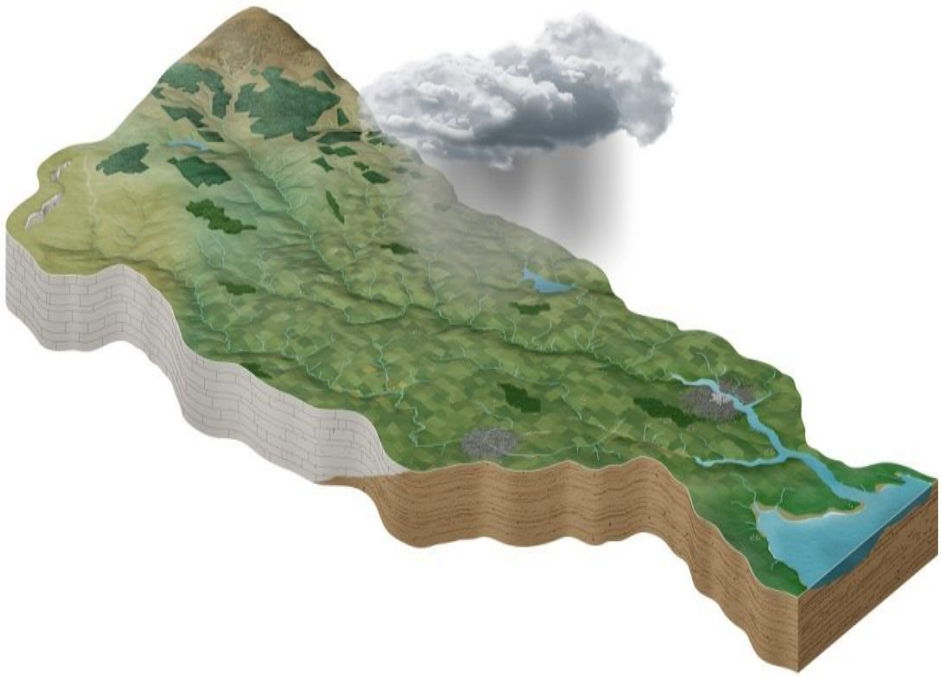
Draft

Guidance on Characterisation Methodology



Catchment Science & Management Unit

Environmental Protection Agency

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Version no. 4

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1 Introduction

1.1 Purpose of Report

The purpose of this report is to describe: i) the role of characterisation in water resources management in Ireland and ii) the approach taken to characterising water bodies, subcatchments and catchments. More extensive information is available in the various publications and guidance documents listed in the References (Section 5). In addition, this document is supported by, and should be read in conjunction with, two other documents:

1. An explanatory document on Source Load Apportionment Modelling.
2. Explanatory documents on the approach to integrating Protected Areas requirements.

1.2 Background and Context

The Water Framework Directive (WFD) is a major piece of EU legislation designed to protect, preserve and improve the aquatic environment whilst encouraging the sustainable use of water. Characterisation of water bodies is a critical element of the work required under the Directive. It sets the scene for where the water resources are and how they function in the landscape, and provides the understanding of how they are impacted by the pressures caused by human activities. The outcome of characterisation is the identification of water bodies at risk of not meeting their WFD objectives. Article 5 of the WFD, supported by Annex II which contains some of the required detail, identifies three components in the characterisation of water bodies:

(a) an analysis of its physical characteristics, i.e., the physical information that describes the water bodies including water body boundaries, typologies, reference conditions, the geology and hydrogeology of groundwater bodies including the nature of the overlying strata, linked groundwater and surface water systems, etc.
(b) a review of the impact of human activity on the status of surface waters and groundwater, and
(c) an economic analysis of water use.

The WFD requires each Member State to have in place a programme of measures in order to achieve the objectives of the WFD (Article 11). Measures are required to ensure protection of existing satisfactory water resources and improvement of unsatisfactory water resources, with the latter often requiring additional supplementary measures. Monitoring programmes are designed to assess whether the measures are effective. The characterisation process is therefore a major driver in designing appropriate monitoring networks and in implementing measures.

Integrated catchment management (ICM) is a framework to facilitate different ways of working towards a better water environment. It has become the agreed approach to achieving WFD objectives and the sustainable use of water and land resources (DECLG, 2015). ICM involves a series of interconnected steps (see Table 1): i) building partnerships; ii) creating and communicating a vision of ICM; iii) characterising the physical, hydrochemical and ecological components; iv) identifying and evaluating possible management strategies and measures; v) designing an implementation programme; and vi) implementing the programme and making adjustments, if necessary.

1.3 Role of Characterisation

Aquatic ecosystems can be damaged or degraded by a wide variety of pressures which arise either from human activities undertaken in specific locations (point sources such as water abstraction

points, wastewater treatment plants, septic tank systems and farmyards) or widely dispersed human activities (diffuse sources such as landspreading of fertilizers and urban areas). For large point sources discharging to water, while the locations are known, an evaluation of impacts and possible mitigation measures are needed. For diffuse and small point sources, there are a number of factors in the landscape, such as the characteristics of the soil, subsoil, bedrock and topography, that determine the degree to which a pollutant will become available in a particular location and the likelihood of it being mobilised and carried along a pathway to a water receptor, such as a river, lake or well. In addition, some water-based ecosystems are more sensitive than others to water abstraction or nutrients and/or sediment arising from human activities. Therefore, the prediction of impacts and successful protection of water resources is a challenging scientific and engineering exercise.

'Characterisation' is the word used to encompass having sufficient knowledge as the basis for decision-making. In order to manage the water resources in a catchment, we must understand (characterise) the movement and attenuation (where relevant), of water and pollutants along the pathways from the pressure to the receptor, understand the impacts, and understand the role of mitigation measures. Therefore, characterisation is a major component of ICM as it provides the scientific basis on which water resources management and WFD implementation is based.

2 Characterisation context

2.1 WFD requirements

Characterisation, as required by Article 5 of the WFD, is undertaken to enable the environmental objectives in Article 4 (see Appendix 1 for further details) to be achieved efficiently, thereby ensuring that (often expensive) measures are correctly prioritised and targeted, and realistic environmental objectives are set and met.

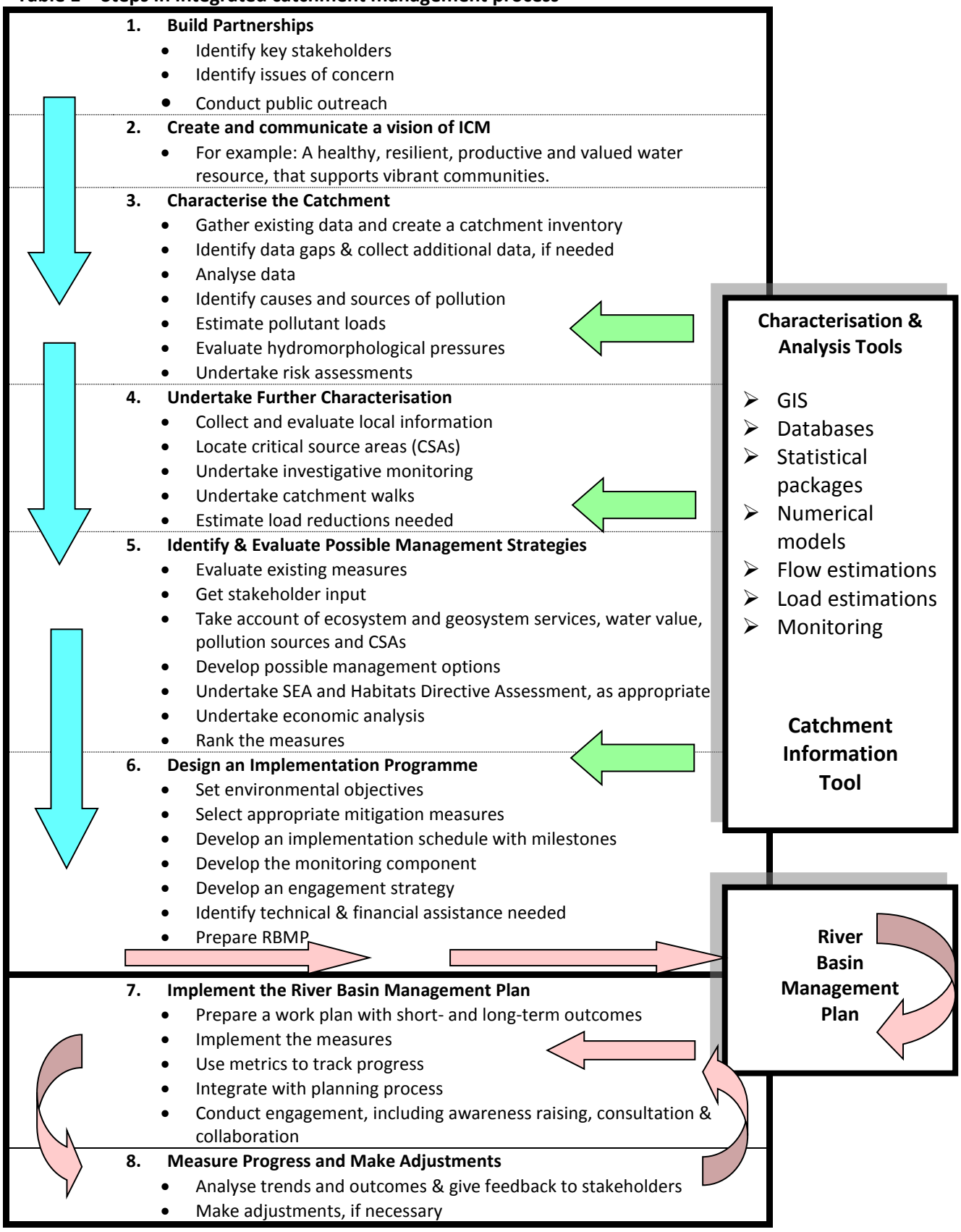
As part of the characterisation process, the following is being undertaken:

- Classification of surface water bodies (river, lake, transitional (estuarine) and coastal) into five status classes (High, Good, Moderate, Poor and Bad,) and groundwater bodies into two status classes (Good and Poor status).
- Assessment and designation of the 'Risk' of water bodies not meeting the WFD objectives, with allocation of water bodies to three categories – *At Risk*, *Not at Risk* and *Review*.
- Evaluation of the requirements of protected areas – drinking water, bathing waters, shellfish waters, nutrient sensitive areas and Natura 2000 sites.
- Conclusions on the significant issues and significant pressures in *At Risk* water bodies.
- Nutrient load reduction assessment or abstraction reduction assessment where relevant.
- Further characterisation if considered to be necessary, which requires undertaking investigative assessments.

The outcome of characterisation assists in the assessment of existing measures and the identification and assessment of potential new measures, and the setting of environmental objectives.

To-date, the main emphasis has been on assessing the ecological impacts of nutrients and, to a lesser degree, hydromorphology. The quantitative impacts of water abstraction (Article 7), and the impacts of priority pollutant pressures also need to be assessed; this work has recently commenced. A future version of this report will provide explanatory material on these assessments.

Table 1 – Steps in integrated catchment management process



2.2 Characterisation Principles

There are a number of key principles that influence the characterisation process:

1. The 'catchment' is the appropriate organising, landscape-based unit for water management, whether it is the catchment area to an individual water body or either a subcatchment or catchment, as defined in Section 2.3.

2. "Risk" as used in WFD characterisation has a restricted meaning; it is not 'risk of contamination' as in common usage or 'facility risk' but is specific to the **likelihood of not meeting WFD objectives**.

3. Characterisation provides an understanding of how catchments work. This includes: i) the physical, hydrochemical and ecological characteristics; ii) impacts; iii) pressures; and iv) quantification of pollutant loads and abstraction amounts in the catchment, using the **source-pathway-receptor concept** as an overarching framework (Figure 1). The aim is to use characterisation to identify the **significant pressures** (i.e. the pressures causing the issues), so that strategies, measures and resources can be prioritised and targeted to enable effective protection or restoration, as required, of our water resources.

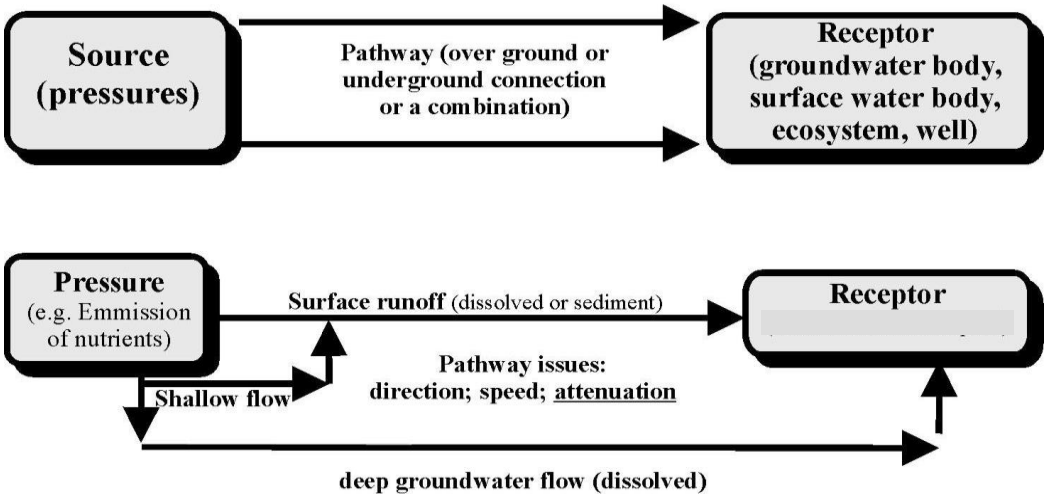


Figure 1: Pressure – pathway-receptor model for implementation of the WFD

4. A three-tiered approach is taken to characterisation, so that the level of assessment effort is commensurate with the level of risk posed. The three tiers are preliminary risk screening, initial characterisation and further characterisation, with each tier becoming increasingly detailed, targeted and specific.

5. A consistent approach is taken to the characterisation, evaluation of measures and the setting of the environmental objectives for surface waters, groundwater and protected areas. The final risk category is based on the most stringent objective relevant to the water body; in certain circumstances, for instance, protected area requirements may be more stringent than surface water or groundwater requirements.

6. An "*At Risk*" designation for a water body means that action beyond basic measures is required to enable achievement of the environmental objectives; therefore resources are required. A

commitment for resources for these supplementary actions needs a relatively high level of confidence in the assessment.

7. Assessment and designation of the risk category is evidence-based. Therefore, information on the environmental supporting conditions (metrics on biology, flows, water levels and water quality, as appropriate) required to achieve the objectives of the water body or site (in the case of Natura 2000 sites) must be available. These are then assessed against the available monitoring data or, in the case of Natura 2000 sites, the water-based supporting conditions of the sites.

8. Where the available evidence is sufficient and confidence in the assessment is high, measures to mitigate impacts and associated environmental objectives can be determined. Where the evidence is limited and the confidence in the assessment is low, further characterisation in terms of investigative assessments is needed before significant investment in additional measures is recommended.

9. The components of the WFD implementation process are illustrated in Figure 2.

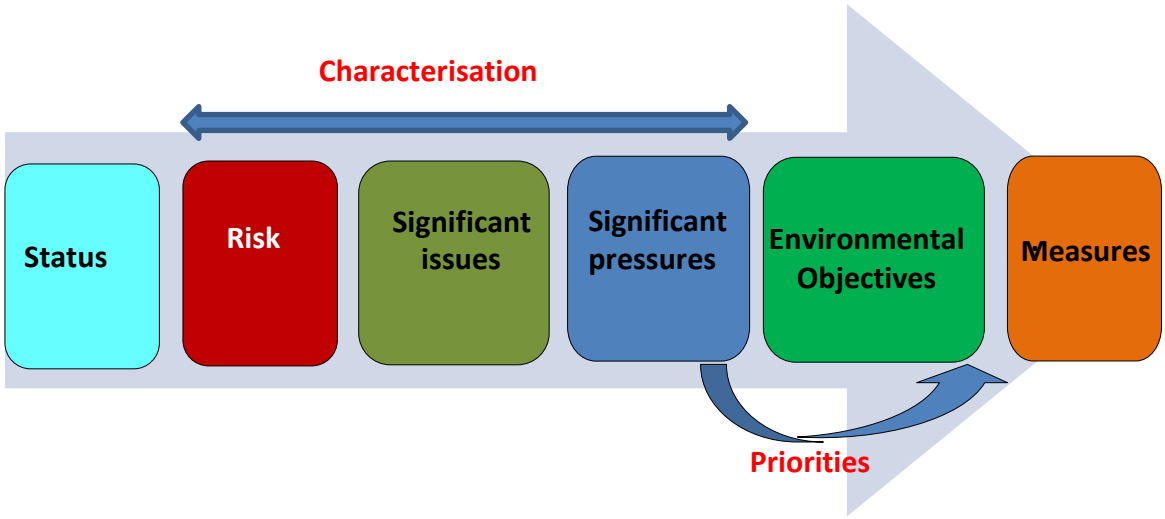


Figure 2: Schematic diagram of WFD implementation process

2.3 Assessment and Reporting Scales

The scales being used in WFD implementation are outlined in Figure 3 and are as follows:

- **Site/field scale:** Most pressures are investigated and dealt with at this detailed scale (e.g. urban wastewater treatment plants, septic tank systems, farmyards, landfills, nutrient and sediment runoff from fields). (Investigative assessments (see Section 3.5) are generally undertaken at this scale.)
- **Water body (WB) scale:** Water bodies are the 'units' for monitoring and reporting of status and risk characterisation results.
- **Sub-catchment scale**: Water bodies have been aggregated into subcatchments, varying in area from approximately 70 to 200 km^2. This is the scale at which most of the scientific elements of characterisation is undertaken. Community engagement is also carried out primarily at this scale.

- **Catchment Scale:** These are the catchments as defined, with some additions in the Shannon catchment, by the nationally-defined hydrometric units, giving 46 catchments in the Republic of Ireland (Figure 4). They are coherent landscape units encompassing and connecting: i) water flowing from upland areas to the coast or, in the case of the Shannon catchment, the Shannon itself; and ii) all pressures with the potential to impact on all the water types in the catchment. They are at a practical scale for deciding on, planning and coordinating activities; in effect, this is a practical management and 'governance' scale for water.
- **River Basin District (RBD) scale:** The seven RBDs used for the 1st cycle of the WFD have been merged to form one national RBD and two cross-border RBDs. The outputs at this scale are the River Basin Management Plans.

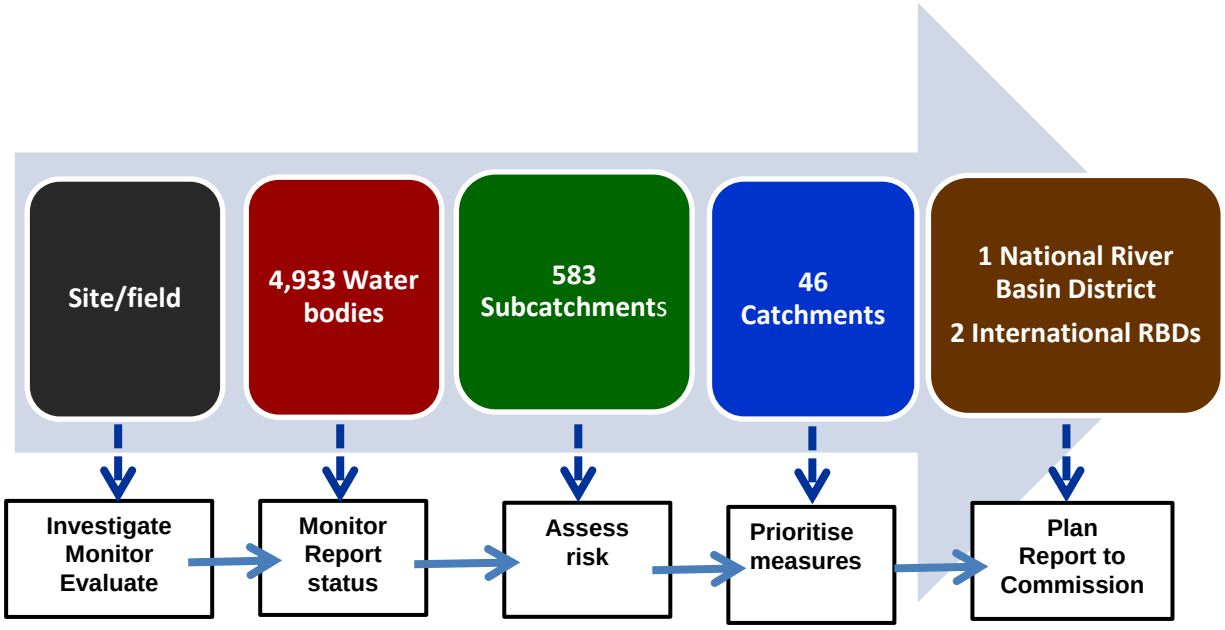


Figure 3: Scales used in catchment management and WFD implementation

2.4 Protected Areas

Protected areas are defined under both the Surface Water and Groundwater Regulations as 'areas designated as requiring special protection under specific Community legislation for the protection of their surface water and groundwater, or for the conservation of habitats and species of European sites directly dependent on water and listed in the register established by the EPA in accordance with Article 8 of the 2003 Regulations'. Under the WFD (Annex IV), Protected Areas include:

(i) areas designated for the abstraction of water intended for human consumption under Article 7 (Drinking waters);

(ii) areas designated for the protection of economically significant aquatic species, such as shellfish areas (Shellfish waters);

(iii) bodies of water designated as recreational waters, including areas designated as bathing waters under the Bathing Waters Directive (Bathing waters);

(iv) nutrient-sensitive areas, including areas designated as Sensitive Areas under the Urban Waste Water Treatment Directive (Nutrient sensitive areas); and

(v) areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant Natura 2000 sites under the Habitats Directive or the Birds Directive (Natura 2000 sites). The provisions of the WFD relate to **water dependent** Natura 2000 sites, which are

certain Special Areas of Conservation (SACs) or Special Protection Areas (SPAs). SACs and SPAs must be maintained or restored at favourable conservation status under their respective directives.

Figure 4: Catchments delineated for Water Framework Directive implementation purposes

2.5 Heavily Modified and Artificial Water Bodies

A heavily modified water body (HMWB) is a: "*body of surface water which as a result of physical alterations by human activity is substantially changed in character, as designated by the Member State in accordance with the provisions of Annex II*". Examples include ports, water bodies affected by flood protection and embankments, water regulation, intensive land use and water abstraction. An artificial water body (AWB) is defined as a *"body of surface water created by human activity"* (Article 2.8 of the WFD). Examples include canals and reservoirs.

While the aim for river, lake, transitional and coastal water bodies is to achieve and maintain Good Ecological Status (GES), HMWBs and AWBs need to achieve Good Ecological Potential (GEP). Ecological Potential is a measure of ecological quality compared to the maximum quality achievable.

34 HMWBs and 37 AWBs were designated in the last cycle. Information on the approach and progress will be included in a future version of this report.

3 Characterisation Approach

3.1 Status

Water body **status** is the parameter used by the WFD to determine the degree of impact by human activities on water resources. It reflects the situation at a point in time and is reported to the EU Commission. Status, which is the basis of the classification of all water bodies, is the starting point for the characterisation process.

There are 4,933 water bodies in total: 513 groundwater bodies; 3,192 river water bodies; 818 lake water bodies; 196 transitional water bodies; and 111 coastal water bodies. Monitoring data – biological, chemical, hydromorphological and, in the case of groundwater, water levels – provide the basis for status determinations. A 'one out, all out' approach is taken, where a single failing sub-element is required to dictate the overall reported status of the water body. Further information on the structure and breakdown of status is provided in UKTAG, 2007.

Despite a substantial national monitoring programme being in place, not all water bodies have an associated monitoring station and nor will it be feasible, or desirable in the future to monitor them all. Unmonitored water bodies are assigned a donor water body which has similar characteristics and pressures, and thereafter are assigned the same status as their donors. In the case of the 513 groundwater bodies, the national EPA groundwater quality monitoring network includes monitoring wells in 128 water bodies, with additional monitoring points in the vicinity of IPPC licensed sites. The monitoring locations in the EPA network are determined by the requirements for achieving a monitoring network that is representative of the variations in hydrogeology and pressure across a groundwater body or group of bodies. The surface water quality monitoring network comprises a series of biological and chemical monitoring sites. Further information on the WFD monitoring network strategy can found at http://www.epa.ie/pubs/reports/water/other/wfd/.

3.2 Risk of Not Meeting WFD Objectives

Risk builds on the status, by incorporating trend information and distance to the threshold of the next lowest status class, to look forward to consider whether a water body is likely to meet its environmental objectives by the end of the implementation period for the plan. Risk is used to highlight the areas where monitoring and measures need to be implemented and/or adjusted so that the objectives can be met on time. Three risk categories are used: *Not at Risk*, *At Risk* and Review; where *Not at Risk* water bodies require maintenance of existing measures to protect the satisfactory

status of the water bodies; *At Risk* water bodies require new, often more targeted, mitigation measures requiring resources in terms of both finances and staff; and *Review* water bodies require additional monitoring and assessment.

Assigning risk is based on:

i) consideration of the ecological status of the water bodies, (high, good, moderate, poor and bad for surface water bodies, and good and poor for groundwater bodies);

ii) the trends in hydrochemistry, particularly of phosphate, nitrate and ammonium for groundwater and rivers, chlorophyll and total phosphorus in the case of lakes, and chlorophyll, phosphate and dissolved inorganic nitrogen for transitional and coastal water bodies. Trends are considered to be significant where they are both statistically significant (90% confidence) and environmentally significant (statistically significant trends that suggest a change in status by the end of the planning cycle is likely);

iii) the distance to thresholds, such as environmental quality standards. The 'distance to threshold' can be either 'near' (i.e. within 25% of the threshold boundary), or 'far'. The purpose of the assessment is to determine if the water body is at risk of deteriorating to a lower water quality status, based on the proximity of the concentration of the parameter to the relevant threshold.

Therefore, decisions on the environmental objectives and associated measures are based on the risk category and not on the status class alone. Three levels or tiers of characterisation are being undertaken so that the level of assessment is commensurate with the degree of risk posed (Table 2).

Table 2: Summary of the differences between the three levels of characterisation

Level	Name	Carried out by	Scale	Datasets used
1	Preliminary water body risk screening	EPA	Water body	National water monitoring data (Appendix 2)
2	Initial characterisation of subcatchments and catchments	EPA with assistance from consultants, local authorities & Irish Water	Subcatchments initially, building up to catchments	Large range of catchment science data, integrated assessments (Appendix 3)
3	Further characterisation	Local Authorities and other agencies, with assistance from EPA	Specific issues in specific locations	Catchment walk findings, investigative monitoring, modelling, engagement, compliance checks, etc.

Further details on the general characterisation approach are given in Deakin (2015).

3.2.1 Groundwater Bodies

The determination of groundwater body risk is being undertaken separately as it requires a catchment-wide approach, rather than a water body and subcatchment approach as is the case for rivers and lakes. The analysis involves consideration of the following:

- Water bodies where average chemical concentrations are exceeding threshold values[1].

[1] Threshold values are set out in statutory instrument No. 9 of 2010 that is available on www.statute.ie.

- Well/spring drinking water protected area requirements.
- Groundwater as a contributor of nutrients and other pollutants to rivers, lakes, transitional and coastal waters, and Natura 2000 sites.
- Widespread groundwater contamination plumes, for example from IPPC and waste sites, and historic mines.
- Groundwater abstraction impacts.

3.2.2 Transitional & Coastal Water Bodies

The determination of the risk category for transitional and coastal water bodies and the setting of objectives and measures are dependent on a catchment scale analysis, which may incorporate multiple catchments. This assessment is carried out after the subcatchment assessments for the contributing rivers and lakes are completed, because it includes consideration of the total riverine inputs to the system, as well as an understanding of the estuarine and coastal dynamics. Estuarine modelling work is being carried out by the EPA Ecological Monitoring and Assessment Unit to help determine the load reductions needed from the catchment to achieve the WFD objectives in the estuaries and coasts.

3.3 Preliminary Risk Screening

Preliminary risk screening is based on the national biological and chemical monitoring dataset and it is carried out at the waterbody scale. In the case of the 4,420 surface water bodies, the results are generated from a new EPA specifically programmed IT system, called the WFD Application. As the outcomes are automated, the rules used have to be conservative, resulting in a relatively high proportion of water bodies being categorised as *Review*. In the next stage of characterisation, initial characterisation, the main focus is on the *At Risk* and *Review* water bodies.

3.4 Initial Characterisation

Initial characterisation is undertaken first for rivers and lakes at a subcatchment scale. All rivers and lakes water bodies are aggregated into subcatchments, which vary in size from 70-200 km^2, giving 583 subcatchments nationally (Figure 5). A subcatchment may include between 3-15 river and/or lake water bodies.

Initial characterisation of subcatchments involves tracking a stream from the source to the outlet, evaluating the biological and chemical data for each river and lake monitoring point sequentially, integrating this information with evidence on the local pressures and pathways (over ground and underground) for water and contaminants, and concluding on the significant issues, significant pressures and the risk category for each water body.

The process involves the following:

- Using the preliminary water body risk screening results, together with the associated information on status, water quality trends and distance to thresholds, as the starting point.
- Physical characterisation – a summary of topography, hydrometeorology, hydrology, geology, hydrogeology and aquatic ecology as the basis for understanding water and contaminant movement in the subcatchment.
- Locating and understanding the relative impacts of activities/pressures, such as agriculture, wastewater discharges, landfills, mines, water abstractions.

- Estimating and apportioning the nutrient loads from the main pressures using the EPA Source Load Apportionment Model.
- Locating critical source areas for diffuse nutrient pressures using the EPA Susceptibility and Pollution Impact Potential maps.
- Evaluating the protected area issues and requirements.
- Incorporating knowledge and information from other public bodies, such as local authorities, Inland Fisheries Ireland (IFI) and Irish Water (IW). The protocol followed is illustrated in Figure 6. In summary, workshops are held with the Environment Sections of each local authority and with regional IFI staff – three/four Catchment Unit staff visit each local authority for between 1 and 3 days, depending on the number of water bodies in the local authority area.
- Where the information available is sufficient, concluding on the significant issues and pressures as the basis for decision-making on environmental objectives and mitigation measures. This is a collaborative process between the agencies listed above.
- Where the information available is insufficient, concluding on further characterisation requirements, particularly Investigative Assessments.

Initial characterisation is subsequently undertaken at a catchment scale where groundwater, transitional and coastal waters, and protected areas which can often span large areas, are assessed, following largely the same process.

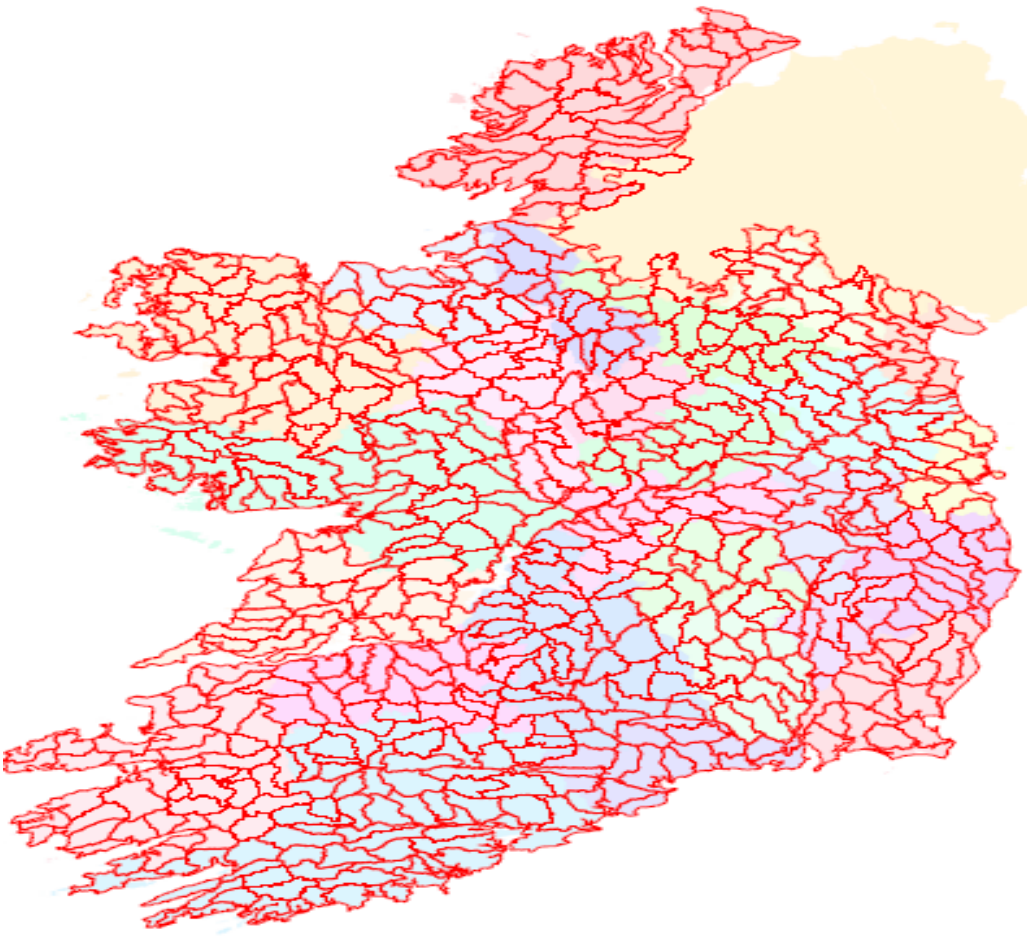


Figure 5: Boundaries of the 583 subcatchments

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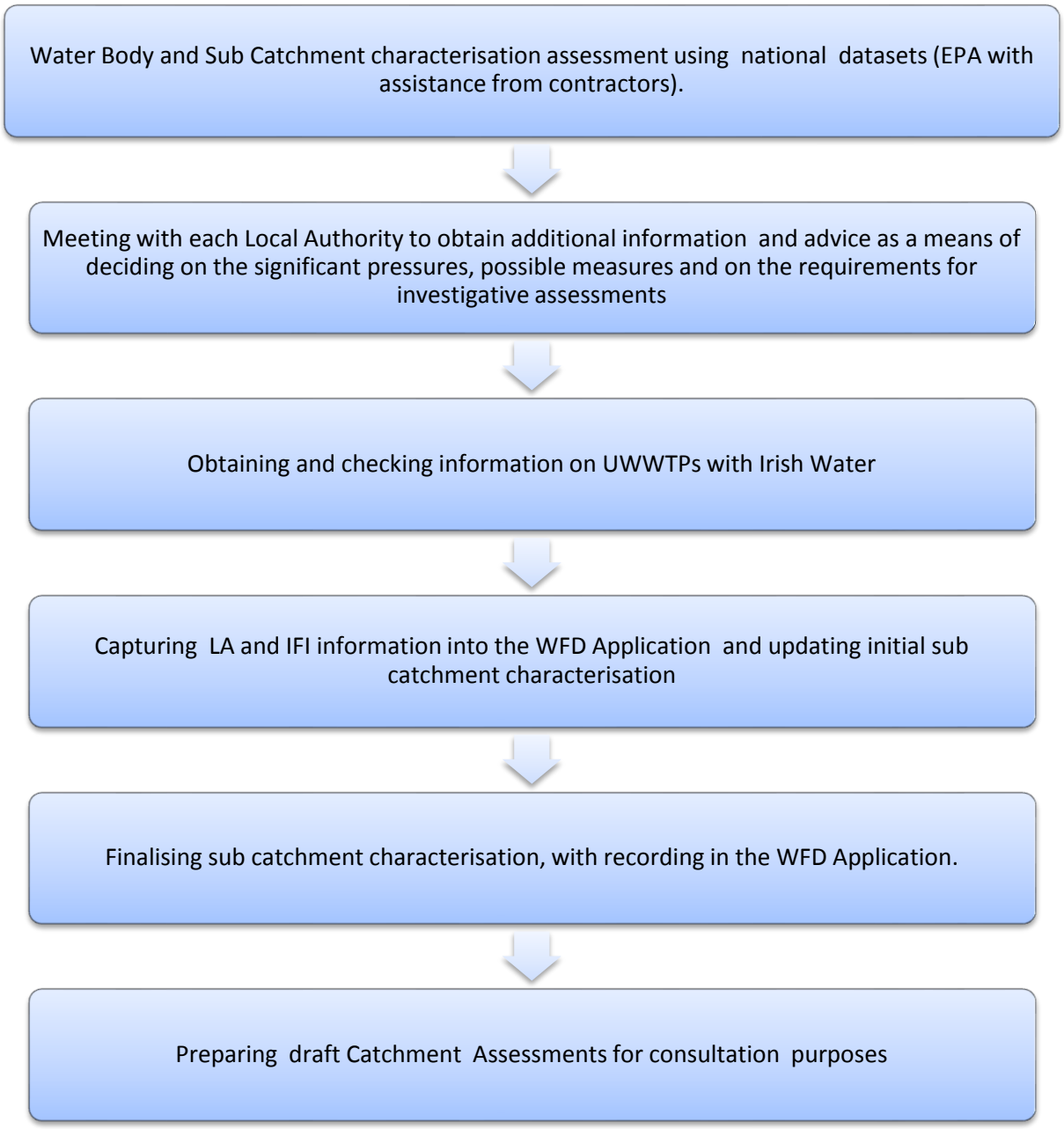

Figure 6: Flow diagram illustrating the collaborative approach involving the EPA, local authorities, Inland Fisheries Ireland and Irish Water

3.4.1 Evaluation of Subcatchment Issues

If a water body is categorised in either the *At Risk* or *Review* categories, an evaluation is made of the significant issue(s) or parameter(s) that is preventing a *Not at Risk* category. Significant issues include, for instance, phosphate, ammonia, nitrate, sediment, habitat quality, water levels, low summer flows. Significant pressures for each of the identified significant issues then need to be identified so that the measures needed to mitigate the impact of the pressures can be targeted.

3.4.2 Information on Pressures

Information on pressures has been compiled from a range of datasets held by various public agencies including EPA, Geological Survey of Ireland (GSI), Office of Public Works (OPW), Department of

Agriculture, Food and Marine (DAFM), Irish Water (IW), Inland Fisheries Ireland (IFI) and Local Authorities. Many of these datasets are available on the EPA's mapping website Envision and on the WFD Application (see Appendix 4 for further details) and Catchments.ie where the full metadata are also presented. While all pressures are considered in the initial characterisation assessment, the key outcome of the assessment is the understanding of which of the pressures are significant (Section 3.4.5).

The Reporting Guidance (EC, 2015) issued by the European Commission sets out a list of pressure types that must be followed by Member States in WISE reporting. These have been tailored to suit Irish conditions. The full list of pressures that are being recorded in the WFD Application and that will be submitted to the Commission using the WISE reporting system is given in Appendix 5.

3.4.3 Source Load Apportionment

A data-driven Source Loading Apportionment Model (SLAM) has been developed by the EPA *CatchmentTools* Project for Irish conditions as a means of predicting the sources of nutrient loads (phosphorus and nitrogen) to surface water from a range of sources including urban wastewater treatment plants, industrial discharges, agriculture, septic tank systems, forestry and urban areas. This model uses an export coefficient approach of: i) calculating annual average nutrient loads from each sector; ii) reducing these loads by a factor, to account for treatment (e.g. urban wastewater) or attenuation in the environment (e.g. diffuse agricultural sources) where relevant, thereby modelling the annual in-stream loads from each sector; and iii) comparing the modelled annual in-stream loads, with estimates of measured annual in-stream loads calculated using available measurements of nutrient concentrations and flow. The model enables the identification of the main sources and the approximate average annual loads from these sources, and therefore facilitates the evaluation of the required load reduction and the targeting of mitigation measures. The model is further described in detail in Mockler et al., *in press*. A typical output is shown in Figure 7.

3.4.4 Location of Critical Source Areas

Critical sources areas are areas that deliver a disproportionally high amount of pollutants compared to other areas of a water body or subcatchment and represent the areas with the highest risk of impacting on a water body. Critical source areas are located by combining the nutrient loadings (phosphorus and nitrogen) applied to the land surface with the hydro(geo)logical susceptibility of the water body to these nutrients.

High hydro(geo)logically susceptible areas are areas from which nutrients, if present or applied, have a high probability of reaching a water body of interest due to the underlying hydrogeological conditions (i.e. the areas that have significant pathway linkages from the source of pollution or pressure to surface water or groundwater receptors)[2]. These maps are now available for phosphate along the near surface pathway and for nitrate along the near surface and groundwater pathways.

[2] Geoscientific information provided by the Geological Survey of Ireland (bedrock, aquifer, vulnerability, subsoil permeability, karst features) and Teagasc (soils, subsoils) have provided the basis for understanding and modelling the movement of water and pollutants through the landscape, thereby enabling prediction of pollutant attenuation and pollutant loading to water. The EPA-funded Pathways Research Project (Archbold, *et al*., 2015) and subsequent EPA *CatchmentsTools* Project has used the pathway susceptibility concept and produced national (1:20,000 scale) pathway susceptibility maps for both nitrate and phosphate as a means of evaluating the likelihood of these pollutants reaching water. For instance, Archbold, *et al*., (2015) concluded "*Therefore, for mitigation measures and management strategies to be successful, it is essential that these transport pathways are identified and understood at subcatchment scale and that mitigation measures and management strategies are pathway specific*".

Figure 8 shows the susceptibility map for phosphate along the near surface pathway for the Suir Catchment. The darker areas (or Very High and High categories) are areas that are most susceptible to transporting phosphate along the near surface water pathway to rivers and lakes.

Pollution Impact Potential maps (PIP) (or critical source area maps) are generated by combining the susceptibility maps with nutrient loadings data calculated from the Land Parcel Information System (LPIS) data provided by the Department of Agriculture, Food and the Marine and the Central Statistics Office. The Pollution Impact Potential map for phosphate to surface water for the Suir Catchment is shown in Figure 9. The darker the blue, the higher the risk. The highest risk areas for phosphate to surface water are the poorly drained areas with relatively high loads from intensive farming, meaning that in these areas phosphate is more likely to flow overland to surface waters rather than being attenuated in the soil and subsoil. Similar maps are available for nitrate in surface water and groundwater.

The roles of the differing biophysical settings on the transport and attenuation of pollutants is illustrated in Figure 10.

In the catchment areas of water bodies with unsatisfactory water quality, the Pollution Impact Potential maps help focus on the areas and sources that might be causing the impacts. They help determine whether agriculture is a significant pressure and can be used to target areas for further investigative assessment at a water body and subcatchment scale. They are available at a maximum scale of 1:25,000 (e.g. water body scale) and are not designed or suitable to be used on their own as a basis for decisions at a farm or field scale. Consequently these maps act as signposts for where investigative assessments and engagement actions should be prioritised.

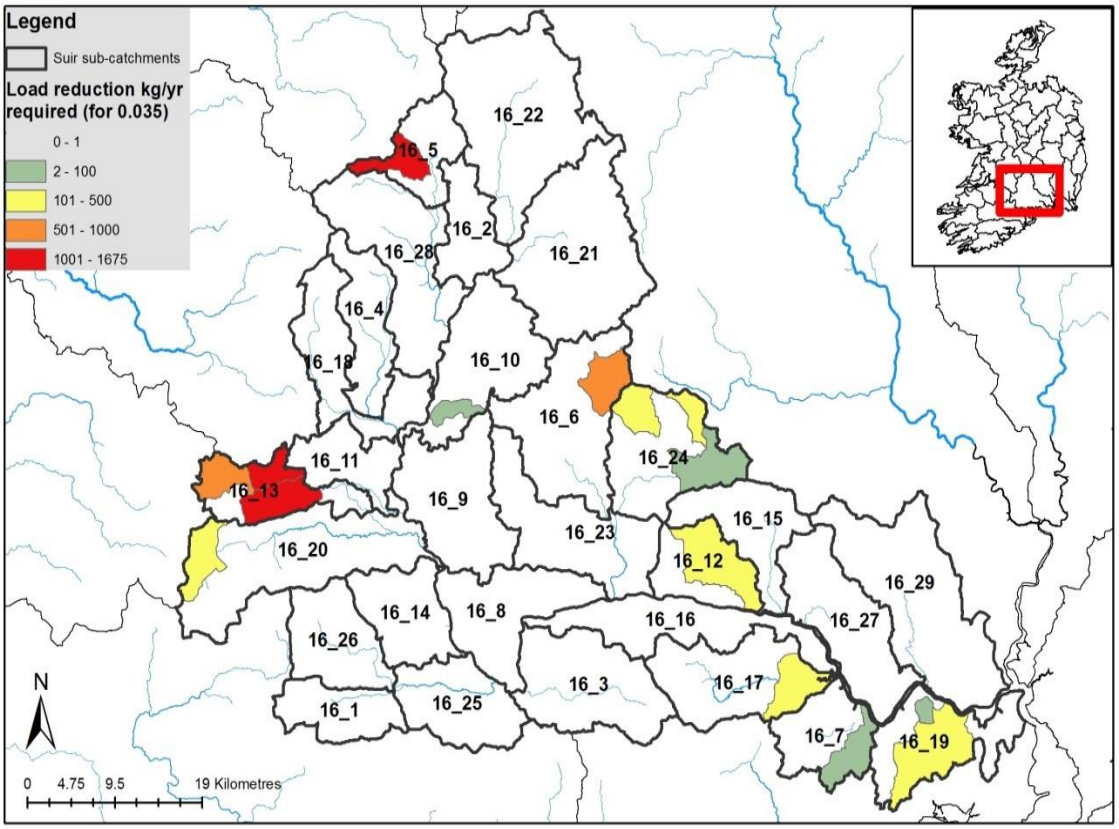

Figure 7: Load reduction required for phosphorus loads to attain 'Good' status based on annual average concentration of 0.035mg l^{-1}.

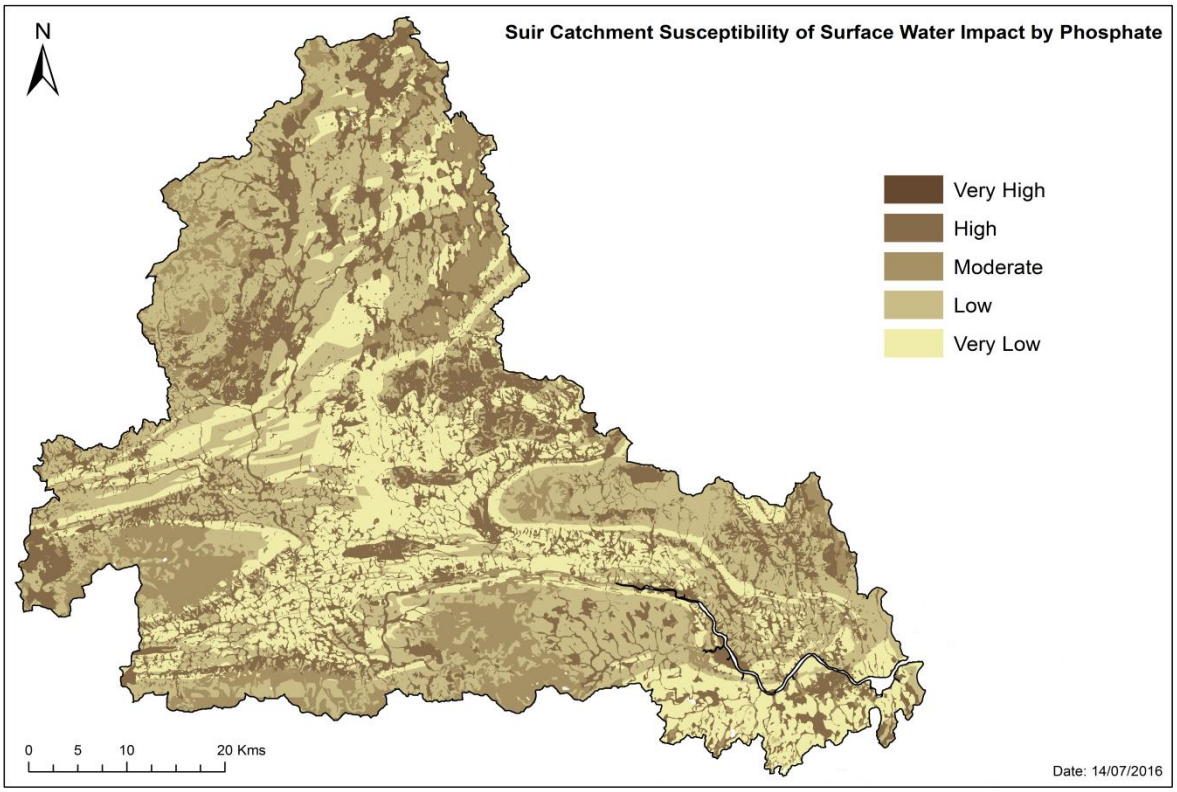

Figure 8: Map showing the Phosphate susceptibility ranking along the near surface pathway for the Suir Catchment

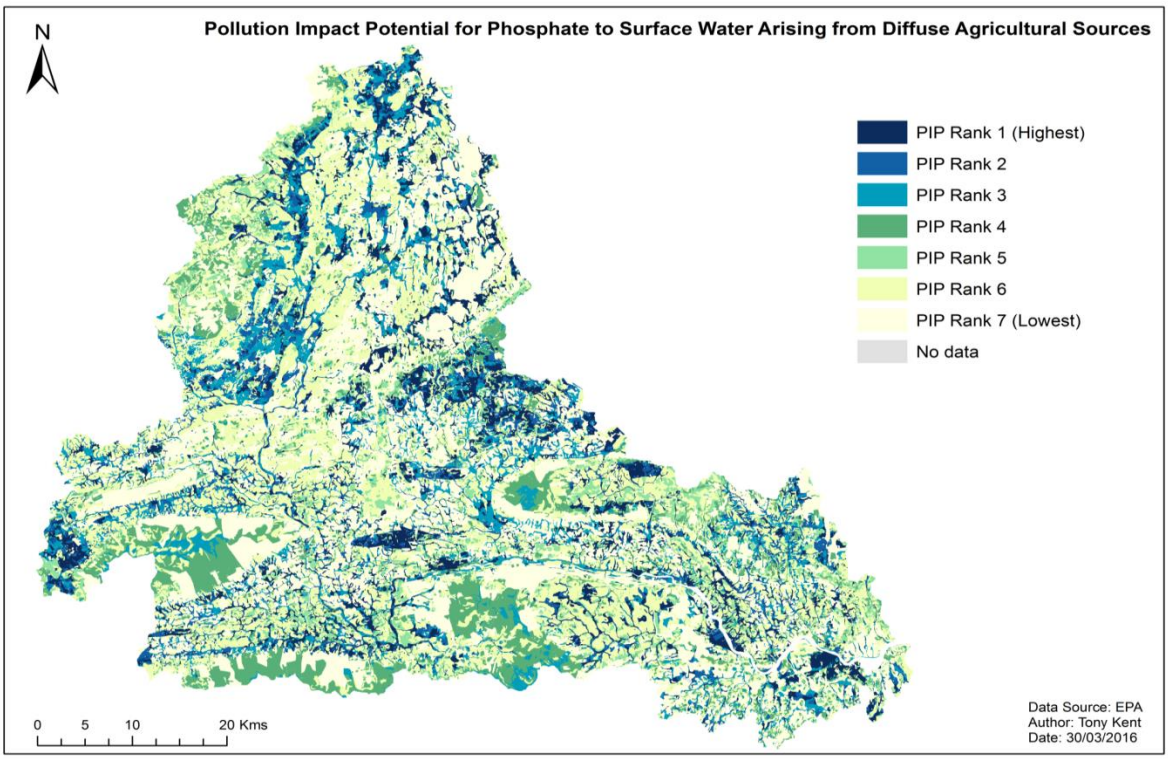

Figure 9: Pollution impact potential (PIP) map for phosphate to surface water arising from diffuse agricultural sources

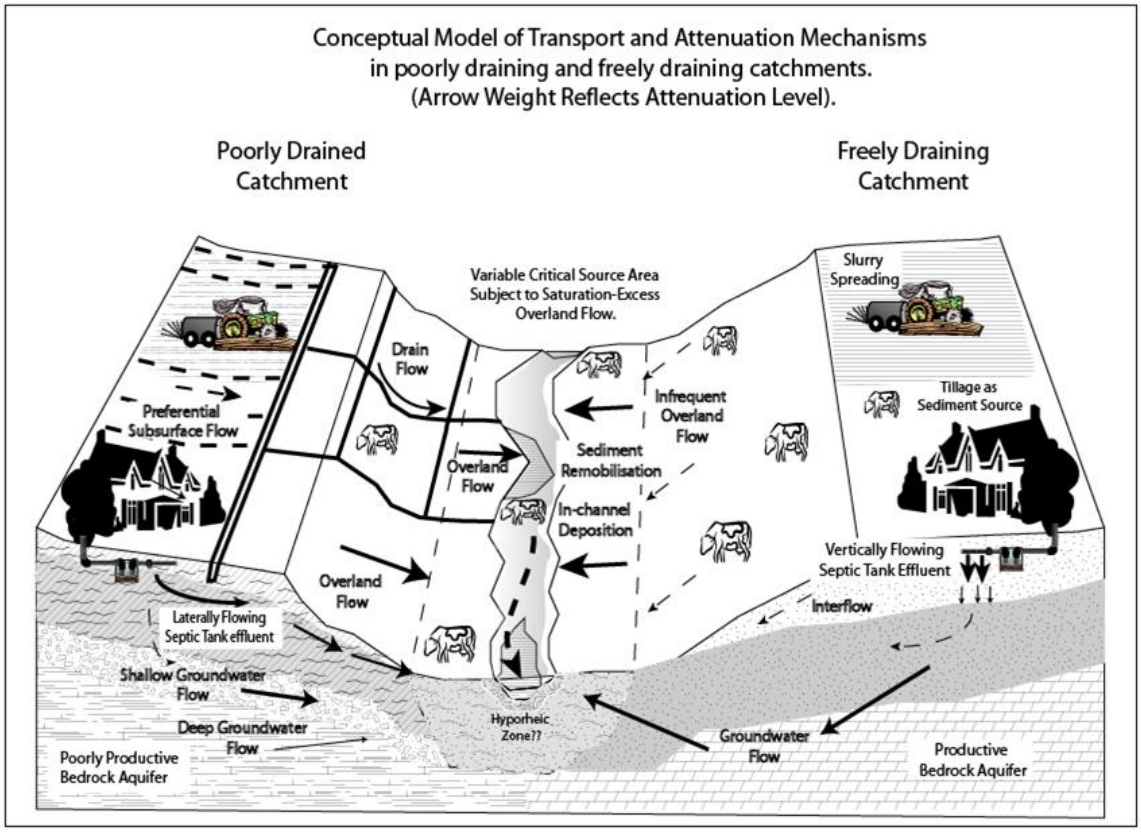

Figure 10: Illustration of pollutant transport mechanisms in different settings (Source: Raymond Flynn, Queen's University, Belfast))

3.4.5 Significant Pressures

A key requirement of the characterisation process is the identification and quantification of the **significant pressures** and their impact on the status of surface water and groundwater bodies; significant pressures therefore only arise for *At Risk* water bodies. Once a pressure is designated as 'significant', measures are needed to mitigate the impact(s). Therefore resources, human and/or financial, are required. In view of this, an adequate level of confidence is needed before further actions are taken. The assessment of significance is undertaken in two steps consistent with the tiered approach to characterisation, first at the sector level through the initial characterisation process, and secondly at the site/field level through further characterisation, which is usually the scale needed for the selection of specific measures to mitigate the issue. In the development of the plan only the first step will be completed with the further characterisation being commenced in 2017 and continuing on during the implementation period of the plan.

The initial characterisation analysis of significance uses a variety of available information, such as monitoring data, information on the biophysical setting, pressure information, source load apportionment modelling, the pollution impact potential maps, and local knowledge and data provided by EPA, Local Authority and IFI staff, to decide whether a pressure is 'significant' or not at the sector level. Common sector level significant pressures include, for instance, discharges from wastewater treatment plants, agriculture (diffuse and/or farmyards), forestry, domestic wastewater treatment systems, urban pollution and extractive industry. The level of confidence in the assessment is typically sufficient at this stage to justify targeting further characterisation and investigative assessments as a means of providing specific additional information on the pressure, particularly the location in the case of diffuse and small point sources. While large point sources, such as wastewater discharges, can be readily located and can often be determined as 'significant

pressures' at the initial characterisation stage because site specific information is already available, it is frequently not possible to locate and evaluate diffuse significant pressures at this stage of characterisation without undertaking an investigative assessment.

During the second step, the precise nature and location of the sector pressure, and a refined understanding of its degree of significance, is assessed to increase the degree of confidence sufficiently to target expenditure on appropriate site-specific measures. Common significant pressures at this stage could include for example, clearfelling in a particular forestry coup in the north west of the catchment, grazing and animal access in the headwaters of the river, tillage or landspreading too close to the stream in a particular reach, lack of dilution at a waste water treatment plant at low flows, etc. This level of significance and confidence is required to actually address these issues.

The determination of significant pressures is based on information available to the end of 2015.

The key factor in the designation of a pressure as 'significant' is that resources and further work is required in the catchment area of the water body either directly as measures, or indirectly by carrying out investigative assessments (see Section 3.5) followed by targeted interventions.

3.4.6 Load Reduction Assessment

Where either or both phosphorus and nitrogen concentrations[3] in a water body are above an environmental quality standard (EQS) and the water body is At Risk as a consequence, a reduction of the nutrient is needed. Load reductions for a river water body (L_{rd-WB}) are calculated from annual averages as follows:

$$L_{rd-WB} = (\bar{C} - EQS) * \bar{Q} * K$$

where,

$\bar{C}$ = average concentration (mg l^{-1}) from EPA monitoring data.

EQS = Environmental Quality Standard (mg l^{-1}).

$\bar{Q}$ = mean streamflow (m^3s^{-1}) obtained from a nearby hydrometric station or estimated as the 30%ile flow from the EPA HydroTool (a model for estimating flows in ungauged catchments).

K = unit conversion factor.

The estimated load reductions should be taken as a guide which is aimed at: i) enabling resources to be targeted to specific areas requiring improvement; ii) estimating the amounts of reductions needed so that appropriate measures can be considered; and iii) ranking water bodies in terms of the scale of load reduction effort needed to help prioritise measures.

Scenario analysis can be undertaken using the results. For instance, an assessment can be made on whether upgrading wastewater treatment plants alone would be sufficient to mitigate the water quality issues or what proportion of the required load reduction would be obtained by an upgrade. Alternatively, the reduction in the loss of phosphorus or nitrate for farmland can be estimated in terms of kg/ha, thereby assisting in the evaluation of measures to achieve the reduction.

3.4.7 Protected Areas

Some Protected Areas have standards and objectives that are in addition to the chemical, quantitative and ecological status tests appropriate for WFD water bodies (e.g. microbial and drinking water standards). The characterisation for water bodies that include these Protected Areas therefore

[3] The chemical form will depend on the relevant EQS for the different waterbody types.

needs to incorporate both the risk assessment appropriate for the water body(s), as well as an additional assessment that takes into account the objectives specific to that Protected Area type. In essence, this means that the water body is assessed against one or more additional objectives specific to the Protected Area. The resulting risk category is the least favourable of the two assessments, consistent with the 'one out, all out' policy. This allows for the assessments for the Protected Area, and the water body in which it is located, to be integrated.

3.4.7.1 Drinking Water Protected Areas

Water bodies are categorised as *At Risk* where:

- Chemical substances posing a threat to human health breach either the parametric values specified in S.I. 122 of 2014 – European Union (Drinking Water) Regulations 2014 or values set to prevent this happening[4] and measures, such as additional treatment (not including situations where the treatment was inadequate from the outset), are required to protect human health.
- Deterioration in quality is such that trend assessment indicates that additional purification treatment would be necessary within one planning cycle.
- Trend assessment indicates that any waters suitable for current or future abstraction are likely to breach standards as set out in the S.I. 122 of 2014 within one planning cycle.

For WFD purposes, there are two main chemicals of relevance that can result in an *At Risk* water body designation – nitrate and pesticides. Some chemicals, such as iron and manganese, may have elevated concentrations as a result of natural background levels – this scenario would not result in an *At Risk* water body category.

3.4.7.2 Shellfish Waters

Areas used for the production of shellfish designated under the Shellfish Waters Directive (SWD) are protected under the WFD as '*areas designated for the protection of economically significant aquatic species*'.

The requirement from a WFD perspective is to ensure that water quality does not impact on shellfish, as set out in the Shellfish Regulations (SI 268 of 2006).

Water bodies containing designated shellfish waters will be *At Risk* where a water quality parameter is above the concentrations given in the Regulations.

3.4.7.3 Bathing Waters

Identified bathing waters are required to comply with the Bathing Water Quality Regulations 2008 (S.I. 79 of 2008). The main pollutants of concern are microbial pathogens. Bathing water profiles are produced by local authorities; these profiles include measures that will be included as sub-plans of the River Basin Management Plan.

Water bodies containing a designated bathing water will be *At Risk* where a bathing water quality parameter is above the limits given in the Regulations based on the 4 year rolling assessment under the regulations.

[4] For groundwater sources, the relevant value is called a threshold value and this is set as 75% of the MAC and is applied as a mean value. For further information, see http://www.wfduk.org/resources/category/classification-208

3.4.7.4 Nutrient Sensitive Areas

Nutrient sensitive areas are: i) water bodies downstream of significiant urban centres which are eutrophic or likely to become so as a consequence of urban waste water discharges if protective action is not taken, as identified under the Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC); and ii) surface waters used for the abstraction of drinking water which contain nitrate levels above those specified in the Surface Water Directive (75/440/EEC). Where sensitive areas are identified there is a requirement for urban waste water to be subjected to more stringent treatment for agglomerations of over 10,000 population equivalent (p.e.) (Article 5, UWWTD). This review is being undertaken currently.

Water bodies that are designated as nutrient sensitive areas under the UWWTD will be given the same WFD risk category as they would if they were not designated, because the nutrient water quality is the driver in both instances. However, nutrient sensitive areas will be given a higher priority in terms of objectives and measures due to their Protected Area objective.

3.4.7.5 Natura 2000 Sites

For WFD purposes, the risk assessment for whether Habitats Directive requirements are being met focuses on the water related supporting conditions or on water related site specific conservation objectives, rather than the full range of biodiversity requirements needed to achieve Favourable Conservation Status. This is because the water related supporting conditions are only one factor of many that contribute to Favourable Conservation Status. The risk, in the WFD sense, only pertains to whether or not the Habitats Directive water-related supporting conditions are being met.

In order to assess the risk of not achieving the water-related supporting condition requirements for the Habitats Directive, the following must be known:

- The water dependency.
- Environmental supporting condition (ESC) requirements for each Special Area of Conservation (and Special Protection Area).
- Site specific condition assessments determining the current state of the supporting conditions.
- Specific targets for the required improvements that must be achieved.

The approach to the determination of the risk category for water bodies with Natura 2000 sites is as follows:

- Where the ESCs have been met, the water body will be categorised as *Not at Risk* from the protected area perspective.
- Water bodies will be *At Risk* for reasons related to the site objectives where:
  i) There is evidence of dependence on water in the relevant water body(s).
  ii) The environmental supporting conditions (ESCs) (metrics on flows, water levels and/or water quality, as appropriate) are known and are based on scientific evidence.
  iii) There is evidence from the site specific condition assessments that ESCs are not being met.
- Where there is some initial scientific evidence that the ESCs in a water body are not being met, the water body will be categorised as *Review* and an Investigative Assessment will be required. This may include a requirement to carry out a condition assessment and/or identification of the relevant ECSs.
- Where the ESCs are not known, a default objective of good status is applied and the standard WFD risk characterisation applies.

- Where the ESCs are equivalent to good water body status, then the WFD water body risk category can be taken to be sufficient to achieve the objectives/conservation condition of the Natura 2000 site.

3.5 Further Characterisation and Investigative Assessments

For water bodies categorised as being At Risk, the initial characterisation process provides the following information:

- The significant pressure(s) at the sector level.
- The location (either precise or general area).
- The critical source areas for diffuse agriculture at the townland (1:25,000) scale
- An estimate of nutrient loads arising from each significant pressure.
- An estimate of the nutrient load reductions needed to enable achievement of the environmental objectives.

A high level of confidence in the assessments is needed as the basis for measures. In the case of point sources, particularly large point sources such as discharges from urban and industrial wastewater treatment plants, the evidence will frequently already be available and the measures required will have been determined. However, in many circumstances, particularly for small point, diffuse or unregulated pressures, there is insufficient information to enable the precise pressure type and location to be determined; the mapped critical source areas for diffuse pressures are at too general a scale (1:25,000) and specific point sources causing impacts cannot be located from desk-based analysis. In these cases **further characterisation** is required to refine the understanding of the significant pressures (Figure 11). This situation arises both in rural streams and where streams pass through towns/urban areas, and in the zones of contribution of wells and springs. Without specific knowledge on the pressure type and its location (field or site scale), the measures required to mitigate impacts cannot be determined or costed with sufficient confidence.

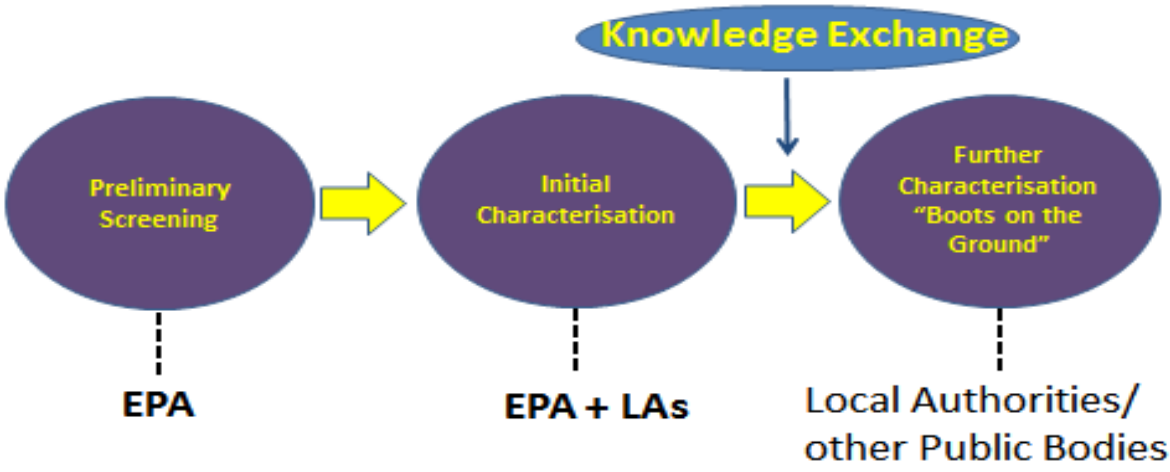

Figure 11: Schematic diagram of characterisation process

The further characterisation process requires **investigative assessments** to be undertaken; investigative assessments are the means of refining the **significant pressures**, both type and location, in the catchment areas of *At Risk* water bodies. Investigative assessments will be carried out primarily by local authority staff, although in certain circumstance other public bodies, such as IFI and the GSI, and consultants may undertake them. Initial draft guidance on investigative assessments has been prepared by the EPA. Therefore, only a brief summary is given here.

There are three levels of assessment:

1. Desk study.
2. Field-based assessment.
3. Involvement of specialists.

The desk study is, effectively, a somewhat more comprehensive analysis than is feasible during the initial characterisation stage. It uses additional datasets that may be available but are not readily accessible during the initial characterisation stage such as additional local authority or Irish Water site specific data. Site specific analysis may also be carried out, such as load, dilution or water balance calculations, or review of the rainfall-nutrient concentration relationships. This will provide additional guidance on the main pressures and pathways, and on the issues that need to be resolved by the investigative assessment. In some circumstances, the desk study will provide sufficient information to enable the significant pressure to be determined with confidence and to determine the significant pressure. However, in all circumstances where field-based investigations are required, it will be the first step in the process.

In essence, the field-based assessment involves catchment walks noting relevant information (e.g. location of pipes, riparian zones, slope and drainage channels), taking readings of relevant parameters (e.g. conductivity, dissolved oxygen) and profiling the river chemistry, assessing biological indicators (e.g. presence of macro-algae and small stream risk scores), talking to local people, and then analysing information and conceptualising the situation thereby obtaining a three dimensional understanding of water and contaminant movement and attenuation in the site/area, followed by consideration of, and conclusions on, the implications and the potential actions/measures/strategies that might be required.

Where diffuse agriculture is considered to be a significant pressure, investigative assessment comprising site and field-based assessment should be focused initially in the high risk (PIP rank) areas i.e. the critical source areas. The maps act as a sign post to where there is a potential critical source area. However, the location of farms in critical source areas does not necessarily mean that they are a significant pressure, as best management practices may already be in place and may be sufficient to achieve the water quality objectives.

For phosphate, point sources are also more likely to be an issue in high risk areas (PIP Rank 1-3) as these areas are likely to have a higher density of drains and ditches acting as a pathway from farmyards to water bodies. The public bodies responsible for investigative assessments will ‘ground truth’ the maps and liaise with farmers and agricultural advisors to further refine the locations of the diffuse sources and small point sources using farm scale information. The outcome of this process will inform where and what type of mitigation measures are ultimately required.

Each further characterisation action is also being recorded and tracked in the WFD Application as a means of managing, communicating and reporting the detailed information at the water body scale.

In some circumstances, the input of specialists, such as hydrogeologists or biologists, will be required, as well as more comprehensive investigations involving, for instance, numerical modelling, drilling of boreholes, determining Q values, etc.

4 Conclusions

- The characterisation and catchment assessment approach used in Ireland for the 2nd cycle has been developed to build on improved data, resource availability, new information technology (IT) automation systems, the integrated catchment management (ICM) approach, the reporting requirements for the EU on the River Basin Management Plans, tiered risk-based levels of

assessment, and the requirement to make the environmental objectives proposed defensible and achievable.

- The approach to WFD characterisation identifies water bodies that are *At Risk* of not meeting their WFD objectives so that they can be prioritised for monitoring and programmes of measures. The approach uses the available monitoring data, including status, trends and capacity assessments, to identify the water bodies *At Risk* of not meeting their WFD objectives; and then seeks to identify the critical source areas and significant pressures that are likely to cause WFD failures in the *At Risk* water bodies.

- A three-tier risk characterisation approach is used so that the level of assessment effort is commensurate with the level of risk, and the expensive, resource intensive effort can be directed towards only those areas for which there is a reasonable degree of confidence in the risk characterisation and where interventions are most likely to be effective in enabling the WFD objectives to be achieved.

- The approach facilitates an integrated assessment of linked water bodies by taking a catchment approach, and builds on existing workflows and newly available modelling tools, datasets and IT infrastructure. It also encourages integration of Local Authority, Irish Water other State Body data and expertise.

- New and updated modelling tools are enabling the location of critical source areas in catchments of *At Risk* water bodies and the estimation of the relative nutrient loads derived from the significant pressures in the catchments, thereby allowing the targeting of efforts.

- Special consideration is given to protected areas as, in certain circumstances, they have standards and objectives that are in addition to the chemical, quantitative and ecological status tests appropriate for WFD water bodies.

- Locating field/site-scale diffuse and small point sources impacting on water bodies is challenging in both rural and urban areas, and is often not possible without further characterisation. Therefore, investigative assessments are proposed as the process for deciding on the specific pressure, both in terms of type and location.

- The characterisation approach outlined in this report needs to be considered as an on-going process so that the monitoring and measures can always be targeted (and adjusted as necessary) towards the water bodies at greatest risk of not meeting the WFD objectives.

5 Acknowledgements

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- Hydrometric & Groundwater Section, EPA, who undertake the groundwater body classification, risk assessments and abstractions assessments.
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Appendix 1: WFD environmental objectives

The **environmental objectives** are set out in Article 4 of the WFD and are summarised as follows:

Surface waters

- Prevent deterioration in status of all bodies.
- Aim to restore to good status by 2015, or if not alternative objectives must be set.
- Protect, enhance and restore all artificial water bodies (AWBs) and heavily modified water bodies (HMWBs) with the aim of achieving good ecological potential and good surface water chemical status.
- Aim to reduce pollution from priority substances, and ceasing or phasing out emissions, discharges and losses of priority hazardous substances.

Groundwater

- Prevent or limit the input of pollutants into groundwater.
- Prevent deterioration in status of all groundwater bodies.
- Aim to restore to good status by 2015.
- Reverse any significant and sustained upward trends.

Protected areas

- Achieve compliance with the standards and objectives for Protected Areas.

Alternative Objectives

- Alternative objectives may be set, such as:
  - Achieving Good status by 2021
  - Achieving High status by 2021 for surface water bodies whose status declined from High to Good.
  - Achieving Good status by 2027.
  - Recovering to Good after 2027 (lower stringent objective).
  - Will not achieve Good, but with no further deterioration happening.

Where an alternative objective is the outcome, a justification must be provided when reporting to the European Commission.

Appendix 2: Datasets used in preliminary risk screening

The data sets used in the preliminary risk screening process are as follows:

- Phosphate, ammonium and nitrate monitoring data at river monitoring stations for the period 2007-2012.
- Total phosphorus and chlorophyll monitoring data at lake monitoring stations for the period 2007-2012.
- Chlorophyll, dissolved inorganic nitrogen and dissolved oxygen monitoring data at estuarine monitoring stations.
- Nitrate and phosphate at groundwater monitoring stations.
- Status results for the period 2010-2012 for river, lake, transitional and coastal water bodies.
- Status results for the period 2010-2012 for groundwater bodies.
- Analysis on trends in chemical parameters, including statistical and environmental significance.
- Analysis of distance to environmental quality standards (EQSs) – a comparison of average annual concentrations with the relevant EQS.

Appendix 3: Datasets used in initial characterisation (Draft)

Data Type	Source	Description	GIS	Excel	Report
General information	EPA	Catchment boundaries	√		
		Subcatchment boundaries	√		
		Local Authority boundaries	√		
		Locations of main towns	√		
		Census information (2011)	√		
Water body information	EPA	Main river channels	√		
		River water bodies	√		
		River water body sub-basin boundaries	√		
		Direction of river water body flow	√		
		Biological and chemistry monitoring stations Groundwater monitoring stations	√		
		Hydrometric monitoring stations (2015)	√	√	
Preliminary water body risk (Tier 1)	EPA	River water body preliminary risk (Tier 1)	√		
		Lake water body preliminary risk (Tier 1)	√		
		Groundwater body preliminary risk (Tier 1)	√		
		Transitional water body preliminary risk (Tier 1)	√		
		Coastal water body preliminary risk (Tier 1)	√		
Water body risk (Tier 2)	EPA	Groundwater bodies Molybdate Reactive Phosphorus risk (2016)	√	√	
Status/Biology	EPA	Historical river biological (Q values) data (1971-2012)		√	
		River biological (Q values) data (2013-2015)		√	
		Biological monitoring site substrate information (2010-2014)		√	
		EPA biologists suspected causes of pollution list (2007-2012)		√	
		Cross border River Status (EPA/NI-EA) (2009-2014)		√	
		Lake ecological status (2010-2014)		√	
		Water residence time (lakes)		√	
		Verified list of lakes with zebra mussels (2016)		√	
		Lagoon and Estuary biology and nutrients (2009-2012)		√	
	IFI	Fish status (2008-2014) (IFI reports)			√
Water chemistry	EPA	River chemistry data (2013-2015)		√	
		Historical water chemistry data (2007-2012)		√	
		Total hardness for metal compounds (rivers/lakes)		√	
		Lake chlorophyll status (2007-2014)		√	
		Lake ammonia and total phosphorous (2013-2014)		√	
		Integrated water quality reports			√
Hydrology	EPA	Hydrology data at subcatchment outlet (2015)	√	√	
		Hydrology data at downstream end of each river water body (2015)	√	√	
		Hydrology data downstream of each water quality monitoring station (2015)	√	√	
		Flashiness index (Q5:Q95) (2015)	√	√	
		Drainage density (2015)	√	√	
	EPA/OPW	Groundwater contribution to river water bodies	√	√	
	OPW	Flood Studies Update SAAR data for ungauged locations	√		
Soils	EPA/Teasgasc	National soils dataset (IFS - Irish Forest Soils)	√		
		National wet and dry soils dataset	√		
	GSI	National subsoil permeability dataset	√		
	Teasgasc	National subsoil dataset	√		
Geology/Hydrogeology	GSI	National aquifer type dataset	√		
		National bedrock geology dataset	√		
		National sand and gravel aquifer dataset	√		
		National karst features dataset	√		
		National groundwater vulnerability dataset	√		
		National groundwater recharge dataset	√		
		Groundwater conceptual models			√
		National crushed rock aggregate potential dataset	√		
		National granular aggregate potential dataset	√		
		Susceptibility to nutrient pollution (phosphate and nitrate) maps (2015)	√		

	EPA	Source protection zones	√		
		Groundwater zones of contribution	√		
Recreation	Irish Sports Council	National walking and cycling trails (2016)	√		
Planning	Local Authority	Development Plans - Landscape and tourism (2014)	√		
		Local Area Plans - Landscape and tourism (2014)	√		
Landcover	CORINE	National CORINE landcover dataset (2012)	√		
Agriculture	EPA	Pollution Impact Potential of phosphate to surface water receptor map	√		
		Pollution Impact Potential of nitrate to surface water receptor map	√		
		Pollution Impact Potential of nitrate to groundwater receptor map	√		
		Source Load Apportionment Model (SLAM – v2.4) (2016)		√	
Forestry	Forest Service	Forest Inventory and Planning System (FIPS) dataset (2007)	√		
	Coillte	Coillte forest landuse type (2012)	√		
	CORINE	Conifer forest and scrub clearfelling dataset (2006-2012)	√		
		Afforestation dataset (2008-2012)	√		
	EPA	Source Load Apportionment Model (SLAM – v2.4) (2016)		√	
Peat	EPA/Teasgasc	Peat soil categories dataset (IFS - Irish Forest Soils)	√		
	Teasgasc	Blanket Bog dataset (ISIS - Irish Soil Information System)	√		
	NPWS	Raised Bog dataset	√		
	EPA	Source Load Apportionment Model (SLAM – v2.4) (2016)		√	
		Extractive industries register	√		
Urban Waste Water (UWW)	EPA	COA facilities	√		
		COA summary		√	
		WWTP facilities	√		
		WWTP Agglomeration boundaries	√		
		WWTP EPA compliance (2006-2014)		√	
		BOD, COD, suspended solids monitoring data (2014)		√	
		Nutrient data for facilities discharging to sensitive areas (2014)		√	
		EPA documents (e.g. inspector reports, EPA action list)			√
		Source Load Apportionment Model (SLAM – v2.4) (2016)		√	
	Irish Water	WWTP Annual Environmental Reports			√
		Priority list of WWTP and COAs for actions			√
Water Treatment Plants (WTP)	EPA	WTP facilities	√		
IPPC	EPA	IPPC facilties	√		
		Source Load Apportionment Model (SLAM – v2.4) (2016)		√	
		EPA documents (e.g. inspector reports)			√
Section 4	EPA	Section 4 discharges	√		
		Source Load Apportionment Model (SLAM – v2.4) (2016)		√	
Domestic Waste Water Treatment (DWWT)	EPA	Geodirectory (Buildings)	√		
		DWWTs	√		
		DWWTs risk ranking (phosphate)	√		
		DWWTs risk ranking (nitrate)	√		
		Source Load Apportionment Model (SLAM – v2.4) (2016)		√	
Waste Facilities	EPA	Waste facilities	√		
		EPA documents (e.g. inspector reports)			√
Historic landfills	EPA	Historic landfill boundaries dataset	√		
Municipal urban discharge	EPA	Source Load Apportionment Model (SLAM – v2.4) (2016)		√	
Unlicensed discharges	EPA	Unlicensed discharges (Suir catchment)	√		
Quarries	EPA	Quarries (operating) dataset	√		
		Extractive industries register	√		
Mines	EPA	Mines	√		
		Extractive industries register	√		
Abstraction	EPA	Abstraction database (Suir pilot study)	√		
		Abstraction project report (Suir pilot study)			√
		Abstraction database	√		
		Abstraction project report			√
		IPC/IE abstraction database	√		

Hydromorphological pressures	OPW	Arterial drainage schemes (V3)	√		
		Embankment schemes (V3)	√		
		Drainage district schemes (V1)	√		
	IFI	Barriers to migration (Nore study)	√		√
	SWRBD	List of heavily modified water bodies (WFD Cycle 1)		√	√
		List of artificial water bodies (WFD Cycle 1)	√	√	√
Freshwater Pearl Mussel (FPM)	NPWS	FPM sensitive areas (priority catchments)	√		√
		FPM specific priority catchments (biological data – 2009)	√		
		FPM specific priority catchments (RHAT data – 2009)	√		
		FPM specific priority catchments (pressures – 2009)	√		
		FPM sensitive areas (with population status) (V2)	√		
		FPM Kerry LIFE project sites (2015)	√		
		FPM draft management plans (2009)			√
Register of Protected Areas	NPWS	Special Area of Conservation locations (2016)	√		
		Special Area of Conservation conservation objectives			√
		Special Protection Area locations (2015)	√		
		Special Protection Area conservation objectives			√
		Natural Heritage Areas locations (2015)	√		
		Proposed Natural Heritage Areas locations (2015)	√		
		Shellfish areas	√		
		Waters designated under Salmonid Regulations	√		
	RAMSAR	RAMSAR sites	√	√	
	EPA	Drinking water designations (rivers)	√		
		Drinking water designations (surface water)	√		
		Drinking water designation (groundwater)	√		
		Designated bathing waters	√		
		Designated nutrient sensitive areas	√		
Programmes	OPW	CFRAMS (Areas for Further Assessment) (2012)	√		√
		CFRAMS (Watercourses Modelled) (2011-2016)	√		√
	OPW/IFI	EREP (location and description) (2008-2014)	√		
	IFI	EREP RHAT data (2010-2012)		√	
	Teasgasc	Agricultural Catchments Programme (subcatchments)	√		√
	Local Authority	Groundwater Protection Schemes	√		√
	SIRBD	Morphological supplementary measures (WFD Cycle 1)		√	√
River Trusts	EPA	Register of River Trusts in Ireland		√	
Background mapping	OSI	Discovery Series mapping (1:50000)	√		
		Ortho photography (aerial photography) (2004-2012)	√		
		Digital Globe (aerial imagery) (2014)	√		

Appendix 4: The WFD Application and its use in the Initial Characterisation Process

Background

Significant resources have been committed to developing the WFD Application to support the river basin management planning process. The Application is accessible through EDEN (https://wfd.edenireland.ie/) to EPA staff as well as staff in other public agencies. There is also a public access point to the information through catchments.ie. Three phases of development have been completed:

1. Phase 1: Support for the preliminary risk screening process – this can be accessed currently.
2. Phase 2: Support for initial characterisation of subcatchments and catchments – this is not yet accessible, but is being used by Catchment Unit staff in undertaking initial characterisation.
3. Phase 3: Provision of information on open access – this is possible since the launch of the catchments.ie website.

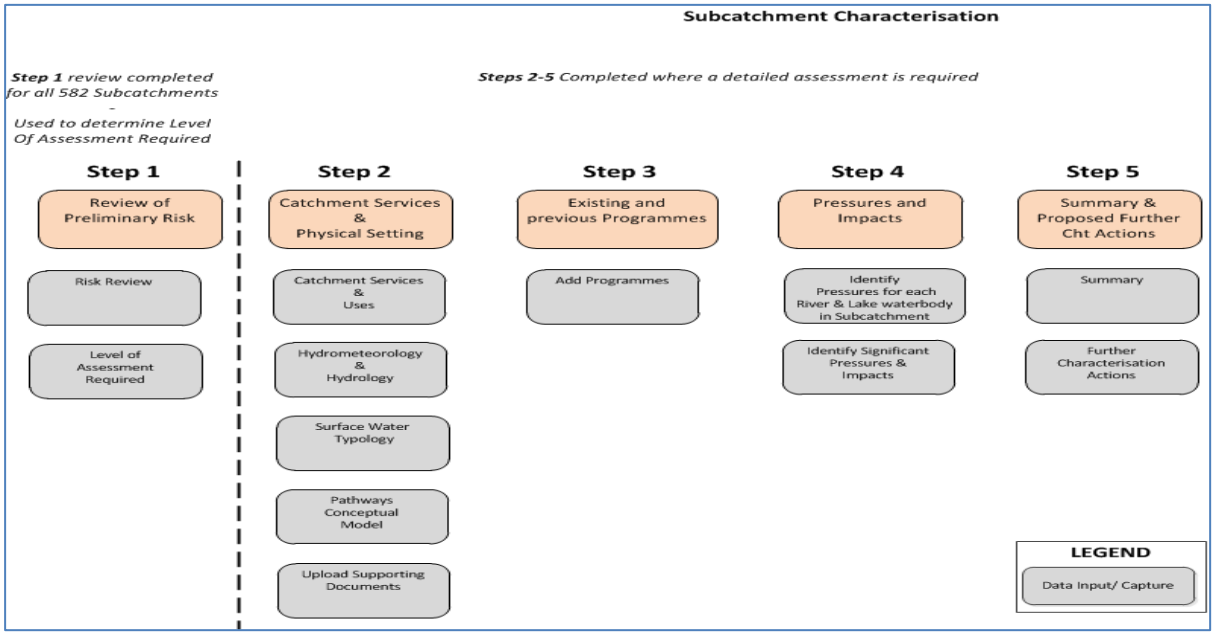
The fourth phase (analysis and recording of objectives) has commenced. Phase 5 (catchment assessments and measures) will be undertaken later in 2016.

One of the key objectives is to ensure that a structured approach is taken to record the data and outcomes, as a means of generating results automatically (which can be overridden where necessary) and of maintaining a consistent and logical approach to recording the outcomes and enabling them to be uploaded efficiently to the WISE reporting system.

Supporting the catchment assessments

The catchment assessments are a summary of the outcomes of the Initial Characterisation (Phase 2) process while the details of the assessments, at a waterbody by waterbody scale, are captured in the WFD Application. As the Initial Characterisation component is not accessible currently, a summary with screenshots is provided here.

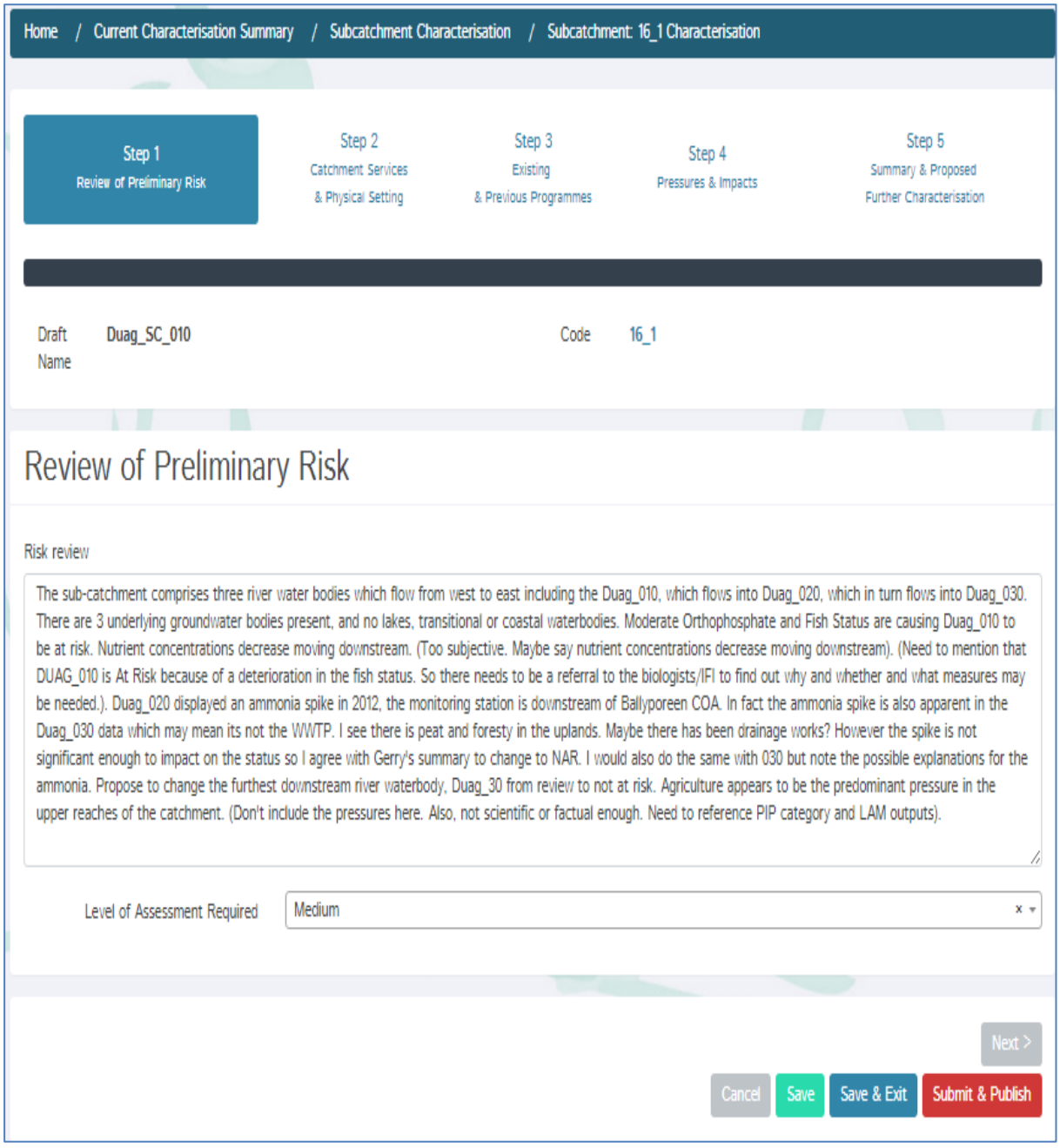
There are 5 steps in the process, providing a structured approach to the characterisation assessment at subcatchment level.



Step 1: Review of Preliminary Risk

Step 1 facilitates an overall review of Tier 1 preliminary risk for all waterbodies in the subcatchment. Based on the review the Catchments Unit will update the calculated Tier 1 risk for waterbodies in the subcatchment.

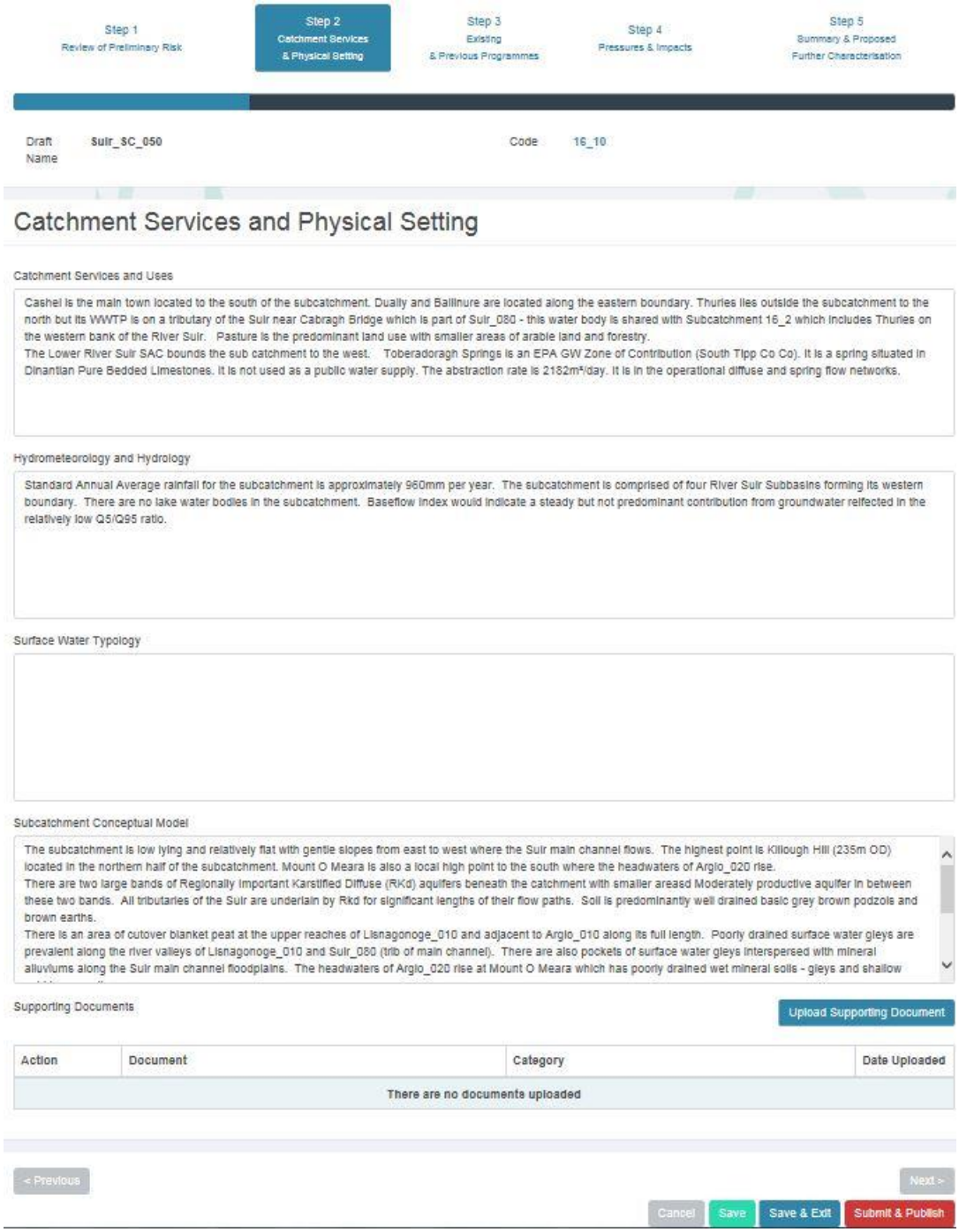
Screenshot



Step 2: Catchment Services and Physical Setting

Step 2 is recording of details on the subcatchment services and physical setting. Information from a number of sources, including map layers will support this part of the assessment. Supporting documents are being be uploaded where necessary.

Screenshot



Step 3: Existing and Previous Programmes

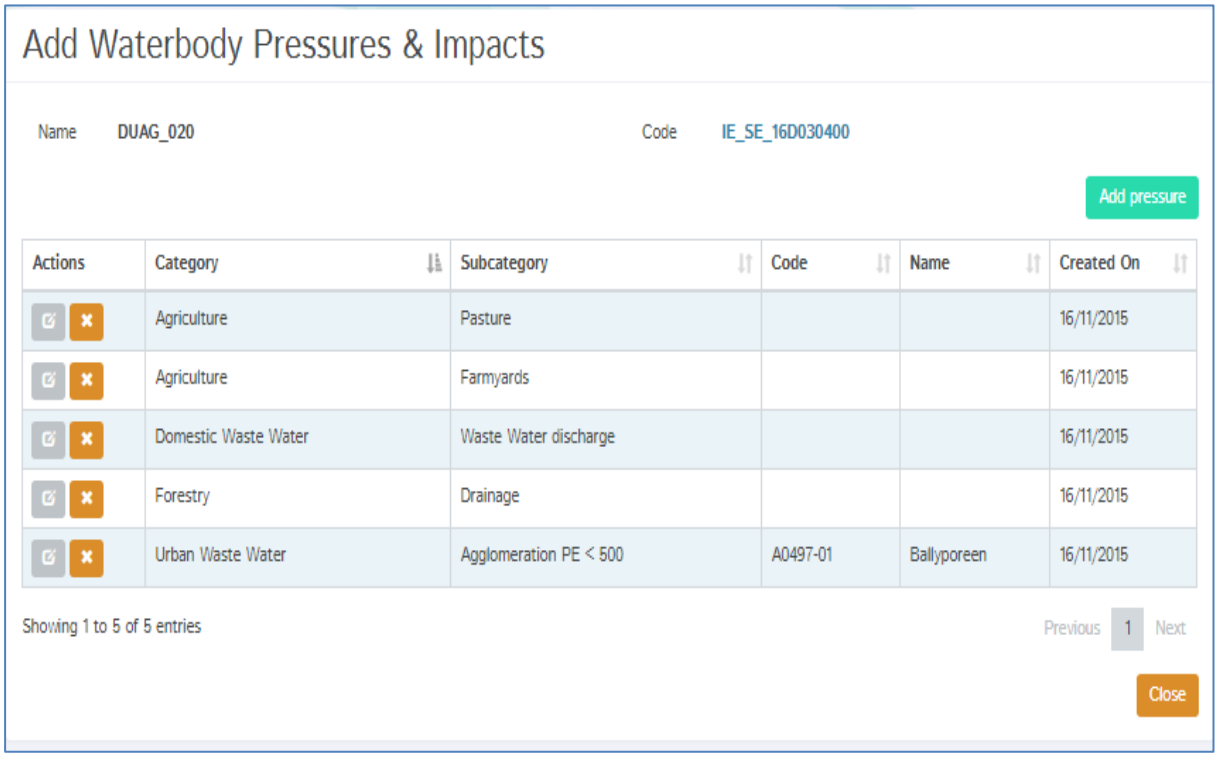
Step 3 allows the capture of information on existing and new programmes within the subcatchment. These programmes are expected to be identified in consultation with external WFD stakeholders, such as Inland Fisheries, the OPW etc. These could include river enhancement programmes, CFRAMs (Catchment Flood Risk Assessment and Management), or similar.

Step 4: Pressures and Impacts

The identification of significant pressures is a key aspect of Characterisation and a key dependency for the design of the Monitoring Programme and Programmes of Measures. Step 4 of the assessment allows Pressures to be identified and categorised using WFD reporting definitions (see Section Appendix 4, for each river and lake waterbody in the subcatchment, which are 'At Risk' or 'Review' or 'Unassigned'. **Pressures will not be identified for waterbodies 'Not at Risk'**.

Where pressures are flagged as significant, the impact must be identified using predefined WISE reporting categories. Where appropriate, links will be made to individual EPA master pressures, which include Urban Waste Water agglomerations and licensed IPC, IE and Waste facilities.

Screenshot

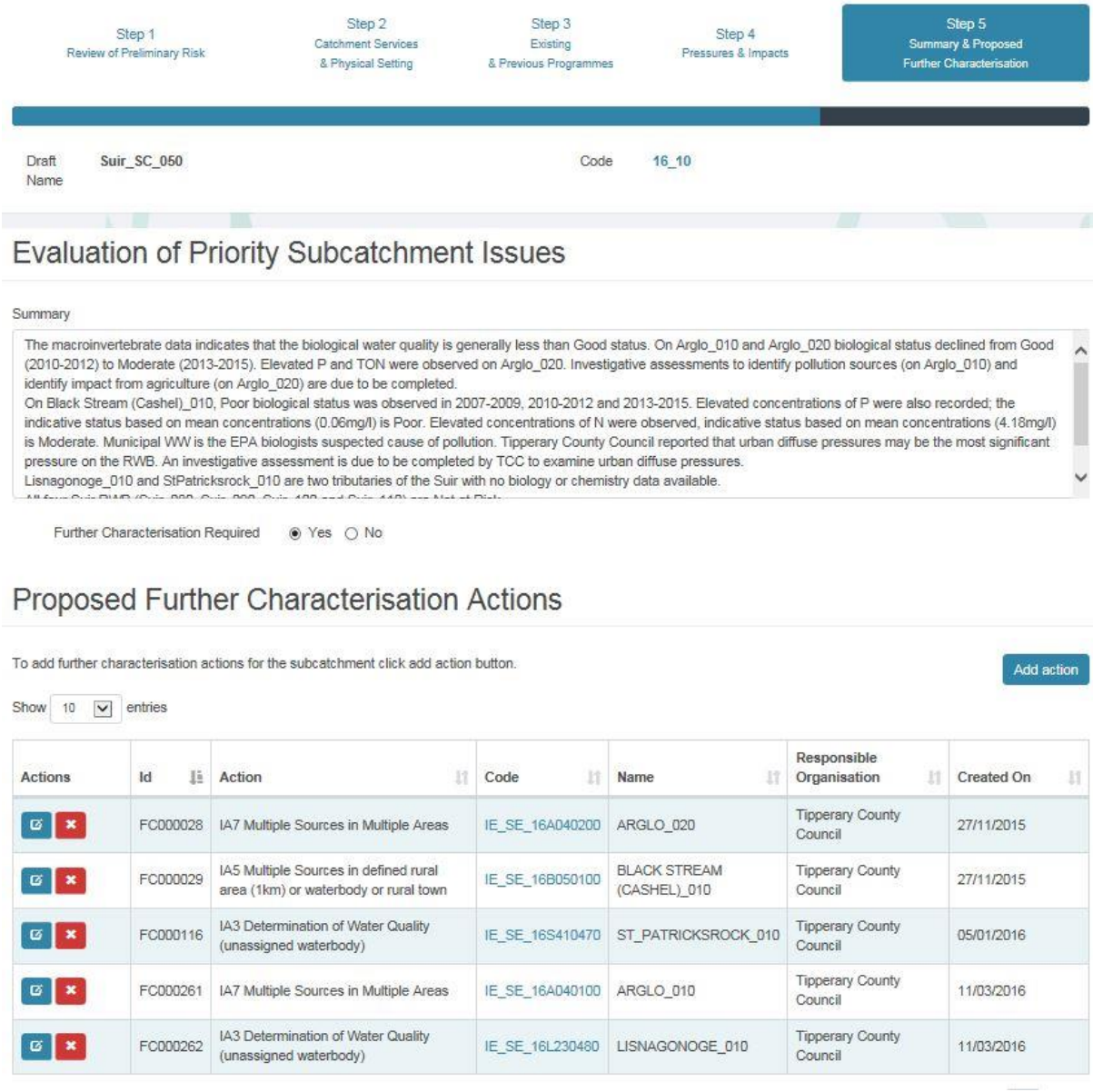


Step 5: Summary and Proposed Further Characterisation Actions

Step 5 will allow the capture an overall summary of the subcatchment assessment. It will also facilitate the capture of further characterisation actions to be undertaken at Tier 3. These will be agreed in consultation with Local Authorities and other stakeholders.

Once the assessment is completed the CSMU can '**Submit & Publish**' it. This will then make a read-only version available to all users. This can be access for the Subcatchment national summary page.

Screenshot


Step 1
Review of Preliminary Risk
Step 2
Catchment Services
& Physical Setting
Step 3
Existing
& Previous Programmes
Step 4
Pressures & Impacts
Step 5
Summary & Proposed
Further Characterisation
Draft Name
Suir_SC_050
Code
16_10
Evaluation of Priority Subcatchment Issues
Summary
The macroinvertebrate data indicates that the biological water quality is generally less than Good status. On Arglo_010 and Arglo_020 biological status declined from Good (2010-2012) to Moderate (2013-2015). Elevated P and TON were observed on Arglo_020. Investigative assessments to identify pollution sources (on Arglo_010) and identify impact from agriculture (on Arglo_020) are due to be completed.
On Black Stream (Cashel)_010, Poor biological status was observed in 2007-2009, 2010-2012 and 2013-2015. Elevated concentrations of P were also recorded; the indicative status based on mean concentrations (0.06mg/l) is Poor. Elevated concentrations of N were observed, indicative status based on mean concentrations (4.18mg/l) is Moderate. Municipal WW is the EPA biologists suspected cause of pollution. Tipperary County Council reported that urban diffuse pressures may be the most significant pressure on the RWB. An investigative assessment is due to be completed by TCC to examine urban diffuse pressures.
Lisnagonoge_010 and StPatricksrock_010 are two tributaries of the Suir with no biology or chemistry data available.
Further Characterisation Required
Yes
No
Proposed Further Characterisation Actions
To add further characterisation actions for the subcatchment click add action button.
Add action
Show 10 entries
Actions
Id
Action
Code
Name
Responsible Organisation
Created On
FC000028
IA7 Multiple Sources in Multiple Areas
IE_SE_16A040200
ARGLO_020
Tipperary County Council
27/11/2015
FC000029
IA5 Multiple Sources in defined rural area (1km) or waterbody or rural town
IE_SE_16B050100
BLACK STREAM (CASHEL)_010
Tipperary County Council
27/11/2015
FC000116
IA3 Determination of Water Quality (unassigned waterbody)
IE_SE_16S410470
ST_PATRICKSROCK_010
Tipperary County Council
05/01/2016
FC000261
IA7 Multiple Sources in Multiple Areas
IE_SE_16A040100
ARGLO_010
Tipperary County Council
11/03/2016
FC000262
IA3 Determination of Water Quality (unassigned waterbody)
IE_SE_16L230480
LISNAGONOGE_010
Tipperary County Council
11/03/2016

Appendix 5: Pressure categories and subcategories recorded in the WFD Application

Pressure Categories and Subcategories		
Pressure Category	**Pressure Subcategory**	**Mapped to WISE Pressure**
Agriculture	Pasture	**2.2 Diffuse – Agricultural**
Agriculture	Arable	**2.2 Diffuse – Agricultural**
Agriculture	Farmyards	**2.2 Diffuse – Agricultural**
Urban Waste Water	Agglomeration PE > 10000	**1.1 Point – Urban waste water**
Urban Waste Water	Agglomeration PE > 2001 to 10000	**1.1 Point – Urban waste water**
Urban Waste Water	Agglomeration PE > 1001 to 2000	**1.1 Point – Urban waste water**
Urban Waste Water	Agglomeration PE > 500 to 1000	**1.1 Point – Urban waste water**
Urban Waste Water	Agglomeration PE < 500	**1.1 Point – Urban waste water**
Urban Run-off	Combined Sewer Overflows	**1.2 Point - Storm Overflows**
Urban Run-off	Diffuse sources run-off	**2.1 Diffuse - Urban run off**
Domestic Waste Water	Waste Water discharge	**2.6 Diffuse - Discharges not connected to sewerage network**
Forestry	Planting and establisment stage	**2.3 Diffuse – Forestry**
Forestry	Drainage	**2.3 Diffuse – Forestry**
Forestry	Clearfelling	**2.3 Diffuse – Forestry**
Industry	IED	**1.3 Point - IED plants**
Industry	IPPC	**1.4 Point - Non IED plants**
Industry	Section 4	**1.4 Point - Non IED plants**
Waste	Waste	**1.6 Point - Waste disposal sites**
Waste	Illegal dumping	**5.3 Litter/fly tipping**
Extractive Industry	Mines	**2.10 Diffuse – Other**
Extractive Industry	Quarries	**2.10 Diffuse – Other**
Extractive Industry	Peat - Harvesting	**2.10 Diffuse – Other**
Extractive Industry	Peat - Drainage	**2.10 Diffuse – Other**
Extractive Industry	Peat - Works	**2.10 Diffuse – Other**
Historically Polluted Sites	Mines	**2.8 Diffuse – Mining**
Historically Polluted Sites	Contaminated land	**1.5 Point - Contaminated Sites/Abandoned industrial sites**
Abstractions/diversions	Agriculture	**3.1 Abstraction/Flow Diversion – Agriculture**
Abstractions/diversions	Water supply	**3.2 Abstraction/Flow Diversion – Public Water Supply**
Abstractions/diversions	Industry	**3.3 Abstraction/Flow Diversion – Industry**
Abstractions/diversions	Fish farms	**3.5 Abstraction/Flow Diversion - Fish farms**

Physical modification	Channelisation	**4.1.2 Physical alteration of channel/bed/riparian area/shore of water body for agriculture**
Physical modification	Embankments	**4.1.1 Physical alteration of channel/bed/riparian area/shore of water body for flood protection**
Physical modification	Dams, barriers, locks, weirs	**4.2.9 Dams, barriers and locks – unknown or obsolete**
Physical modification	Culverts	**4.1.1 Physical alteration of channel/bed/riparian area/shore of water body for flood protection**
Physical modification	Land Drainage	**4.1.2 Physical alteration of channel/bed/riparian area/shore of water body for agriculture**
Physical modification	Overgrazing	**?**
Aquaculture	Aquaculture	**2.9 Diffuse – Aquaculture**
Water Treatment	Discharges	**1.9 Point – Other**
Atmospheric	Atmospheric	**2.7 Diffuse - Atmospheric deposition**
Invasive species	Invasive species	**5.1 Introduced species and diseases**
Other Anthropogenic Pressures	Golf Courses	**7 Other anthropogenic pressures**