Waters of LIFE

Framework of Measures and Best Practice Guidelines for the Protection and Restoration of High Status River Waterbodies

Annex 5: Domestic Wastewater Treatment Systems

Tables of Measures for Mitigating Impacts from Significant Issues arising from Domestic Wastewater Treatment Systems in Catchment Areas where the Objective is Restoration

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1 Introduction

The Waters of LIFE is a European Union funded Life Integrated Project which aims to help reverse the loss of Ireland's most pristine rivers. The ongoing loss of high-status waters is a worrying trend for water quality in Ireland. The protection and restoration of these waters is one of the key underpinning principles of the EU Water Framework Directive.

The project aims to develop, test and validate effective catchment management measures to reverse this declining trend. Six project catchments have been selected, five demonstration catchments and one control catchment. These catchments are based on the following sub catchments defined by the EPA in Ireland's River Basin District Management Plan:

- Avonmore, Co. Wicklow - https://www.watersoflife.ie/catchments/avonmore/
- Awbeg (Kilbrin), Co. Cork - https://www.watersoflife.ie/catchments/awbeg_kilbrin/
- Graney, Co. Clare - https://www.watersoflife.ie/catchments/graney/
- Islands, Co. Roscommon / Co. Galway - https://www.watersoflife.ie/catchments/islands/
- Sheen, Co. Kerry (Control Catchment) - https://www.watersoflife.ie/catchments/sheen/
- Shournagh, Co. Cork - https://www.watersoflife.ie/catchments/shournagh/

The measures in this document were identified in the context of mitigating the issues related to domestic wastewater treatment systems (DWWTSs) acting on high status objective river waterbodies in general and the demonstration catchments in particular. However, these measures are equally applicable to river waterbodies which have been assigned a good status objective under the river basin management plan.

2 The threat to HSO waterbodies

One-off housing is a feature of the catchment areas of HSO waterbodies. While houses are generally present at low densities, the DWWTSs associated with such housing can have significant local impacts particularly in HSO water as relatively small pollutant loads of, for instance, phosphate can breach the environmental quality standard (EQS) in headwater streams. As an outcome of the characterisation process undertaken by the EPA[1], DWWTSs are recorded as *significant pressures* in nine HSO waterbodies.

DWWTSs can threaten water quality and public health when: i) they are on unsuitable sites; ii) they fail to operate satisfactorily; and iii) there is a high pollutant loading.

2.1 Site suitability

Site suitability is determined by two factors arising from the hydrogeological conditions:

1. The **hydraulic** factor:
    - ♦ Where percolation is satisfactory, for instance in moderately permeably subsoil, effluent will migrate vertically to the underlying water table and then horizontally in groundwater to watercourses.
    - ♦ Where the percolation rate is too low, usually due to the presence of low permeability subsoil, surface ponding of effluent often occurs, particularly during wetter periods, with frequent bypassing of the percolation area either directly in pipes or indirectly in overland and shallow subsurface flows to surface water. This situation has the potential to arise in the catchment areas of HSO waterbodies as 42% of such areas are underlain by poorly draining mineral soils and 30% by poorly draining peatland (WoL, 2023a).

[1] https://www.catchments.ie/data/#/dashboard/pressure?_k=1w2yq0

2. The **attenuation** factor:
    - Where percolation is satisfactory, good attenuation of pollutants occurs in the subsoil, provided the minimum thicknesses of subsoil above bedrock and above the water table are complied with, and therefore the threat to groundwater and subsequently to surface water is minimised.
    - Where the percolation is inadequate, there is insufficient treatment of the effluent prior to reaching a water receptor, such as watercourses, groundwater and wells/springs, thereby posing a pollution threat.

Further information on site suitability is given in EPA (2021b)[2] and in Daly (2005)[3].

2.2 System installation, operation and maintenance

Even on suitable sites, DWWTSs may not operate satisfactorily where treatment systems are either not installed and maintained satisfactorily, or not regularly de-sludged. The EPA Code of Practice (EPA, 2021b) provides details on the requirements.

2.3 The pollutants of concern

The pollutants of concern are phosphate, nitrogen mainly as ammonium, BOD and microbial pathogens. Their main potential pathways for pollutants to HSO waterbodies are:

1. In pipes to drainage ditches and watercourses, where percolation is either inadequate or the system is not performing adequately.
2. As shallow subsurface and overland flows, particularly in wetter periods, from ponding at the percolation area.
3. As groundwater, where the percolation area is constructed with an insufficient thickness of subsoil above bedrock, thereby enabling pollutants to enter groundwater.

2.4 The pollutant loading

HSO waterbodies are more susceptible to impacts from pollutants than waterbodies with a good status objective, as the environmental supporting conditions, e.g. EQSs, are more stringent. Therefore, a lower pollutant loading, for instance from a small number of DWWTSS either scattered randomly or, more commonly, from a cluster of houses, can be significant.

The mean loads for nutrients arising from DWWTSs are as follows (Gill and Mockler, 2016)[4]:

Phosphate load = 0.68 kg P per person per year.
Nitrogen load = 4.15 kg N per person per year.

As the average number of people per house is 2.8, the average nutrient load is:

Phosphate = 1.9 kg P per house per year.
Nitrogen = 11.62 kg N per person per year.

The load from DWWTSs entering watercourses and the likelihood of significant impacts will vary depending on the pathway:

1. Where the effluent is piped to ditches and watercourses, the total load from the DWWTSs will enter the HSO waterbody. This could pose a threat particularly in Summer when flows are low, and aquatic ecosystem are more susceptible to impacts.
2. Where the effluent pathway is by shallow subsurface or perhaps overland flows from ponded areas, the load will often be reduced as some percolation is likely, there will usually be uptake

[2] https://www.epa.ie/publications/compliance--enforcement/waste-water/2021_CodeofPractice_Web.pdf
[3] https://www.gsi.ie/documents/GWNewsletterNo45.pdf
[4] https://dx.doi.org/10.1016/j.envsoft.2016.07.006

of nutrients by plants, and runoff is less likely in dry conditions. This pathway is likely to be most active in wet weather when dilution may reduce the likelihood of significant impacts.

3. Where the effluent pathway is underground, some dilution will occur in groundwater and the ammonium is likely to convert to nitrate, which would pose a lesser threat.

3 EPA Risk-based Methodology and Inspections

The EPA have developed a risk-based methodology with an associated inspection plan for the period 2022-2026 (EPA, 2021a)[5]. Inspections are allocated to three categories and three zones (Figure 1):

1. Zone 1: Higher relative risks to surface water where DWWTSs have been identified as a pressure on water quality under the national river basin management plan.
2. Zone 2: Higher relative risks to household wells, where there is higher groundwater susceptibility to percolation of wastewater pathogens into groundwater.
3. Zone 3: Lower relative risk. In this zone, a recommendation is to prioritise inspections in high status objective and *At Risk* waterbodies.

4 Guidance on measures

4.1 Overall approach

A key principle in deciding on and establishing measures is **"right measure in the right place"**. Determining the 'right measure in the right place' is based on a number of factors, such as the following:

i) The **issue of concern** (pollutants, hydrology, morphology). The main pollutants of concern arising from DWWTSs are: phosphate, ammonium, nitrate, BOD and Faecal Indicator Organisms (FIOs). Each has differing potential both in their impact and abilities to be transported in water and, in particular, to be attenuated on the land and in the landscape.

ii) The hydrogeological characteristics that determine the physical setting, in particular whether a site is **freely draining (FD)** or **poorly draining (PD)**[6] or has **shallow bedrock**, as this influences the flowpaths of water and associated pollutants and the attenuation potential.

iii) The **pressure,** including the pollutant loading, causing the issues of concern, in particular whether a conventional septic tank system or a secondary or tertiary treatment system is used. In the case of pollutants, the relative **loading** from the pressure and the **likelihood** of the loading reaching the receptor are important factors that require consideration and assessment. For instance, effluent piped to watercourses generally poses a greater threat than effluent that enters directly into groundwater.

iv) Whether the objective is to **'restore' (improve) or 'protect' (maintain**), as more stringent and resource intensive measures are likely to be needed to achieve the restore/improve objective.

Therefore, each of these factors needs to be taken into account in deciding on measures prior to their establishment, as a means of ensuring that they are efficient and effective in achieving their objectives. The catchment science and management process that encompasses these factors is shown in Figure 2.

[5] https://www.epa.ie/publications/compliance--enforcement/waste-water/2022-2026-NIP---Final.pdf

[6] Poorly draining mineral soils are those mapped as 'Imperfect', 'Poor' and 'Very Poor' on the National Soils Hydrology map at this link: https://gis.epa.ie/EPAMaps/Water. See Section 3.5 in Waters of Life (2023a) for further details.

4.2 Context for consideration of measures

The purpose of this Annex is to provide guidance where DWWTSs have been identified as *significant pressures*. Desk-based and field-based assessments as part of catchment characterisation will have been undertaken. Therefore, the following factors will be known, thereby providing the basis for decision-making on measures: a) the issues of concern arising from pressures that are impacting on the ecosystems (such as phosphate, nitrate, ammonium, BOD and FIOs); b) the physical setting (poorly draining (mineral and peatland) and freely draining); c) the location of the DWWTSs; and d) the 'story' of the catchment.

While the catchment characterisation process will locate DWWTSs that are *significant pressures* and provides general information on a site, more detailed and specific information may be needed before decisions on specific measures can be made. Also, the specific DWWTSs considered to be impacting on water quality may not be known, particularly where there are clusters of houses. Both desk-based and field-based assessments are likely to be required to provide the information needed for decisions on measures.

4.2.1 Desk-based assessment

A possible starting point for the desk-based assessment could the local authority planning file. If available, the site characterisation details (visual assessment, trial hole test, percolation tests, location relative to watercourses and extremely vulnerable areas) and the planning decision can be assessed and noted. If there is no planning file, the details from the catchment characterisation can be checked and noted. In particular, an initial assessment of the likely pathways (see Section 2-3) for pollutant(s) of concern can be undertaken and possible reasons for problems outlined for evaluation during a site visit.

An additional source of useful information is the output of the SANICOSE model (Gill and Mockler, 2016), which gives the relative risk from nutrient pollution arising from DWWTSs. Also, the zone for inspections (see Section 3) could be checked – for instance, Zone 1 indicates a higher relative risk to surface water.

4.2.2 Field-based assessment

The objectives of the field-based assessment are:

i) To check that the planning permission requirements were undertaken.
ii) To check if the site is causing pollution and the reasons for this.
iii) To decide on the measures needed to mitigate any problems on the site.

Possible points to note during the site visit[7]:

- Location of the DWWTSS relative to watercourses or drainage ditches.
- Presence of vertical pipes, mounds or other structures that might indicate the presence of a DWWTS near a watercourse or drainage ditch.
- Pipes or land drains in stream banks that might be linked to the system.
- Presence of 'sewage fungus' and other ecological indicators.
- Conductivity and temperature measurements in nearby watercourses can assist in locating possible entry points for pollutants.
- Presence of toilet paper in stream.
- Presence of suds that might indicate detergents.
- Ponded effluent at ground surface.
- Evidence of ponding shown by green patches on lawns indicating the presence of nutrients.

[7] These points were taken, with minor amendments, from Section 6 in LAWPRO/EPA (2022b).

- Presence and type of bedrock either on the site or in the stream banks and channel, if exposed. The presence of outcropping bedrock may indicate an inadequate thickness of soil and subsoil to treat the effluent. In addition, the bedrock type is also relevant; some such as granite, metamorphic rocks and shales can indicate a risk to surface water as they tend to have a relatively low permeability, while others such as limestone may indicate a risk to wells, groundwater and associated ecosystems.
- Presence of small seeps or springs indicating a high-water table.
- Presence of rushes on the site or on nearby fields indicating the likelihood of poor percolation.
- Poaching in an adjacent field potentially indicating poor percolation.
- Topographic location and slope – a flat site adjoining a stream or ditch may indicate a high-water table during wet weather.

The outcome of the field-based assessment is a conclusion on whether a particular DWWTSs is contributing pollutants to a HSO waterbody. If it is, the following information is needed prior to a decision on the mitigation measures:

- What are the pollutant and hydraulic loadings?
- Which of the pathways in Section 2-3 is enabling pollutants to enter the watercourse?
- What are the ground/hydrogeological conditions on the site, e.g. is it poorly draining?
- What constraints are likely to be present on the site, e.g. area available for measures, low permeability subsoils, high water table?
- Are there wells in the vicinity (either on site or on adjacent sites)?

4.3 EPA Code of Practice

A knowledge and understanding of the EPA Code of Practice for wastewater treatment and disposal systems serving single houses (EPA, 2021b) is key to deciding on and establishing the measures needed to mitigate impacts from DWWTSs. The Code of Practice provides detailed guidance on: policy and legal background; waste water characterisation; site characterisation and suitability; the different systems; construction and installation; and operation and maintenance. Compliance with Code of Practice is required. In addition, Gill *et al*. (2018)[8] provides useful information on system maintenance and desludging.

In particular, the Code of Practice provides details on the systems that are suitable for the broad range of physical settings present in the catchment areas of HSO waterbodies, and it details the setting where a site is not suitable for discharge to the ground. Therefore, it provides the basis for decisions on the measures needed to mitigate the impacts of the pollutants of concern in the physical setting found during the field-based assessment.

4.4 Grant Scheme

The Department of Housing, Local Government and Heritage have introduced a new grant scheme for faulty septic tank and other domestic wastewater treatment systems that may affect water quality. A homeowner may be eligible for this grant in one of three ways:

1. If an inspection by the Local Authority (LA) under the National Inspection Plan finds that there are problems with the wastewater system. The LA will inform the homeowner at the time of inspection of what to do next and will subsequently issue an advisory notice. Any works carried out in compliance with such a notice are eligible for grant aid.
2. If the DWWTS is in a High Status Objective Catchment Area. These are areas where the water quality is excellent and needs protection or is failing to meet excellent quality and requires

[8] https://www.epa.ie/publications/research/water/Research_Report_253.pdf

restoration. To see if the DWWTS is in one of these areas, check by inputting the EIRCODE in a map at this link. The homeowner can apply directly to their Local Authority for the grant. The system must serve a house, which is situated in a catchment area identified as a Prioritised Area for Action, in accordance with the River Basin Management Plan 2018-2021.

The grant is not means tested and covers 85% of eligible and pre-approved works (up to a maximum of €5,000). More grant details are available from the Department of Housing Local Government and Heritage. However, in order to avail of the grant, the septic tank or treatment system must have been entered in the register of domestic wastewater treatment systems by the 1st February 2013 or, in the case of a house completed after that date, within 90 days of connection of the premises to the treatment system.

Local authorities manage the grant scheme on behalf of the Department, and LAWPRO supports them.

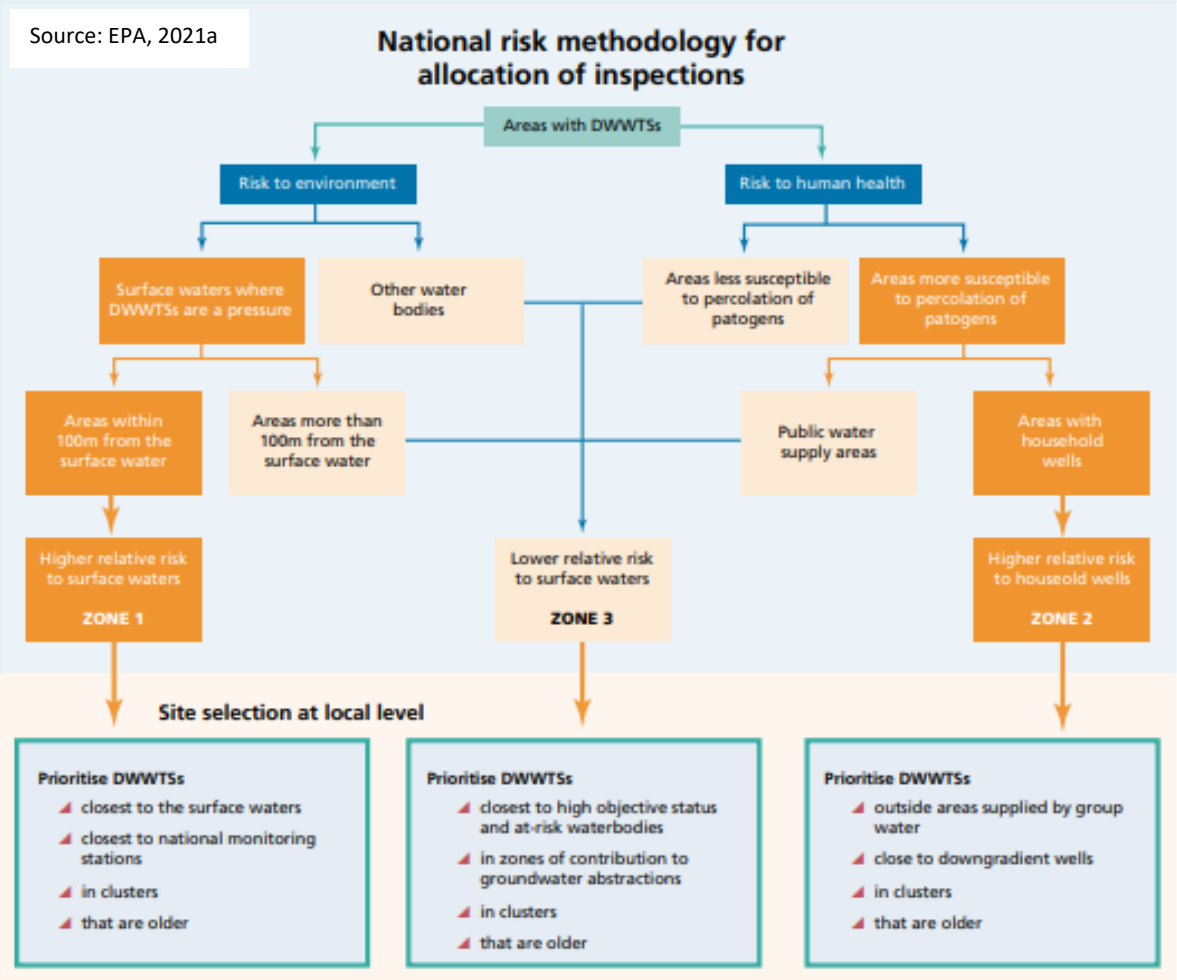

Figure 1: National risk methodology for allocation of inspections and site selection at local level.

Sources of Information

It is recommended that this report be considered in conjunction with the Waters of Life Measures Framework report (Water of Life, 2023a), which provides the background catchment science understanding on which the measures are based.

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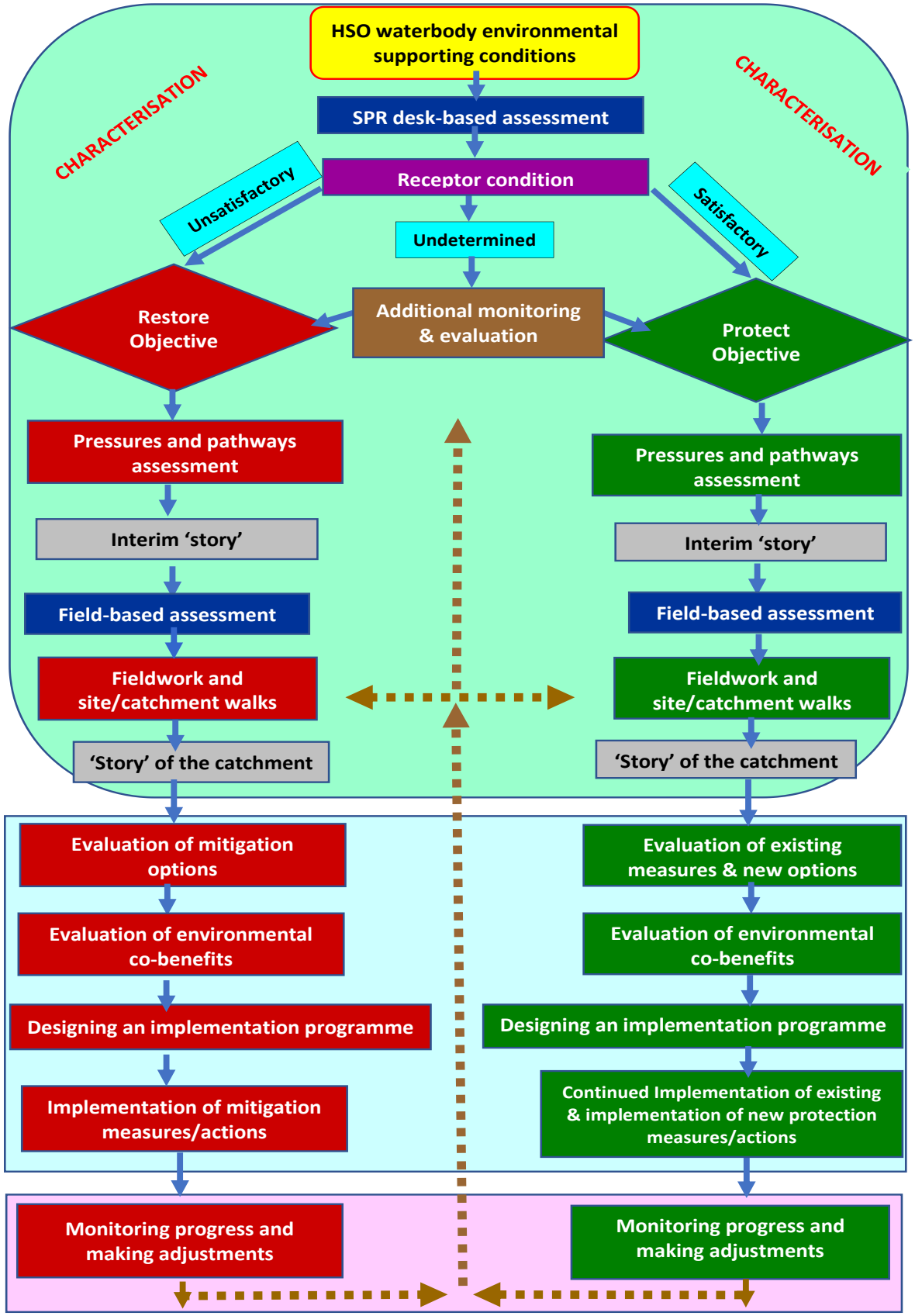

Figure 2: Process flowchart for evaluation of measures in HSO waterbody catchments.