel which puts the water body "at risk" as there is much known of its behaviour and impact on indigenous species particularly the freshwater pearl mussel. The assessment in Republic of Ireland will put any water body containing a high impact alien species in the "at risk" (1a) category.

Both risk assessments made use of expert judgement, in particular those water bodies that are not directly impacted by an alien species but are adjacent or in close proximity to an impacted water body were considered "probably at risk". In Northern Ireland it would appear that it was only sites of nature conservation interest that were considered by expert judgement whereas in the Republic of Ireland all water bodies adjacent or in close proximity to impacted water bodies were considered.

In the Republic of Ireland the risk assessment for alien species will be adopted as a shadow assessment, hence whilst the risk assessment is carried out for this pressure it will not override other risk assessments and will be used to inform the development of a programme of measures.

6.2 Protected Areas

Northern Ireland

SACs - Draft Favourable Condition targets for each site based on the habitat and species features for which each site is designated were identified. These targets relate to the extent of the site, water quality requirements, water table and flow requirements, habitat, morphology and disturbance. Sites with Favourable Condition targets relating to water quality were assessed with monitoring data, if it was available. The risk categories below were assigned to sites with habitats and species which require a GQA class A for biology or chemistry as identified in the favourable conditions for each site. Chemical GQA data from 2001-2003 was used, however for biological GQA data for 2000, 2002 and 2003 was used. This is because of the concerns of the validity of 2001 data due to the restricted sampling as a result of the foot and mouth epidemic.

Table 6.1 – Biological and chemical GQA and Risk Category classification for Natura sites

GQA	Risk category	UKTAG category
Always A	Not at risk	2b
1 or more B	Probably at risk	1b
1 or more C	At risk	1a
D,E,F	At risk	1a

For sites that had other specific water quality objectives (e.g. suspended solids, alkalinity, SRP and TP), monitoring data was used to assess the compliance with the favourable conditions targets for the respective site. When two or more monitoring sites occurred within a protected area site the highest risk score was applied, following the precautionary principle.

In order to complete the risk assessment water bodies that encompass the protected area site or that the site encroaches upon were identified and data on morphological and surface/groundwater abstraction pressures for these areas were obtained from the relevant risk assessment. Expert opinion was then used to allocate a risk category to a SAC area.

SPAs - For SPA sites, non-avian requirements are restricted to the extent of habitats within the designated area, and the extent /number of roosting sites. These were provisionally assessed on basis of morphological pressures if available. However, of the ten SPAs, four are also designated as SACs and therefore were assessed for all pressures.

Marine water bodies in which there is a SAC or SPA present have been categorised as 2a unless there is evidence to show that the SAC or SPA is at less than favourable condition which results in a 1a categorisation. It has been demonstrated that Strangford Lough is at less than favourable condition.

Bathing and Shellfish Water Directives - Designated Bathing and Shellfish Waters have been assessed using the following criteria and the 2001, 2002 and 2003 results:

Failure of mandatory standards – 1a

Pass mandatory standards but fail guideline standards – 2a

Pass guideline standards – 2b

The whole water body in which the protected area falls is categorised the same as the protected area.

The sensitive areas designated under the UWWT Directive are considered in Section 4.4 diffuse pollution.

Republic of Ireland

In the Republic of Ireland the risk assessment in relation to protected areas has been less widely implemented.

SACs - There has been some work carried out in relation to those SACs that support populations of the freshwater pearl mussel (*Margaritifera sp.*). In Ireland, *Margaritifera* is a scheduled species under the 1976 Wildlife Act (Statutory Instrument No. 112, 1990) and consequently the species and its habitat are protected by law. Only two species are endemic in Ireland: *Margaritifera margaritifera* and *Margaritifera durrovensis*. Both are listed in Annex II (and V) of the Habitats Directive (92/43/EEC) *Margaritifera durrovensis* is protected under the Wildlife Act, EU Habitats Directive, and Bern Convention (The Convention on the Conservation of European Wildlife and Natural Habitats). *Margaritifera margaritifera* is listed on the most recent International Union for Conservation of Nature and Natural Resources (IUCN) Red Data List as "Endangered" (IUCN, 1996). *Margaritifera durrovensis* is listed as "critically endangered".

Information collected by the NPWS indicates the current state of knowledge of the conservation status of the populations identified. Given that *Margaritifera* is a long-lived species, a population is considered to be unfavourable if it is failing to recruit, as well as if the population is declining. Based on available survey and monitoring data the NPWS has assigned these rivers 1a, 1b and 2a risk categories according to the scheme in Table 6.2 below. The majority of the rivers identified fall into the 1b and 2a categories, as further information is required.

Table 6.2 Risk Classes applied by NPWS to *Margaritifera* spp. SAC rivers.

Risk Category	Criteria
1a	Unfavourable conservation status
1b	Unfavourable conservation status
2a	Favourable conservation status or no data available regarding conservation status
2b	No 2b risk categories have been assigned due to limited available data on recruitment rates and population profiles, and also due to the extreme sensitivity of the Freshwater Pearl Mussel to siltation and eutrophication

Risk classes indicated in the NPWS dataset have been applied as follows:

- Information provided on the conservation status of the populations identified has been treated as impact data, and is to be considered alongside the Q-Value impact assessment already conducted by RBDs.
- In consultation with national experts, the NPWS have agreed that it should be assumed that the mussel is present throughout the river system upstream of the end point grid references given (and not simply in the water body upstream). The *Margaritifera* impact class should therefore, be applied to all water bodies upstream of the point indicated. Identifying water bodies upstream may require some judgement:
- Water bodies downstream of a point will not be assigned any *Margaritifera* impact risk class.
- For each water body, the *Margaritifera* risk class should be compared to the Q-Value risk class. Of the two, the worst case of risk should be applied and entered as the pollution risk class for that water body, and those upstream. (For example, where Q= 1a and *Margaritifera*= 1a, a 1a risk class is assigned. Where Q= 2b and *Margaritifera*= 1a, a 1a risk class is assigned. Where Q= 1a and *Margaritifera*= 2a, a 1a risk class is assigned). This assessment was included with the impact data used in the pollution assessment so as to mask the distribution of *Margaritifera* spp. as they are a “critically endangered” species.

Bathing Waters Directive - The Bathing waters have been assessed in a similar manner as those in Northern Ireland with the same risk categories applied.

The groundwater risk assessment also considered protected habitats particularly in relation to Groundwater Dependent Terrestrial Ecosystems (GWDTEs), e.g. fens and turloughs and sensitive aquatic waters.

Comparison of Risk Assessment Methodologies

The risk assessment for the bathing waters for both jurisdictions follows the same principal and risk category allocation hence there will be good agreement between the two methods and the integration of the shared water bodies should be facilitated relatively easily.

In relation to Natura sites the Northern Ireland assessment is more comprehensive as there is more information available for the assessment of these sites with favourable condition targets established for each site. Favourable condition targets have been compared with monitoring data and pressure assessments to provide a risk assessment of the relevant water bodies. In the Republic of Ireland the risk assessment of Natura sites is restricted to those that support populations of freshwater pearl mussel (*Margaritifera spp.*) and sensitive aquatic waters identified in the groundwater risk assessment. There has been much concern over this mollusc as it is a “critically endangered” species. Information is therefore available to allow a meaningful risk assessment to be carried out. Further development of the other protected areas will be carried out in the further characterisation process.

6.3 Commercial Fisheries

Northern Ireland

In Northern Ireland the assessment of commercial fisheries was considered in the morphology impact assessment and is discussed in section 4.2.

Republic of Ireland

In the Republic of Ireland the commercial fisheries assessment was considered as an additional risk assessment and was included as a shadow assessment used to inform the risk assessment procedure. Finfish farms and suspended culture shellfish have been considered under the marine waters point source pollution risk assessment. Where such activities are practiced within a water body the risk is assumed to be 2a until further characterisation can be carried out. In relation to other forms of commercial fishing and in particular dredging and bottom culture shellfish, a GIS of fishing activities has been prepared and a group of experts from the Marine Institute and the Central Fisheries Board will provide their expert opinion on the impact of such activities.

Comparison of Risk Assessment Methodologies

Notwithstanding the fact that the Northern Ireland morphological assessment considered the impact of commercial fishing a comparison of the two assessments is dealt with under this section.

Datasets differences – The datasets used in Northern Ireland and those proposed for the Republic of Ireland are consistent in that a GIS has been developed illustrating the distribution of commercial fishing in the marine waters of both jurisdictions.

Risk Assessment Interpretation – The Republic of Ireland included both suspended aquaculture and finfish farms in the point source assessment but Northern Ireland only considered the assessment of finfish farms in this assessment.

7.0 Overall Summary of Risk Assessment Review

The risk assessment review of the approaches taken in both jurisdictions of the NS SHARE has highlighted some differences in the risk assessments. These differences vary with some resulting from data availability and dataset differences whilst others are a result of the interpretation of the risk assessment guidance and higher level policy decisions. Table 7.1 summarises the review of the risk assessments carried out in each jurisdiction. The significance of the differences identified has been assessed and is included in the table as either high, medium or low based on the extent of additional work required. The NS SHARE project will address these issues as part of the further characterisation process.

The differences between the two risk assessment methodologies have been summarised under the main pressure categories, i.e. abstraction and flow regulation, morphological pressures, point source pollution pressures, diffuse source pollution pressures and impact data.

7.1 Abstraction and flow regulation

For the abstraction risk assessment the main difference in the assessment relates to the estimation of natural flows. In Northern Ireland the flow estimation model for the derivation of natural flows was based on the Micro LowFlows model. This model is based on the principal of the catchment operating as a closed system with inputs (precipitation) balancing outputs (run-off) and losses (evaporation). In the Republic of Ireland low flows were estimated from the generation of a low flow contour map from low flow statistics at existing gauging stations throughout the island of Ireland. This approach is highly dependant on the quality and distribution of gauged catchments.

In both instances an estimation of the deviation from natural flow resulted in the assignment of the various risk categories. Similar thresholds of deviation were used for the various risk categories. Whilst the methodologies used in both jurisdictions were different they should harmonise well across shared water bodies. Both jurisdictions have identified the need for further detail on unregulated abstractions, such as agricultural, which should be collected as part of further characterisation process. In addition regulated abstractions require verification of abstraction volumes as in many cases this volume is estimate

The uncertainty of Q95 flows at the downstream extent of the lake water bodies was the determining factor in using the mean flows in the Northern Ireland assessment. Given the discrepancies identified in the use of the Q95 statistic in the assessment of natural flows in lake water bodies, sensitivity testing to establish the effect of using the alternative methods in each jurisdiction should be investigated.

7.2 Morphological Risk Assessment

The major difference in the morphological risk assessments is the inclusion of intensive grassland as a landuse pressure in the Northern Ireland assessment. In the Republic of Ireland it was felt that the inclusion of intensive grassland was over precautionary, particularly when considered in the context of coniferous, arable, urban and peatland uses.

The inclusion of this land use affected 88 water bodies in Northern Ireland, a number of which are located in border areas. This will have obvious implications for the harmonisation of the risk assessment in cross border water bodies. The approach adopted by the EHS Water Management Unit is consistent with the guidance offered by UK TAG and it is felt that the assessment, whilst precautionary, is representative of morphological pressures on surface water bodies.

In relation to dataset differences, for the most part the datasets used in both jurisdictions should facilitate harmonisation, particularly where dredging, channelisation, land cover and shoreline reinforcement are considered. However the use of the Habitat Modification Score from River Habitat Survey information in Northern Ireland will present problems in the harmonisation given that a similar survey is not available in the Republic of Ireland.

In Northern Ireland aquaculture and fishing datasets available from DARD were used in the morphological impact assessment, similar datasets were not available at the time of the initial characterisation for the Republic of Ireland. However these activities are currently being mapped in the further characterisation process and this will facilitate the harmonisation process.

7.3 Point Source Risk Assessment

In Northern Ireland the consideration of WWTW with a PE of >250 in the risk assessment differs from the Republic of Ireland assessment which only considers WWTW with a PE >500. The Northern Ireland assessment, with the higher resolution, is therefore more robust and will result in the consideration of more WWTWs. In the Republic of Ireland the smaller treatment plants have been considered in the diffuse risk assessment.

In order to assess the impact of the smaller treatment plants in the Republic of Ireland in a similar manner to that carried out in Northern Ireland, it would be necessary to establish the location of such works and derive an estimated pollution load from the works as in the majority of cases monitoring information is not available. This would then allow a better harmonisation of the risk assessments.

7.4 Diffuse Source Pollution

One of the main differences in the risk assessment relates to the designation of sensitive areas under the UWWT Directive. In Northern Ireland all catchments draining into Lough Erne and Lough Neagh were designated as sensitive areas under the UWWT Directive and a risk assessment category of 1b, probably at risk, was assigned to these catchments. This resulted in a large portion of water bodies to

be placed in the probably at risk category. In the Republic of Ireland sensitive areas under the UWWT Directive were assigned to specific water body stretches and were not necessarily classified as probably at risk from diffuse source pollution. The implications for harmonisation of the risk assessment are that there will be many more water bodies considered at risk in Northern Ireland as a more precautionary approach was adopted. It will be necessary to establish a way of incorporating the two approaches in the harmonisation process and further characterisation.

In the models used in the diffuse source risk assessment the risk categories were assigned based on the probability of a concentration for an agricultural pollutant being less than a predefined threshold. In Northern Ireland if the probability was between 0.5-0.8 the water body was classified as probably at risk (1b) whilst a probability of less than 0.5 resulted in a water body being put at risk (1a). In the Republic of Ireland the corresponding probability ranges were 0.25 -0.6 and less than 0.25. In Northern Ireland the EHS have investigated the effects of assigning the probability range of 0.5-0.8 to risk category 2a rather than to 1b. It was established that this would result in the DPST outputs under representing the extent of recorded impact. The approach used in Northern Ireland to assess agricultural pollutants will result in the assignment of more water bodies at risk when compared to the Republic of Ireland risk assessment and this will have an impact on cross border catchments.

The risk assessment relating to acidification due to forestry also differs between the two jurisdictions. In Northern Ireland critical load calculations were used as the criteria for assessing the impact of acidification. In the Republic of Ireland acid geology was used as the determinand. It has been agreed that the EPA would provide data on critical loads so that the ROI assessment could follow a similar approach to the EHS in Northern Ireland.

7.5 Impact Data

In Northern Ireland the precautionary approach is used in that if either the impact assessment or the pressure assessments show the water body at risk then equal weight is given to each assessment. In the Republic of Ireland the Q values are given precedence over both other impact data and the pressure assessment. The different approaches adopted will therefore lead to Northern Ireland reporting more water bodies at risk which will again result in discrepancies in the risk assessment at cross border catchments that will require addressing at the harmonisation and further characterisation stage.

7.6 Groundwater

Vulnerability/vertical pathway layers used in Northern Ireland and the Republic of Ireland have been developed independently and differ in some elements including the scale of the data used. Northern Ireland also carried out an assessment of urban land uses on the groundwater bodies whereas this was not considered in the Republic of Ireland.

The groundwater risk assessment in both jurisdictions are similar and adopt the same principals in the implementation of the risk assessment, i.e. the pressure, pathway, receptor model. However in the Republic of Ireland significant point source pressures have been identified and where necessary local groundwater bodies defined to target specific problems. In Northern Ireland less rigorous analysis of point source pressures was undertaken and this pressure risk will be reviewed during further characterisation.

7.7 Other Risk Assessments

Alien Species - Both risk assessments use the document, *Guidance on the Assessment of Alien Species Pressures* prepared by the UK Technical Advisory Group (TAG), however the species lists are slightly different.

In Northern Ireland water bodies containing alien species from the list have been classified “probably at risk” with the exception of the Zebra mussel which puts the water body “at risk”. The assessment in Republic of Ireland will put any water body containing a high impact alien species in the “at risk” (1a) category.

In Northern Ireland water bodies of nature conservation interest that are adjacent to impacted water bodies were considered to be probably at risk whereas in the Republic of Ireland all water bodies adjacent or in close proximity to impacted water bodies were considered.

Protected Areas - In relation to Natura sites the Northern Ireland assessment is more comprehensive as there is more information available for the assessment of these sites with favourable condition targets established for each site. In the Republic of Ireland the risk assessment of Natura sites is restricted to those that support populations of freshwater pearl mussel (*Margaritifera spp.*) and sensitive aquatic waters identified in the groundwater risk assessment. Further development of the other protected areas will be carried out in the further characterisation process.

Commercial Fishing - The Northern Ireland morphological assessment considered the impact of commercial fishing whereas in the Republic of Ireland commercial fishing was not considered in the morphological assessment and was restricted to the assessment of point source risk from aquaculture and finfish farms.

7.8 Next Steps

The next steps will involve the refinement of the risk assessments through further characterisation. Discussions have already begun relating to the scope of this work under the NS Share project. It is anticipated that the areas identified in this report will be addressed during the further characterisation process when shared or cross border water bodies will be assigned a risk category.

Table 7.1 Summary of Risk Assessment Comparison in NS SHARE Study Area

Risk Assessment	Water Body	Northern Ireland	Republic of Ireland	Significance
Water Abstraction and Flow Regulation	River Water Body	Q95 flows derived from Micro Low Flows – software for estimating low flows based on catchment characteristics.	Q95 flows derived from gauged river flows throughout the island of Ireland.	Medium
	Lake Water Body	Mean flows used to derive natural flows	Q95 flows used	Medium
Morphology	River Water Body	Habitat Modification Score (HMS) of River Habitat surveys used to assess risk.	No RHS available for Republic of Ireland	high
		National datasets used where RHS not available	National datasets used in determining risk	Low
		LCM2000 land use dataset used to determine intensive land use	CORINE dataset used to determine intensive land use	Low
		Use of improved grassland as an intensive land use pressure	Improved grassland was not classified as an intensive land use for morphological risk assessment	High
	Lake Water Body	Assessment of feeder stream impacted by morphological pressures was carried out using LCM2000 and OS Mapping	Feeder stream morphological pressures were assessed using OPW datasets, with buffer zones applied around the water body	Medium
		Assessment of built development on shore zone	Built development on the shoreline not considered.	Medium
	Coastal and Transitional Water Bodies	Aquaculture and Fishing included in risk assessment	Commercial Fishing assessment considered as a shadow assessment to inform the development of the programme of measures and did not form part of the morphological risk assessment	Medium
		Built development considers the shoreline reinforcement information from Roads Service	Built development determined from National Irish Coastal study	Low
		Land use pressures not included in assessment	Land use pressure included in the assessment	Medium

Risk Assessment	Water Body	Northern Ireland	Republic of Ireland	Significance
Point Source Pollution	All Water bodies	Priority substances were specifically assessed within the risk assessment, and a discharge containing a priority substance at twice the EQS was considered 'probably at risk'.	This was not carried out in Republic of Ireland although the IPC and Section 4 Licences would have dealt with these pressures indirectly.	High
		Datasets for the WWTWs/WTW and industrial consent discharges included three and four years of data respectively.	In the Republic of Ireland Urban waste water returns for 2003 were used for WWTWs, there was no compliance data for WTW and industrial discharge data varied depending on the availability of EPA and Local Authority monitoring.	Medium
		Risk Assessment considered all WWTWs/WTWs with a PE of >250	The threshold for the inclusion of a WWTW/WTW in the risk assessment was a PE of 500 or more. The smaller treatment plants have been incorporated into the Diffuse Risk Assessment	Medium
Diffuse Source Pollution	All Water bodies	Diffuse Pollution Screening Tool (DPST) – uses land-use info, topography, soil type, pesticide use etc.	Empirical relationships developed and adopted in ROI using similar environmental criteria and pressure datasets to that in NI	Medium
		Impact data used to qualify the pressure risk assessment. Precautionary approach adopted in that if either the impact data OR the pressure data showed WB at risk then this category is applied.	Impact data used in a similar way to that in NI with the exception of the Q system impact data. This data took precedent over pressure data even if the pressure data indicated a worse situation in relation to the risk.	High
		Probability of 0.5 - 0.8 that the concentrations for agricultural pollutants will be less than a predetermined threshold as an indication of probably at risk category (1b).	1b risk category was assumed to be represented by 0.25-0.6 probability of a water body attaining a Q value of 4 or greater.	High

Risk Assessment	Water Body	Northern Ireland	Republic of Ireland	Significance
Diffuse Source Pollution (continued)	All Water bodies (continued)	The assignment of a risk category of 1a for diffuse source pollution to Lough Erne and Lough Neagh was adopted in Northern Ireland as these lake water bodies are designated as sensitive under the UWWT Directive. In addition the catchments draining into these water bodies are also designated under the Directive and have been assigned a minimum of 1b for diffuse pollution.	Specific water bodies have been assigned as sensitive under the UWWT Directive and not on a catchment wide basis	High
		Critical load calculations were used as the criteria for assessing the impact of acidification	Acid geology was used to determine the risk associated with acidification.	Medium
Impact Data	Surface Water Bodies (Freshwater rivers and lakes)	The precautionary approach is used in that if either the impact assessment or the pressure assessments show the water body at risk then equal weight is given to each assessment.	In the Republic of Ireland the Q values are given precedence over both other impact data and the pressure assessment.	High
	Marine Water Bodies (Coastal & Transitional)	Those water bodies that are assessed as “potential problem areas” under the OSPAR classification system have been assigned a risk category of 2a	OSPAR “potential problem areas” have been assigned a risk category of 1b.	Medium
		Water bodies whose concentrations are above the EAC have been designated as 1b until further information becomes available. In addition chemical concentrations between twice the BRC and EAC were assigned a risk category of 1b.	Marine expert input resulted in the removal of the 1b category (probably at risk) from the risk classification scheme for the hazardous substances risk assessment.	Low
		Concentrations below twice the BRC for trace elements put the WB not at risk (2b). There was no “probably not at risk” (2a) classification	A compliance history of no failures over the last 4 years placed a WB in category “2a”, if it had a compliance history of no failures over a period greater than four years it was considered to be class “2b”.	Low

Risk Assessment	Water Body	Northern Ireland	Republic of Ireland	Significance
Groundwater Risk Assessment		In Northern Ireland the information on septic tank occurrence was incorporated into the Diffuse Pollution Screening Tool.	Septic tanks were included in the diffuse source risk assessment under clustered on-site systems & leaking urban sewerage systems	Low
		An assessment of urban land uses on the groundwater bodies was carried out	Urban land uses not considered in groundwater assessment	Medium
		Point source pressures have not been assigned to local groundwater bodies but rather to entire water body.	Significant point source pressures have been identified and where necessary local groundwater bodies defined to target specific problems	High
Alien Species	All surface water bodies	Cord grass is included in Northern Ireland, however Dace and Nutall's waterweed are excluded. There are therefore six common species used in the Northern Ireland and Republic of Ireland assessment.	Dace and Nutall's waterweed included in risk assessment but cord grass is excluded.	Low
		Only water bodies containing Zebra Mussel are placed in 1a category, other alien species result in a 1b classification.	Any water body containing a high impact alien species in the "at risk" (1a) category.	Medium
		Risk Assessment considered in overall risk category allocation	Risk assessment to be used as a shadow assessment to inform the development of the programme of measures.	High
Protected Areas		Favourable condition targets are available for many of Natura sites. These targets were compared with monitoring data to assign a risk category	Favourable condition targets were not available. Risk assessment therefore confined to <i>Magaritifera spp.</i> assessment and sensitive aquatic systems identified under the groundwater assessment.	High
Commercial Fishing		Point source risk assessment in Northern Ireland did not include the assessment of suspended aquaculture other than finfish farms.	The Republic of Ireland have included the suspended aquaculture and finfish farms in the point source assessment of coastal embayments and lagoons	Low
		Commercial fishing was considered in morphology risk assessment.	Not included in morphology risk assessment but it is proposed to include this pressure as a risk to morphology in further characterisation.	High