# Misconnections

## A nationally significant water management issue **Briefing note**

This document is a briefing note for the 19th February 2013 national stakeholder workshop on misconnections - it has the following sections:

1) An explanation on the misconnection problem
2) The impact of misconnections on surface and bathing waters,
3) Current activities and future solutions
4) Appendices.

## 1.0 Why do we want to talk to you about this?

Ultimately, we want to ensure that all our rivers and beaches are as healthy as possible. We want to engage the key, national stakeholders (see Appendix 1) in a discussion about how best to achieve that ambition. Addressing misconnections is an especially complex challenge, but it also offers great opportunities to benefit people, communities and wildlife.

This complexity means that inevitably there are some uncertainties in our understanding of the current picture and gaps in our knowledge about the most effective options for addressing this issue in the longer term. Because of this we want to bring some key, national stakeholders together to share knowledge, ideas and thoughts so that we can develop a better approach to tackling pollution caused by misconnections.

Our draft aims for these discussions are to:

- Share and test our understanding of the issue and our current evidence base.
- Consider the issue in the broader context of growth and urban regeneration.
- Develop a common view of the roles and responsibilities in preventing and managing misconnections and associated impacts.
- Discuss possible solutions, including opportunities for joint working and integration (e.g. technical measures, regulatory approaches, awareness raising, etc).
- Consider the need, and potential for, ongoing discussion and collaboration.

## 1.1 What are misconnections?

Misconnections or wrong connections are the terms applied to situations where drainage from a building or site has been connected to the wrong part of the sewer network. These can be a foul water misconnection to a surface water system whereby sewage is discharged directly to a river, stream or the sea (e.g. a washing machine connected to the rainwater drains). Or misconnections can be where clean and uncontaminated rainwater enters foul sewers rather than discharging to surface or ground waters. With clean misconnections there can be indirect pollution due to sewerage overflows.

Misconnections affect the quality of the water and how we use it, as well as damaging the local ecology.

Misconnections can be above ground whereby appliances or drains are wrongly connected usually as a result of extensions, domestic refitting of toilets, kitchens and bathrooms. They can also include below ground misconnections often due to mistakes by builders or developers. The contamination of surface water sewers can also occur due to infiltration or leakage from contaminated ground, foul sewers, sewer blockages and failures.

For the purposes of this paper a misconnection is defined as being: *"any direct discharge by third parties of foul wastewater to a separate surface water sewer, or of surface water or groundwater to a separate foul sewer".*

## 1.2 Why do misconnections occur?

In the UK, sewerage networks have developed over many years since industrialisation and the growth of urban areas. The first sewers were almost always combined and so collected both rainfall and foul flows. Most of the older, inner city urban areas in the UK are therefore served by combined sewerage networks. With the continued growth of urban areas the extension of combined sewerage networks was not a practical solution because of the overall volumes of water needing to be accommodated. As a result, gradually from around the 1950s (but as early as pre-World War I in some areas), sewer systems in developments in the UK became separated. For about 50% of the UK properties, foul water is collected separately and taken for treatment and surface water from rainfall is allowed to discharge directly to a nearby receiving watercourse or groundwater. This principle is based on the premise that surface water is relatively free from polluting material and causes few water quality issues for the receiving watercourse.

Unfortunately, over time, the separation of the flow between the two sewer systems has presented a number of problems for water quality. The principal problem is that any foul sewage misconnections of drainage from domestic, commercial and industrial premises can easily enter watercourses and so impacting directly on water quality with serious consequences in some areas. Over the last twenty years there has been more development and ‘urban creep’ coupled with a trend for house improvements and a DIY culture. This has resulted in more and more misconnections. The scope of Building Control and planning regulation is limited and doesn’t extend to all drainage work so is not effective to prevent misconnections. In addition, awareness about the concept of separate sewerage systems amongst professionals, building trades and the public is not at all assured and perhaps reducing amongst some sections of the population (see details of Ipsos MORI report below).

Pollution from surface water systems can also occur because run off is not always clean – atmospheric fallout, spillage and incidents, illegal discharges, vehicle washing, foul sewer failures can all add to the overall polluting load entering rivers, streams and the sea. This is especially the case after periods of prolonged dry weather when there is a build up of contaminants coupled with reduced flows in receiving waters. To counteract such problems, some nominally contaminated surface areas might be connected to the foul network adding to the incidents of sewer overflows and surcharging especially in wetter weather. Urban run off is also a SWMI which is being dealt with in another stakeholder workshop.

In addition, ‘clean’ misconnections are widespread and occur when roof drains and clean surface areas are connected to foul drainage systems often progressively over many years. Excessive flows of clean rainwater into foul sewer networks even when combined adds to treatment and conveyance costs and energy use.

## 1.3 What are the problems?

For many years, the Environment Agency and other interested groups have identified the risks and impacts from misconnections as a significant concern particularly in some urban catchments. Misconnections cause direct or indirect pollution [clean misconnections] and adversely affect angling, water sports and other recreational activities, as well as causing the loss of sensitive plants and animals in rivers and lakes due to reduced water quality. Small watercourses and bathing waters in urban areas are particularly impacted.

Foul sewage discharges contain many pollutants including nutrients like phosphorus and nitrogen, pathogens (bacteria and viruses), sewage derived debris, oxygen depleting organic matter and toxins, some of which are of particular concern because of their persistent nature. These pollutants contribute to the overall compliance and risk of non compliance with EU Directive standards under the Water Framework (see Appendix 3), Bathing Water and Shellfish Waters Directives. There are also more localised pollution impacts.

There has been an extensive effort to investigate and rectify misconnections since the 1990s by the Environment Agency, water companies and local authorities, generally focused on the most obviously polluted outfalls. Despite this effort the impacts from misconnections are still apparent.

The true scale and impact of misconnections remains particularly difficult to quantify. This is due to a number of reasons; urban surface water sewers can discharge legal, but potentially unsatisfactory, combined sewer overflows; any failures of the foul sewerage network often enter into surface water sewers or groundwater; surface water sewers can be very extensive and often convey other contaminants from above ground activities and even contaminated land; misconnections vary in type and scale; and the ecology of many urban watercourses is also impacted by other factors and stresses such as poor substrate and physical modification. Misconnections are often only one of several significant impacts on water quality.

There are various estimates of the extent of sewer misconnections. In 2007 the Environment Agency considered that as many as one in five properties have misconnections that discharge effluent into rivers. It is realised that the true scale of the problem and its impact on water quality is not fully known beyond local assessments[i]. A more recent Department for Environment, Food and Rural Affairs (Defra) estimate states that between 0.6% and 2.0% of households are misconnected (Defra, 2009), which they equate to approximately 150-500,000 households in the UK.

Overall 2.3% of properties on networks investigated have some sort of misconnection. Experience from investigations by water companies, on surface water sewer networks, reveal that approximately 35% are due to above ground connections of washing machines, 10% dishwashers and 20% sinks with 5% being toilets and 1% being the whole property. A significant number of other problems are due to particular issues like duel manholes that can allow undetected cross contaminated of foul to surface or surface to foul. There is very little knowledge on the extent of clean misconnections.

A recent UKWIR project[ii] estimated the potential number of misconnections in each of the water company catchments, see table below. This is based on the numbers of misconnections found from investigation, property housing stock, types of drainage system and incidents of polluted outfalls Whilst the dataset was limited it does provide one estimate of the potential numbers in the various Water Company areas.

[i] EA (2007) The unseen threat to water quality, Diffuse water pollution in England and Wales report
[ii] UKWIR Project WM07E305 -Draft Report

| Source | Above ground external misconnection | Internal waste pipe to internal pipe | Underground misconnection within curtilage | Underground misconnection outside curtilage |
|---|---|---|---|---|
| Anglian Water | 15,900 | 6,700 | 600 | 900 |
| Welsh Water | 4,800 | 2,100 | 200 | 400 |
| Northumbrian Water | 6,300 | 2,500 | 200 | 500 |
| Scottish Water | 10,400 | 4,700 | 400 | 300 |
| Severn Trent Water | 28,400 | 11,700 | 1,000 | 1,300 |
| Southern Water | 10,600 | 4,300 | 400 | 500 |
| South West Water | 2,400 | 1,000 | 100 | 200 |
| Thames Water | 32,300 | 13,600 | 1,000 | 1,200 |
| United Utilities | 14,400 | 5,700 | 500 | 1,100 |
| Wessex Water | 6,500 | 2,900 | 200 | 300 |
| Yorkshire Water | 9,800 | 4,200 | 300 | 500 |
| TOTAL | 141,800 | 59,400 | 4,900 | 7,200 |

Estimated number of potential misconnections by water company - UKWIR draft report.

## 1.4 The Water Framework Directive (WFD)

The Water Framework Directive (WFD)[iii] requires that all water bodies in all member states meet the conditions of "good ecological status" by 2015. It also has the requirement that no water body may deteriorate in terms of its existing ecological status, which can be high, good, moderate, poor or bad. The current status of UK water bodies means that considerable work needs to be done in order to meet the requirements of the WFD. The WFD is delivered primarily through River Basin Management Plans (RBMPs)[iv]. These regional, 6 yearly plans set out how we intend to improve poor quality waters to good status. The plans will deliver improvements over three phases or cycles, 2009-2015, 2015-2021, 2021-2027. Each cycle has a planning process in which significant water management issues (SWMI) are identified. These issues represent the major blockers to achieving good status. When these issues have been identified, the process is then to work with others to explore and identify ways of tackling them and these approaches are in incorporated into the plans.
We are in the planning stage for cycle 2 which runs between 2015 and 2021. We have identified the Significant Water Management Issues (SWMIs) and now the task is to work with stakeholders to highlight these challenges and plan how they can be addressed.

## 1.5 Why are misconnections a nationally significant water management issue?

Most of the UK population live in towns and cities. Urban streams, rivers, lakes, canals and the sea are important features of the local environment in many of these places and often the most common way for people to interact with nature. Many urban redevelopments now have water bodies as a central element of their design, emphasising how highly communities value these features. There is evidence to suggest that people would be prepared to pay more in rent and council tax to live in such places. There is also evidence to show that a good environment, including areas of water attract a positive house price premium[v] - this inherent value extends to coastal areas. Ensuring good water quality at beaches is critical to the tourism industry and local economies. Any adverse publicity about bathing water quality at beaches can therefore have quite serious consequences.

[iii] http://www.defra.gov.uk/environment/quality/water/legislation/water-framework-directive/
[iv] http://www.environment-agency.gov.uk/research/planning/33106.aspx

The challenge of misconnections is significant because of its scale and ubiquitous nature. Problems caused by misconnections are therefore common, widespread and occur in most built-up areas. Urban fringes in particular, have a majority of housing of post-war vintage which tend to be served by separate surface water sewers discharging directly into our watercourses. Surface water sewers provide a ready pathway for misconnected drainage to enter the environment.

Resolving the problems caused by misconnections, especially at the catchment level, cannot only be achieved through one-off interventions. Whilst investigating misconnections is still essential in some areas, surveys are expensive and difficult whilst misconnecting drainage is relatively easy and low cost. Ongoing vigilance is needed to prevent problems re-occurring. The diffuse nature of pollution from misconnections also means that regulatory and legal remedies are often cumbersome and inefficient so cannot be solely relied on to address the problem.

Consequently, approaches based on education, awareness-raising and collaboration are needed to complement investigation work to remove misconnections. There needs to be a 'step change' in raising awareness about the problem with both the public and professionals alike. These messages can easily sit alongside similar communication regarding the misuse of surface water sewers. Experience suggests that only sustained campaigns are effective in the long-term so we are particularly keen to identify actions that will deliver permanent change.

## 1.6 Link between SWMI and Defra's consultation on urban diffuse pollution

Over the last 20 or so years considerable progress has been made on point source pollution such as sewage effluent from waste water treatment works. This has highlighted other less examined issues and as a result over recent years diffuse urban pollution has been has become more prominent. The Government has recognised this and made a commitment, firstly under the Natural Environment White Paper, then under the Water White Paper to create a national (England) strategy[vi] to tackle these sources of pollution, the scale of the impacts, and who can help play a part.

As set out above, SWMI engagement is a key element of the River Basin Management Planning process.

It has been recognised that there is an opportunity to draw maximum benefit by tweaking the timing of both these two processes. Elements of both can be combined to help maximise the cross fertilisation of ideas. The learning from the SWMI workshops will inform the consultation exercise when developing Government strategy. Likewise the knowledge and understanding developed as part of the Government consultation will be fed into the River Basin Management Planning process to deliver a more effective outcome.

# 2.0 Current and potential future problems with misconnections in surface waters and the sea

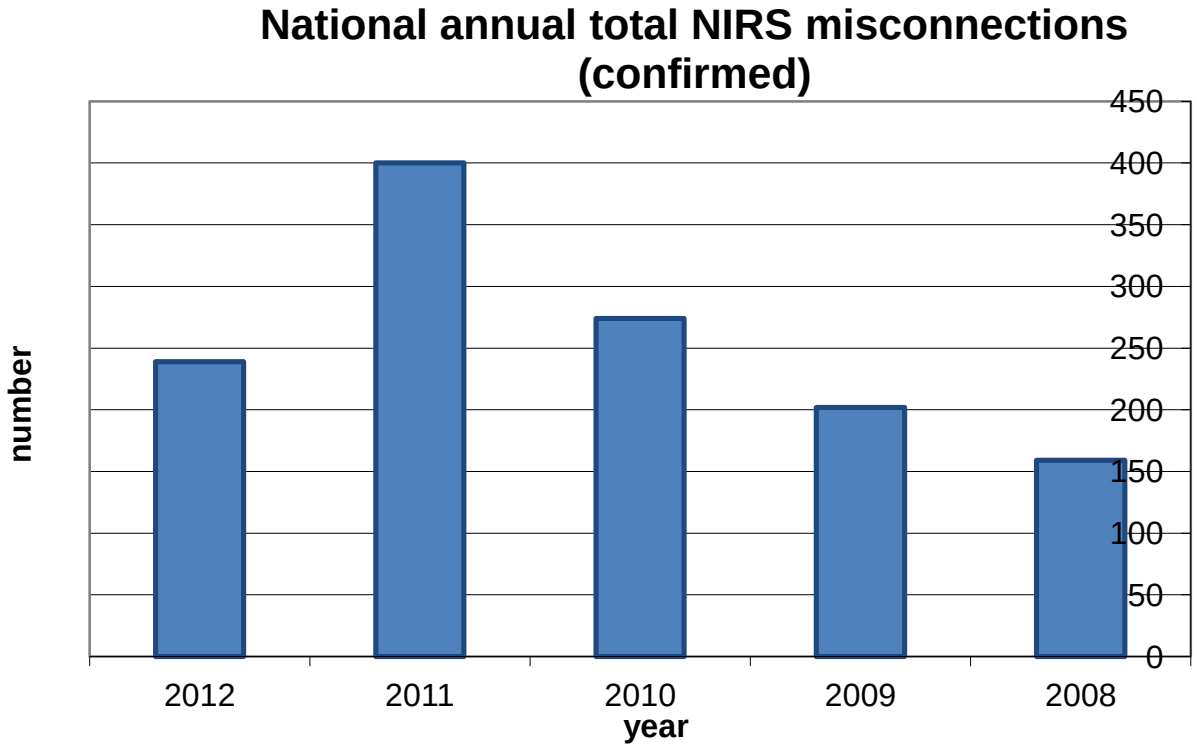
## 2.1 General overview

Discharges from misconnections contain a wide range of pollutants which are typically found in sewage. These enter watercourses and the sea directly with no effective treatment so the impacts can be significant locally but are dependent on the amount of dilution available in any receiving watercourse. In addition impacts are difficult to quantify singularly given the combined effects of general urban run off.

[vi] http://www.defra.gov.uk/consult/2012/11/20/water-pollution/

Figure 1 sets out the number of pollution incidents attributed to misconnections which amount to over 200 a year[vii]. This data cannot be considered comprehensive as not all events are recorded. Appendix 2 provides a pressure analysis for the urban and transport sector for failing water bodies[viii]. It can be seen that misconnections might contribute significantly to phosphorus, dissolved oxygen and ammonia failures with a high number still to be fully investigated. Each of these pressures are discussed below, with additional evidence.

**Figure 1:**




## 2.2 Phosphorus

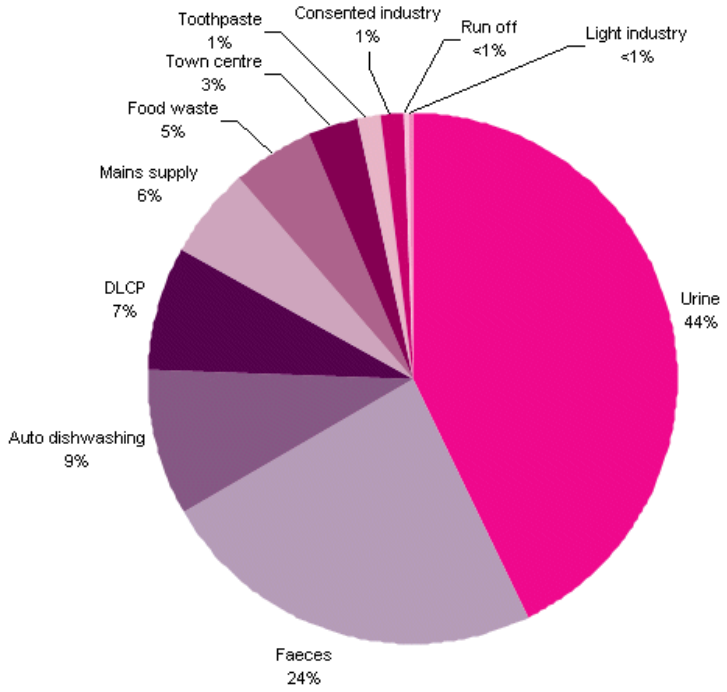
Phosphorus concentrations in our rivers increased significantly between 1950 and the 1980s. Sewage treatment and other measures have reduced river lengths with excessive (>1mg/l) levels since 1990 but there has been a rise over the same period in the length of rivers with low (<0.06mg/l) levels. Misconnections especially from washing machines contain phosphorus which contributes to eutrophication. Eutrophication is the adverse effects on water uses and ecology of excess algal/plant growth caused by too much nutrient enrichment in rivers and lakes. Eutrophication is an international concern and has been recognised as an issue in England and Wales since the 1990s[ix]. An absence of eutrophication problems is part of achieving Good Ecological Status under the Water Framework Directive (WFD). A preliminary conservative estimate of the damage costs of freshwater eutrophication is around £54-96m/pa[x]. Misconnections clearly contribute to this impact and in many areas there is a more basic aesthetic impact due to excessive algal growth in small urban watercourses. A SWMI workshop stakeholder workshop on freshwater eutrophication was held last year.

[vii] Environment Agency, National Incident Database, 2008-2012
[viii] Environment Agency, 2011 update Reasons for Failure, v27.06.2012
[ix] Aquatic eutrophication in England and Wales: a proposed management strategy. Environmental Issues Series. Environment Agency, Bristol, UK, 1998 and;
Aquatic eutrophication in England and Wales: a management strategy. Environmental Issues Series. Environment Agency, Bristol, UK, 2000.
[x] Pretty JN, Mason CF, Nedwell DB, Hine RE, Leaf S, Dils R. (2003) Environmental Costs of Freshwater Eutrophication in England and Wales. Environ Sci Technol, 32:201–8.

The significant inputs of phosphorus on a national scale[i] and catchment level[i] are from sewage works and agriculture but there are minor contributions from industry, misconnections, urban drainage, leaking sewers, combined sewer overflows, septic tanks and small package plants that can be locally significant (e.g. in the headwaters of catchments).

Current and planned measures to control eutrophication will not achieve good ecological status in densely populated areas. Given what we know about the scale and location of population growth, these measures may also be insufficient to prevent deterioration of waters in some areas. Extending control measures and tackling misconnections that contribute directly to this problem is therefore important.

**Figure 2: Summary of sources of phosphorus to sewer from domestic sources**




Source: WFD UK TAG

Within sewage, dishwasher detergents (9% of P in sewage), laundry detergents (7%), food and drink additives (around 25% within faeces and urine[xi]), and phosphate dosing of drinking water supplies (6%) are significant sources of phosphates (see Figure 2).

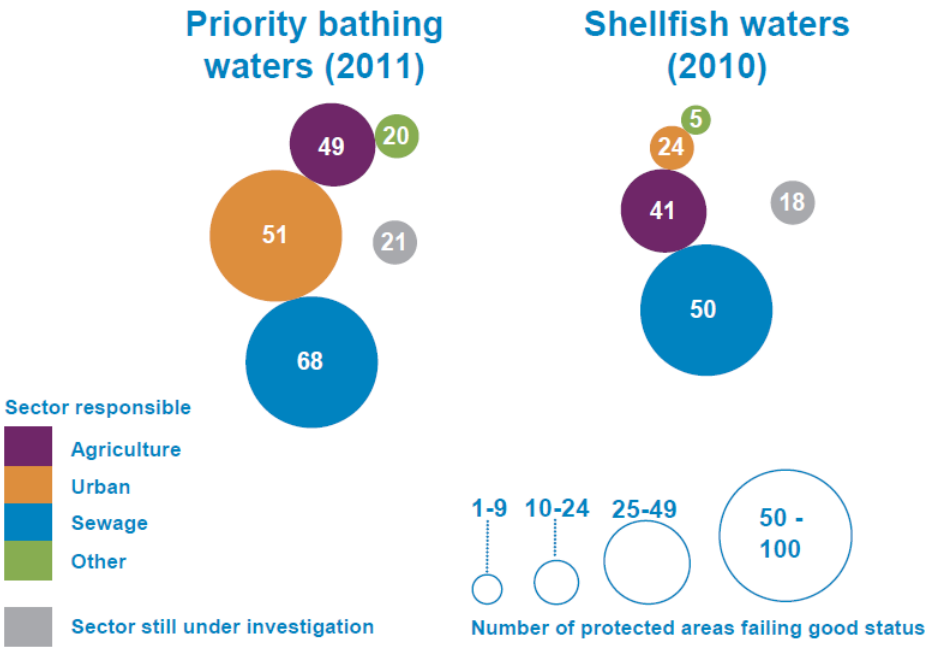
## 2.3 Faecal Indicator Organisms

Faecal indicator organisms (FIOs) are regarded as an indicator of the presence of more dangerous bacteria from faeces. Sewage discharges into urban watercourses and surface water sewers contain FIOs, sometimes at significant concentrations. Sewage treatment even at a secondary level reduces FIO concentrations by several orders of magnitude. Ultra Violet (tertiary) treatment of sewage effluents can then render FIO concentrations to extremely low levels.

Figure 3 sets out the current situation regarding the reasons for failure in relation to FIOs and Shellfish (2010) and priority Bathing Waters (2011). Around 51 designated bathing waters and 24 designated shellfish waters are impacted by FIOs from urban sources, which will include misconnection problems.

[xi] Environment Agency, 2010 WFD Classification Results, http://www.environment-agency.gov.uk/research/library/data/97343.aspx

**Figure 3: Faecal Indicator Organisms and Reasons for failure**




Reasons for failure SW (2010) and BW Database (2011) data, Environment Agency

Failure and risks of failures of bathing waters and shellfish waters have potential impacts on public health and economic impacts on tourism.

## 2.4 Sanitary pollutants

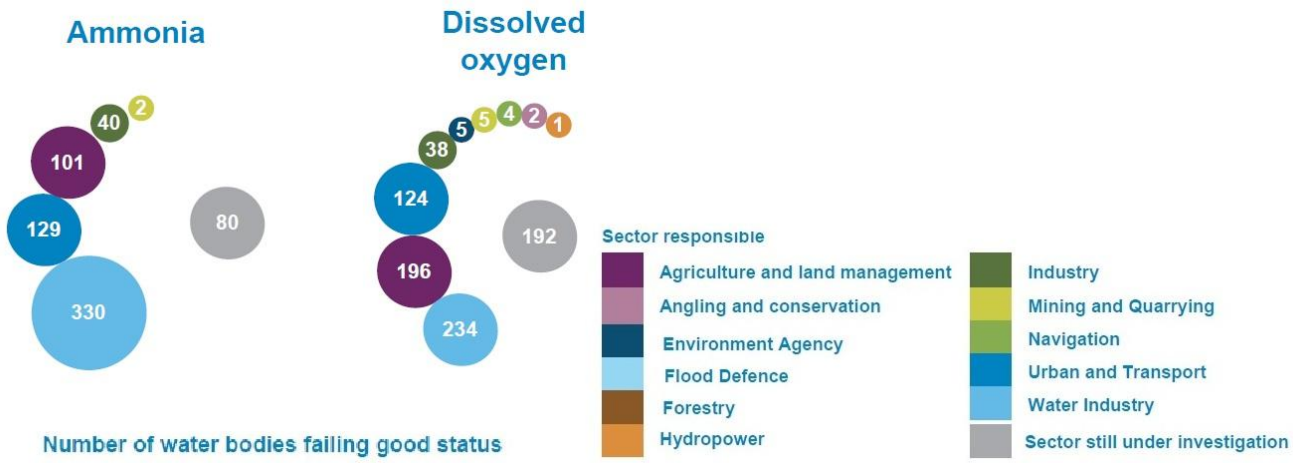
The key sanitary pollutants that are likely to be related to misconnections include ammonia, dissolved oxygen and biochemical oxygen demand. Ammonia is produced when nitrogenous organic wastes are broken down and is therefore found in sewage. The nitrification of ammonia in the aquatic environment reduces dissolved oxygen. Aquatic organisms use dissolved oxygen in water for respiration. In addition organic matter can reduce light levels further reducing the production of oxygen via photosynthesis. A reduction in dissolved oxygen can cause stress and lethal effects on aquatic life. The higher the biological oxygen demand, the greater the potential of organic waste to cause a drop in dissolved oxygen. Unionised ammonia is also hazardous due to its toxic and sub-lethal impacts on fish and macro invertebrates. Although a small number of transitional waters (estuaries) have pressure from dissolved oxygen, sanitary pollutants are generally an issue for rivers. Ammonia and dissolved oxygen concentrations are pH, temperature and flow dependent. The process of eutrophication and the presence of organic rich sediment can also affect dissolved oxygen concentrations.

Based on 2010 classification data, approximately ten per cent of assessed water bodies in England and Wales do not achieve good or high status for ammonia with an equal ten per cent for dissolved oxygen[xii]. Urban and Transport was cited as the responsible sector for 124 and 129 water bodies failing for dissolved oxygen and ammonia respectively[xiii]. Misconnections contribute to these failures in some water bodies but it is not clear to what extent.

Figure 4 sets out the current position regarding the reasons for failure in relation to sanitary pollutants in more detail.

[xii] Environment Agency, 2010 WFD Classification Results, http://www.environment-agency.gov.uk/research/library/data/97343.aspx
[xiii] Environment Agency, 2011 Reasons for Failure v 16.05.11

**Figure 4: Sanitary pollutants and Reasons for failure**




The Environment Agency's Strategic Assessment (December 2007) indicated that approximately twenty per cent attributed to urban pollution (sewer overflows and misconnections) (England and Wales) which includes misconnections.

## 2.5 Chemicals

The rise in manufacturing and other industries, transport and more-intensive agriculture has resulted in an increasing use and release of chemicals into the environment. Chemicals covered under the WFD are ones that are perceived to cause a risk to the environment or human health. These chemicals are categorised as:

- EU Priority Substances: The WFD obliges Member States to reduce environmental levels to an acceptable level (an EQS) to achieve good chemical status (GCS) and for the most dangerous priority hazardous substances (PHS) to cease or phase out emissions completely;
- UK Specific Pollutants: Substances not included in the EU list above, but for which Member States have concerns about their hazardous properties and presence in the environment.

There are on going factors that will modify the compliance situation for UK water bodies such as EQS revisions, new chemicals, continuously improving data and changes to the monitoring programme. There is a SWMI workshop in March considering chemicals.

Of particular relevance to misconnections are Nonyl-Phenols (NPs) and their Ethoxylates (NPEs) which are restricted under UK and EU legislation. These chemicals are commonly found in imported clothing and released into the aquatic environment via washing clothes. A very basic estimation suggests that imported clothing might account for up to 20% of NP and NPE in UK rivers[xiv]. Sewage effluent is considered to be a predominant source of NP & NPEs. On average, based on Water Company investigations, circa 35% of all misconnections found are from washing machines or sinks.

Substances causing failure of Good Chemical Status are shown in figures 5, 6 and 7 below. Tributyltin (TBT) and PAHs make up over 60% of failures with the metals cadmium and nickel also showing significant numbers of failures (10 and 9%, respectively).

[xiv] Environment Agency, Chemicals Compliance Team, Annual Enforcement Report 2011/2012, https://publications.environment-agency.gov.uk/PDF/GEHO0712BWSX-E-E.pdf

**Figure 5: Priority and priority hazardous substances and other pollutants causing chemical status failures in 142 surface water bodies in 2010**

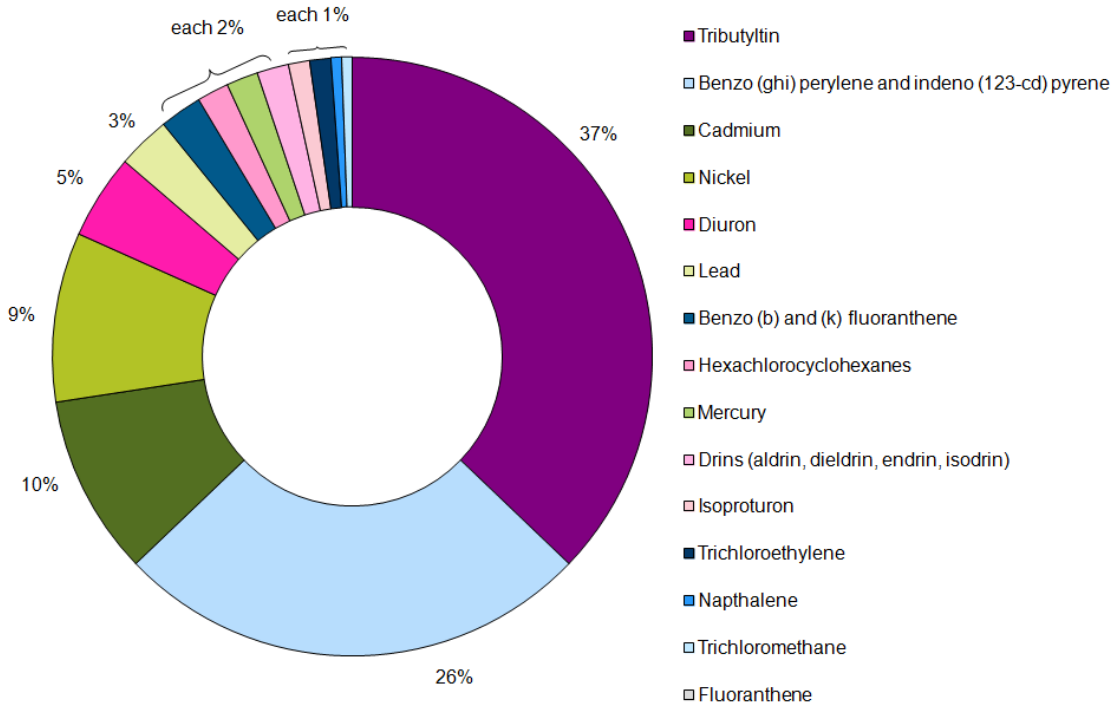



**Figure 6: Specific pollutants causing ecological status failures in 756 surface water bodies in 2010**

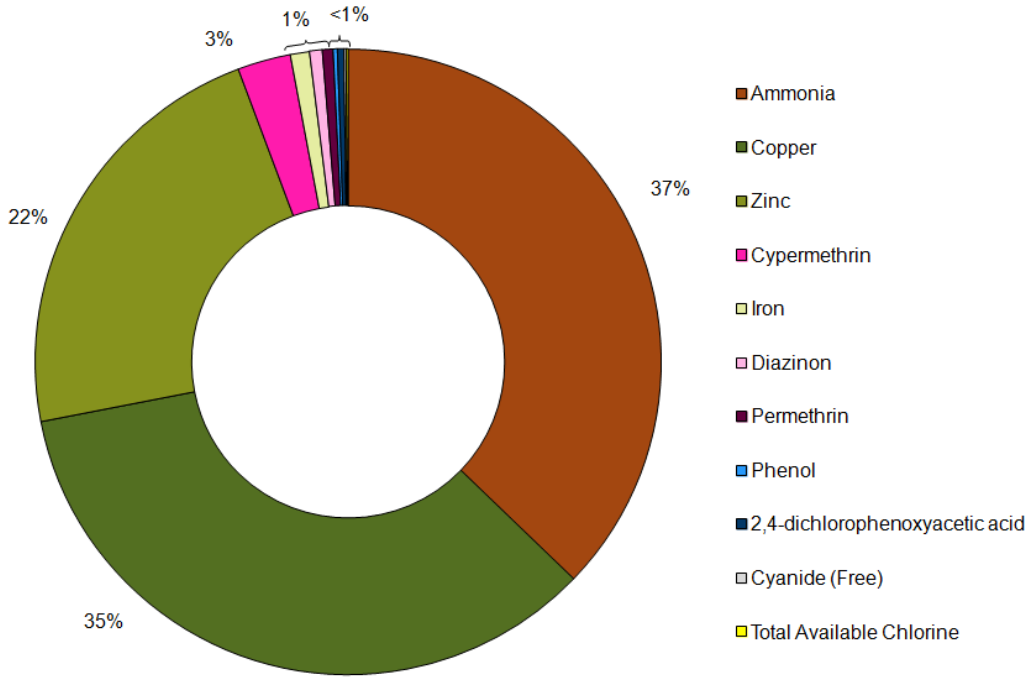
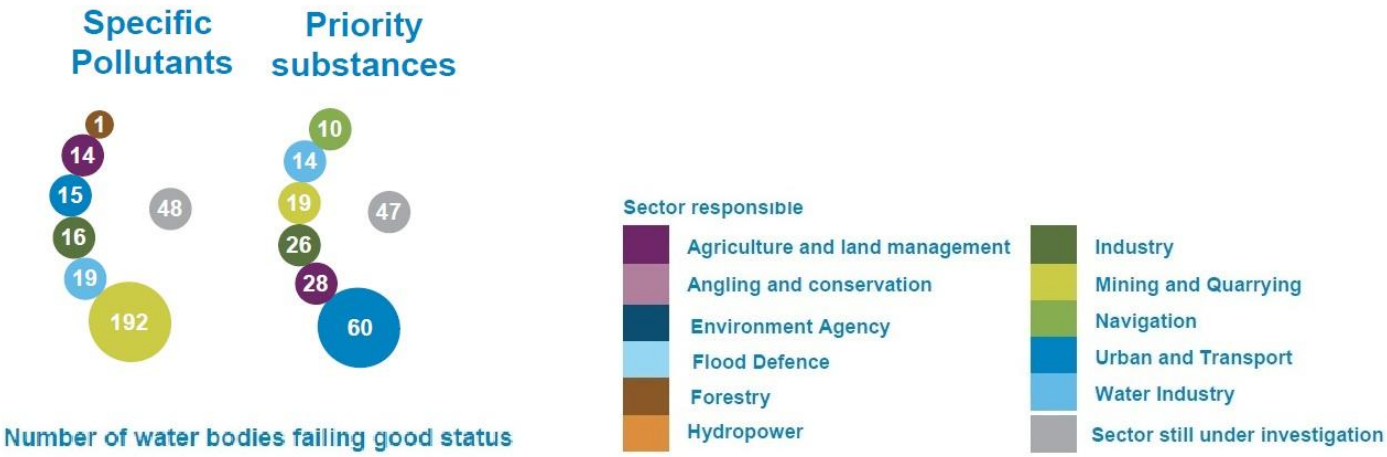


**Figure 7: Number of water bodies in England failing good status due to specific pollutants and priority substances, by sector responsible[4].**




## 2.6 Other impacts

In addition to the WFD related failures set out above misconnections also have a number of additional impacts.

The aesthetics of urban watercourses are adversely affected by misconnections especially due to sewage derived debris. These visual impacts are often made worse in drier weather when sewage fungus or the effects of eutrophication become more apparent. Access and use of urban streams also increases in warmer drier weather.

Clean misconnections reduce sewerage capacity. The operational capacity of foul sewer networks is easily compromised by rainfall. Whilst some infiltration from groundwater and rainfall is inevitable, prolonged periods of wet weather, such as that experienced in the summer of 2012 indicate the true scale of the problem. Increased foul sewer flows result in more overflows to water bodies and to properties in some cases. Clean water infiltration also increases conveyance and treatment costs and adds significantly to energy use. Most sewage treatment works can handle storm flows but diluted sewage is harder to treat. These factors can lead to development pressure on infrastructure in some areas which in turn will affect growth.

## 2.7 The current situation regarding public awareness

An Ipsos MORI research project[xv] was completed in April 2009 to provide baseline measures of awareness and understanding of 'misconnections' issues amongst the pilot audiences in certain hotspots - London, Torquay and Birmingham. The study also explored attitudes and perceptions about the impact of misconnections in terms of the effect on the environment and quality of life.

The study found that a third of respondents do not have any idea what type of drainage system their property had, with 15-34 olds and women least likely to know. Eight in ten respondents claim that most household installations were plumbed in by qualified tradesmen and nine out of ten felt this would have been done correctly. 55-64 year olds were most likely to correct bad plumbing if they found out about it. The youngest (15-24) are split, with some being the least likely to correct bad plumbing, claiming that it is not their responsibility. Women cited safety reasons as the main reason for correcting bad plumbing. Those in the London urban area appeared to be more insular and influenced by things that affect them directly, rather than their local area or community. 35-45 year olds and men more than

[xv] Ipsos MORI Misconnection Research 2009

women are most likely to say they would correct bad plumbing to avoid further damage. Overall, nearly seven out of ten thought that it was unlikely that they would be traced and fined for misconnected drainage.

# 3.0 Current activities and future solutions

## 3.1 Investigating pollution from surface water outfalls

Sewerage managers have been faced with misconnections ever since separate sewer systems were introduced. Over many years the Environment Agency [and NRA previously] has worked alongside Water and Sewerage Companies and local authorities to investigate surface water outfalls with evidence of misconnections. These programmes have been fairly extensive and have resulted in real improvements to some watercourses and outfalls where projects have been focussed.

The Water and Sewerage Companies own surface water sewers and therefore have legal responsibility to investigate pollution from their assets. The cost of investigating sewer misconnections is therefore usually met through Water and Sewerage Companies' Asset Management Plans and water rate payers. As local authorities and the Environment Agency have some key responsibilities they are also involved in this investigation effort. Local authorities and the Environment Agency have the powers to require homeowners to rectify misconnections. The Environment Agency also has a more general duty to deal with pollution and achieve EU directive compliance. The cost of actually fixing misconnections once identified usually falls to property owners. Identifying misconnections especially in extensive surface water catchments can be very costly even though most drainage rectifications are usually relatively low cost to resolve.

To address the problem Water UK and the Environment Agency working alongside other bodies via the National Misconnections Strategy Group (NMSG) have developed a Good Practice Guide that identifies "an operational approach for investigation and resolution of pollution from surface water sewerage systems affected by misconnections" (Water UK, 2009)[xvi].

The extent to which this effort has resulted in achieving compliance with WFD standards is not yet clear although there are some local water quality improvements. Additional investigation effort to ensure Bathing and Shellfish Water compliance is also occurring with the Environment Agency leading this work particularly in the North West and South West and working with Southern Water on some south coast investigation projects.

The extent to which local authorities have, and are still able to provide support to ensure rectifications is a key factor in making progress. The Environment Agency is currently undertaking a trial to assess how it might use its own Anti Pollution Works Notices (APWNs) powers where property owners fail to act voluntarily. This should be completed in 2013 and provide evidence to support the use of APWNs in future. Regardless legal action to rectify misconnections is costly, cumbersome and resource intensive.

The NMSG, EA and Water Companies have also embarked on various initiatives to raise awareness with the public and professionals alike. A 'connectright' website[xvii] has been developed that incorporates a property checking facility based on post codes and property age, to indicate the risks of having a misconnection. This site includes information and advice to property owners and links to other relevant sites. Between February 2010 and July 2012 the site received an average of 4.4 hits per day. The NMSG is supported, amongst others, by all UK Water Companies, Consumer Council for

[xvi] http://www.water.org.uk/home/policy/publications/archive/infrastructure/misconnections-good-practice-guide/good-practice-managment---misconnections.pdf
[xvii] http://www.connectright.org.uk/

Water, the Chartered Institute of Plumbing and Heating Engineers and the Local Authority Building Control organisation.

# 4.0 Potential future solutions and possible approaches

## 4.1 Overview

As noted above, analysis suggests there are major challenges in the current investigation of misconnections and understanding the potential outcomes from such activity. These challenges are likely to extend into assessing the effectiveness of potential future solutions. Further ecological recovery can be lengthy and uncertain given the complexities of the factors that contribute to achieving good ecological status in urban catchments.

Taking into account these uncertainties, the way forward would perhaps develop a mix of measures including both practical investigations and activity based on behaviour change and awareness raising. Practical measures might be incorporated into catchment-based planning to focus on problem stretches and outfalls. In some situations this might include the bespoke design of solutions by the water industry, EA and/or local authorities. This suggests a need to firstly investigate and rectify misconnection problems from polluted outfalls alongside additional measures to address aspects such as sewer maintenance, capacity improvements and removing surface water misconnections from foul sewerage systems. In some situations it may be more cost effective and assured to incorporate sustainable drainage infrastructure (SUDS) to effectively treat contaminated surface water drainage rather than trace misconnections. SUDS would also have other benefits relating to urban run off and flood water management as well as improving habitats, amenity and providing a 'safety net' for water quality.

## 4.2 Solutions for tackling known misconnection inputs

There is an obvious need to maintain and extend current investigation activity being undertaken by Water and Sewerage Companies working in partnership with the EA and local authorities. Funding is an issue for Water Company Asset Management and business plans. Further developing and sharing good practice and improving techniques amongst key partners also make sense and this work is on going but not yet fully complete. It is worth noting that the number of surface water outfalls identified as impacted by misconnections is likely to far exceed the current investigation effort and available funding notably since the EA has commenced walkover surveys on many catchments. The overall length of sewers in Water Company ownership has also increased significantly with the recent transfer of private sewers, by circa 40%.

In some situations the sheer scale and effort in investigating misconnections might not be cost effective or practicable. Therefore alternative methods that effectively limit the impact from polluted surface water sewers would need to be explored. Total costs of either approach would need to factor in on going maintenance effort as well as other benefits in improving water quality. Most costs associated with investigating misconnections are staff resource time. There are additional costs to property owners to rectify misconnections. Running awareness raising activities alongside investigation work is likely to amplify the benefits. Costs need to be set against the potential benefits of WFD compliance.

It is essential that misconnections once identified are actually rectified including a resort to legal action if necessary. Current cooperation from local authorities is not always adequate nor does it necessarily match efforts by Water Companies. The use of EA's Anti-Pollution Works Notices powers are being evaluated in the Midlands which may provide an alternative legal mechanism alongside or instead of local authority Building Act powers. Using either of these legal powers still has a cost to the regulator especially if Notices are not acted upon by property owners although there is provision for cost recovery.

## 4.3 Solutions for preventing future misconnections

The 2010 Building Regulations Approved Document H[xviii], s2.62 requires that drainage should be connected to the 'correct system'. The adequacy of checks by Building Control Officers cannot be fully assured partially due to work loads and statutory inspections windows. However it is possible to raise awareness about misconnections with this group and also via planning approval for new developments. There are potentially other mechanisms for raising awareness and leverage such as property conveyance via RICS, mortgage companies, etc. However the fact remains that many misconnections are caused by plumbing errors that are outside of any formal regime.

There may be technical solutions to the misconnection problem through developing effective building products that act to prevent or limit plumbing errors, e.g. coloured coded drainage pipe work that also extends to white goods.

There is clearly a need to raise awareness about misconnections with the general public, building trades and professionals. Most property owners use plumbers or builders to install kitchens, bathrooms and even white goods so this is a key group to focus on. Efforts to raise awareness have been on going via the NMSG. Water Companies have developed their approved plumber schemes which are now being incorporated into the Watersafe scheme. The Chartered Institute of Plumbing and Heating Engineers is also in support of Watersafe.

Retail outlets for both the trade and DIY sectors could be utilised as well. White goods and detergent manufacturers, retailers and repairers could all have a role to play as well as the media in general including magazine publishers.

There are also regulatory options such as the introduction of General Binding Rules as in place in Scotland. These make it an absolute offence to discharge pollution to surface water sewers which makes enforcement far simpler for regulators. There have also been recent efforts to extend the powers of Water Companies so as to replicate those held by local authorities. Additional powers would allow notices to be served to rectify drainage but also provide for the recovery of costs.

## 4.4 Other solutions including tackling multiple and combined inputs into surface water drainage networks

As stated above the cost effectiveness of investigating and rectifying misconnections in extensive surface water sewers might be limited. Alternative measures such as SUDS, first flush interception and in-situ treatment technology are all potential options worthy of further consideration.

There are certain advantages of installing treatment on surface water systems in so far as they do provide other benefits such as flood water management, a degree of security, they address other water quality impacts, etc. There are of course many practical factors to consider such as capital and operational costs, sustainability and land availability that might act to limit utilisation.

## 4.5 Evidence gaps and uncertainties around the solutions

Our main evidence gaps regarding current control measures set out above are:

- It is not known that the current investigation activity is adequate to address the estimated number of misconnections. There are significant funding implications in extending this activity and not just for Water Companies as local authorities and the EA would need to complement effort correspondingly.

[xviii] http://www.planningportal.gov.uk/buildingregulations/approveddocuments/parth/approved

- Any changes in regulation are likely to require in depth justification, would take time to develop and are not assured to address existing misconnections unless in combination with other activities.
- There is little experience to understand the cost effectiveness of investigations versus alternative options such as SUDS.
- Awareness raising amongst any sector be it public, trades or professionals is not assured. For many the misconnection problem is externalised, not apparent and possibly low priority.
- Improvement in ecology and status are difficult to measure and slow to observe. There are also other synergistic impacts from a range of urban pollutants that make the correlation of any measures against improvements i complex and uncertain.
- Technical solutions are largely undeveloped, untested and slow to come to market.
- There are other factors that might mask improvements such as population growth, climate change; land use change hat are difficult to quantify and understand.

# Appendix 1 - Main national stakeholders for misconnections

The list may not be exhaustive.

Water industry; the National Misconnections Strategy Group, 10 water companies in England and Wales plus Scottish Water.
Retail sector; white goods, detergents and plumbing products.
European Commission
Defra, Welsh Government, other UK Administrations
Environment Agency and EA Wales including Regions/Areas and Liaison Panels
Ofwat and Consumer Council for Water
Natural England and the Countryside Council for Wales
Catchment groups
NGOs - Rivers Trusts, Angling Trust, RSPB, WWF, Pond Conservation, Plantlife, Wildlife Trusts, Salmon & Trout Association, Wildlife & Countryside Link
Water sports and outdoor amenity groups
National Trust, CL&BA and other land owners
National park authorities
Local authorities
Tourism interests
Abstractors – water companies, farmers, industry
Internal Drainage Boards
Angling groups
Canal & River Trust
Water body owners including water companies
General public
Academic and research organisations and consultancies providing services in this area.

# Appendix 2

New for v2

## Pressure/Sector analysis of water bodies failing good status in England & Wales (2012)

| | Sector responsible for the pressure | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2012 Pressure | Agriculture & rural land managem't | Angling & conservat'n | Environment Agency | Flood Defence | Forestry | Hydropower | Industry | Mining & Quarrying | Navigation | Urban & transport | Water industry | Still under invest'n |
| Priority substances | 28 | | | | | | 26 | 19 | 10 | 60 | 14 | 47 |
| Specific Pollutants | 14 | | | | 1 | | 16 | 192 | | 15 | 19 | 48 |
| Abstraction & flow | 46 | 2 | 3 | | 1 | 2 | 14 | 2 | 7 | 7 | 190 | 526 |
| Physical Modification | 299 | 18 | 52 | 1 | 5 | 16 | 103 | 21 | 42 | 302 | 210 | 1820 |
| Phosphate | 1437 | 3 | 1 | | 3 | | 109 | 2 | 4 | 422 | 1404 | 499 |
| Nitrate | 38 | | | | | | 1 | | | | 28 | 47 |
| Sediment | 415 | 3 | 2 | | 10 | 1 | 21 | 16 | | 77 | 21 | 52 |
| BOD | 21 | | | | | | 14 | | | 55 | 141 | 6 |
| Dissolved Oxygen | 196 | 2 | 5 | | | 1 | 38 | 5 | 4 | 124 | 234 | 192 |
| Ammonia | 101 | | | | | | 40 | 3 | | 129 | 330 | 80 |
| Groundwater Pressures | 73 | | | | 1 | | 7 | 23 | | 14 | 9 | 117 |
| pH | 17 | | | | 30 | | 4 | 10 | | 63 | 3 | 10 |
| Temperature | 3 | | | | | | 5 | | | | 8 | 6 |
| Inv non native Species | | 1 | | | | | | | | | | 31 |
| Fish Stocking | | 1 | | | | | | | | 1 | | 2 |
| Still under investigation | 233 | 9 | 5 | 1 | 29 | 1 | 64 | 38 | 5 | 203 | 213 | 563 |

## Appendix 3

### Reasons for water bodies failing good status by sector in England & Wales