Item 2

Scrutiny Report of Cardiff's Environmental Scrutiny Committee

Restore Our Rivers

January 2017

CARDIFF
CAERDYDD

City and County of Cardiff Council

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CHAIR'S FOREWORD

About a year ago I was contacted by a number of local anglers who were concerned about the state of the River Ely. They told me that parts of the river were effectively dead and that fish stocks were steadily declining. They were not sure why this was happening, but indicated that general pollution was probably a contributing factor. A little surprised and worried at the thought that my local river was dying I decided to look into the matter.

The work started with an item titled 'River Pollution in Cardiff' that was hosted by Cardiff's Environmental Scrutiny Committee. This took place on the 15th March 2016 and considered the problems facing local rivers and how these could be addressed. To shape the discussion we invited our partners at Dwr Cymru, Natural Resources Wales, South East Wales Rivers Trust, Cardiff Rivers Group and Glamorgan Anglers. During the meeting it quickly became apparent that the pressures of modern life were having a negative impact on our local rivers; in particular the River Ely was struggling having recently been categorised as 'poor' and 'Bad' in parts in a recent Natural Resources Wales assessment. It also became clear that there were lots of individuals and organisations working hard to improve the quality of our rivers and that the best way forward was to establish some kind of working partnership. The Restore Our Rivers inquiry was born.

Fast forward to August 2016 and a task & finish group was established to considered a range of options and initiatives for improving the quality of rivers and water courses in Cardiff and the wider South East Wales River Basin. To deliver this piece of work we co-opted partners from Dwr Cymru, Natural Resources Wales, Keep Wales Tidy, South East Wales Rivers Trust, Cardiff Rivers Group, Glamorgan Anglers and Groundwork Wales. The group met on a regular basis between August and December to discuss a wide range of river issues including pollution prevention, sustainable drainage, environmental improvements, delivering a united communications message, working with volunteer groups and building a regional or catchment based approach. At the end of the inquiry we summarised our work and created the Restore Our Rivers report. The report makes 20 recommendations and

is supported by 140 key findings. All of the recommendations are designed to drive river quality improvements across the South East Wales River Basin.
To my mind the single most important theme coming out of the report and recommendations is partnership working. By working together as a partnership we will achieve more; this inquiry clearly illustrates the point. On this note, I would like to thank all of the partners for their hard work during the last six months – you have added knowledge, experience and enthusiasm to the task. You have all been a pleasure to work with. I would also like to thank the witnesses who have provided evidence to the inquiry; your valuable contributions have added a wider perspective to the task and have shaped our key findings and recommendations.

As this inquiry draws to an end my hope is that the recommendations are collectively delivered through the partnership. In particular the creation of a regional working group is essential for implementing the other recommendations and dealing with any future problems in our rivers. By working together we can restore our rivers.

Councillor Paul Mitchell
Chairperson – Environmental Scrutiny Committee

INQUIRY METHODOLOGY

Cardiff's Environmental Scrutiny Committee along with its co-opted partners (Dwr Cymru; Natural Resources Wales; Keep Wales Tidy; South East Wales Rivers Trust; Cardiff Rivers Group; Glamorgan Anglers and Groundwork Wales) considered a range of river quality issues and options relating to improving the water quality in river and other watercourses in the South East Wales River Basin. In reviewing the various options the group drew upon a number of witness contributions and information sources including:

- Witness contributions from Dwr Cymru;
- Witness contributions from Natural Resources Wales;
- Witness contributions from Keep Wales Tidy;
- Witness contributions from the City of Cardiff Council;
- Witness contributions from Groundwork Wales;
- Witness contributions from the Cardiff Rivers Group;
- Witness contributions from Afonydd Cymru;
- Evidence gathered by Cardiff's Scrutiny Research Team and presented in the reports titled 'River Pollution in Cardiff: Background on the Ely, Rhymney and Taff' (**Appendix 1**) and 'Restore Our Rivers: Best Practice in Managing Ecological Issues' (**Appendix 2**).

From this body of evidence the Members drew key findings and the 20 recommendations made in this report. The Environmental Scrutiny Committee Task & Finish Exercise will report to the Environmental Scrutiny Committee on the 10th January 2017, and subject to approval of the draft report it will be commend to Cardiff Council's Cabinet and governing bodies of each of the co-opted partners for consideration and response.

INQUIRY TERMS OF REFERENCE

The collaborative task & finish working group will consider, evaluate and address the current problems facing Cardiff's rivers and watercourses. In doing so the exercise will develop a series of work packages which will review the following areas:

- Measurement and benchmarking of the current condition of Cardiff's rivers and watercourses;
- Prevention opportunities which can be applied to Cardiff's rivers and watercourses;
- Educational opportunities which can be applied to Cardiff's rivers and watercourses;
- Improvement opportunities which can be applied to Cardiff's rivers and watercourses;
- Regional opportunities which can be applied to the rivers and courses of the wider South East Wales River Basin.

In doing this the task & finish working group will explore best practice, receive witness contributions and access research resources from a wide range of sources. The task & finish exercise will address each of the five work package themes individually and a bespoke terms of reference will be created for each of the work packages.

The task & finish exercise will aim to identify a series of key findings and recommendations for each of the five work packages; these will be recorded in this report which will upon conclusion be submitted to the to the Welsh Government Cabinet Secretary for Environment and Rural Affairs; Cardiff Council's Cabinet Member for the Environment and the decision making body of each of the partner organisations who have provided representatives to support the collaborative task & finish working group. A copy of the report will be made available to other interested parties.

The collaborative task & finish working group will include Elected Members from Cardiff's Environmental Scrutiny Committee and co-opt appointed representatives from the Cardiff Rivers Group; Dwr Cymru; Glamorgan Anglers; Keep Wales Tidy; Natural Resources Wales and the South East Wales Rivers Trust.

MEASUREMENT & BENCHMARKING

At the start of the task & finish exercise the group identified measuring the condition of the three rivers and tributaries as a priority. Understanding the current conditions of the watercourses was seen as a vital starting point because it would help set the context of the overall exercise and act as a reference point against which future progress could be measured.

To deliver this work the group commissioned Cardiff Council's Scrutiny Research Team to write a paper titled 'River Pollution in Cardiff: Background on the Ely, Rhymney and Taff'; this document is attached to this report as **Appendix 1**. The report specifically comments on:

- General background profile information on the three rivers (the Ely, Rhymney and Taff);
- Background information on water quality assessment methodologies;
- Information on key water quality indicators and assessment results.

General information on the river's geographical profiles and characteristics which are presented in the report were collected from internet-based research and from existing Committee papers. The more detailed information on water quality indicators, assessment methods and ratings were provided by officers from Natural Resources Wales.

Background - Cardiff and the South East Wales River Basin

Most of Cardiff is located on a large flood plain which hosts the rivers Taff, Ely and Rhymney. The three rivers flow into the Bristol Channel and along with a series of supporting tributaries they provide drainage for a large section of South East Wales.

The rivers are recognised to have played a significant role in the economic, geographical and social development of Cardiff. They continue to provide an important role by supporting a healthy environment, enhancing habitat, providing leisure opportunities, generating energy, supporting the local economy, facilitating drainage and generally supporting well being.

River Quality Standards

River quality is measured by the standards set out in the Water Framework Directive; this is a European instruction which has been applied to United Kingdom law. **Appendix 1** describes the four main measures or tests contained within the Water Framework Directive and which are used to identify the condition of United Kingdom rivers and watercourses, these are:

- **Ecological Status** – The ecological status of a river is determined by examining three key aspects. These are biological quality elements (the communities of fish, invertebrates, diatoms and macrophytes); general physico-chemical conditions (the levels of dissolved oxygen, ammonia, phosphate, pH , temperature); and the 19 national pollutants (tests for the presence of 19 polluting substances agreed by advisory group UKTAG).
- **Chemical Status** – Water quality is monitored for its Chemical status, this involves testing for compliance to European Standards for 41 substances.
- **Additional Tests – Alien Species & Hydromorphological Conditions** – Tests for Alien species and assessements of hydromorphological conditions are undertaken to inform the overall assessement of river water quality conditions.
- **Overall Status Classifications** - The Ecological status, Chemical status and additional tests are combined to give an overall status described as one of five status classes which are High, Good, Moderate, Poor or Bad.

To help support the report officers from Natural Resources Wales provided basic descriptions for each of the five overall status classifications, these were:

- **High:** Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
- **Good:** Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.
- **Moderate:** Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.

- **Poor:** Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
- **Bad:** Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

Common Reasons for Failing Elements

Appendix 1 identifies five main reasons for sections of failing elements of river systems according to the Water Framework Directive, these are:

- Sewage/Combined sewage overflow/Misconnections known collectively as 'urban diffuse' where the ecology can be affected by raw (but often diluted) sewage / waste water making its way into the river. This can lead to degraded habitats for the flora and fauna.
- Point Source Sewage Treatment Works is the final treated discharge from Sewage Treatment Works. It all enters the river via one pipe at one location.
- Siltation is a form of pollution from deposits of silt or clay. It can be suspended sediments or the accumulation of sediment on the river bed.
- Mitigation measures where water bodies are modified for uses such as flood protection, public water supply, urbanisation to such an extent that Good Status is not achievable These need to attain Good Ecological 'Potential' (as opposed to status) which means we will need to put in place measures that maximise the ecology given the modified nature of the water body
- Barriers to fish migration in the form of weirs, culverts or sewer pipes. Man-made weirs, culverts or pipes as a result of urbanisation can present barriers to fish migration that prevent fish from migrating upstream to their spawning grounds.

The Three Rivers – A Summary

This section of the report provides a summary of each of the three rivers and their tributaries.

- **The River Ely**

The River Ely starts from Tonyrefail and runs for a distance of 24 miles to the Bristol Channel at Cardiff. The river flows past the settlements of Tonyrefail, Llantrisant, Pontyclun, Peterston Super-Ely, Ely, Cardiff and Penarth, and has three major tributaries which flow into the river, these are Nant Mychydd; Afon Clun and Nant Dowlais.

The river Ely and its tributaries is broken up into five sections these are shown in **Table 1** and **Diagram 1**. Recent analysis of the five sections of the river Ely identified that one section was categorised as 'Good'; two sections were categorised as 'Moderate 1'; one section was categorised as 'Poor' and one section was categorised as 'Bad'.

The information from **Table 1** explains that the River Ely has altered due to industrialisation and urbanisation with the introduction of man-made structures such as weirs; these structures create barriers to fish migration to their spawning grounds leading to depleted fish stocks. Natural Resources Wales is implementing a five-year project to address this issue.

Appendix 1 also explains that the water quality in the river has been put under pressure by sewage and other contaminations that affect the ecology and fish populations. It cites acute pollution incidents in 2010 and 2013 that have impacted the Clun water body and downstream on the Ely. Furthermore, it states that the Nant Dowlais (source to confluence with Ely River) water body also suffers from diffuse rural pollution, notably around siltation.

The report identifies several areas of the river that are borderline failures for phosphates. Too much phosphate can lead to accelerated algae and plant growth that can affect oxygen levels and disrupt the balance of the ecosystem. Dwr Cymru is looking at the potential impact from their assets on levels of phosphate, under an AMP6 funded catchment wide investigation.

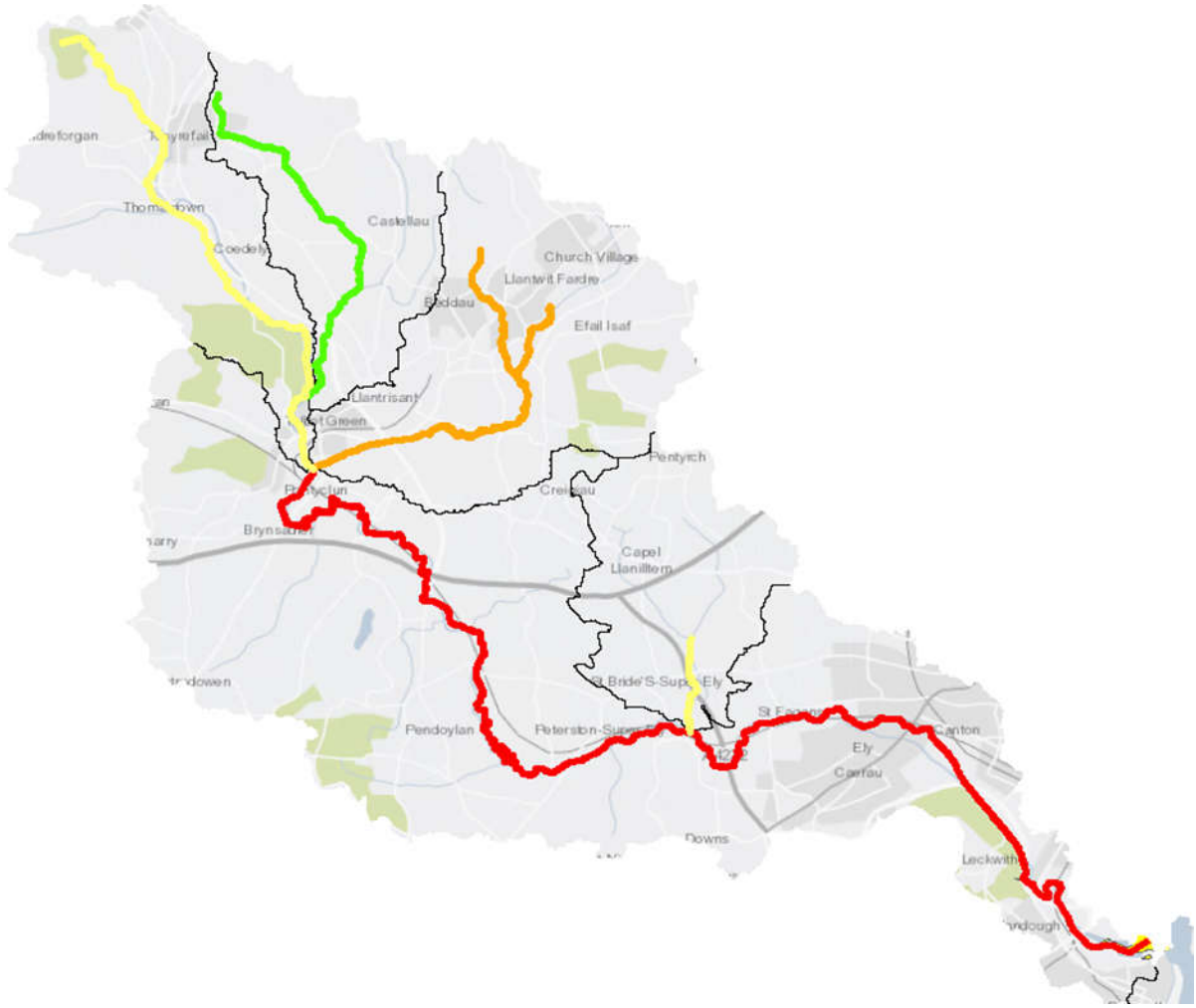
The results in **Table 1** show that the main body of the River Ely from its confluence with the Clun to its mouth has an overall status that is classified as “Bad”. This condition (status) is reflected in the population numbers for salmon, trout, chub, eel and invertebrates affected. Other failing elements are raised levels of Benzo(a)pyrene, Fluoranthene and Tributyltin (TBT). The reasons for the failing status on this part of the river are due to previous pollution incidents from unknown sources and other unknown sources.

Most of the tributaries upsteam of the river have significantly better “overall status” ranging from “Poor” to mostly “Moderate” and “Good”. The overall status of the “Nant Clun section up to its confluence with the River Ely”, has been classified as “Poor”. The failing elements of assessments are fish and invertebrate populations. The failure in conditions on this part of the river is mainly attributed to previous pollution incidents from unknown sources, misconnections and sewage pollution.

The overall status of the “Nant Dowlais source to its confluence with Ely River” and the “Ely River source to its confluence with Nant Clun” sections have both been classified as ‘Moderate’. The reduction of salmon and trout populations in these areas of the river are key factors that has led to this classification. For the “Nant Dowlais source to its confluence with Ely River”, the main reason is due to “Diffuse Agri (siltation)”, The “Ely River source to its confluence with Nant Clun” has barriers to fish migration, and increased levels of nutrients from STWs, sewage and misconnections.

Only the section starting from “Nant Mychydd source to its confluence with the River Ely” has a ‘Good’ overall status.

Diagram 1 – The River Ely



High	
Good	
Moderate	
Poor	
Bad	

- 5 sections: 1 ‘Good’ 2 ‘Moderate 1 ‘Poor’ 1 ‘Bad’.
- Urbanisation and Industrialisation has led to man-made barriers that block fish migration.
- The ‘Poor’ and ‘Bad’ sections fail on fish and invertebrate populations.
- Misconnections and pollution contributing factors.

Table 1 - River Ely Framework Directive Status 2015 Cycle 2.

Waterbody Name	Overall Status	Failing elements	Fish supplies driving failure	Reason For Failure
Nant Dowlais - source to conf Ely R	Moderate	Fish	Salmon, Trout	Diffuse Agri (siltation),
Nant Clun - source to conf Ely R	Poor	Fish, Invertebrates	Salmon, Trout	Misconnections, Sewage pollution, previous polln unknown source
Nant Mychydd - source to conf Ely R	Good	None	N/A	N/A
Ely R - source to conf Nant Clun	Moderate	Fish, Diatoms	Salmon, Trout	Barriers, STW/sewage/misconnections
Ely R - conf Nant Clun to Allot Gardens, Ely	Bad	Benzo(a)pyrene, Fish, Fluoranthene, Invertebrates, TBT	Salmon, Trout, Chub, Eel.	Previous pollution unknown source, others unknown.

- **The River Rhymney**

The River Rhymney rises at Odyn Fach within the Brecon Beacons National Park and runs for a distance of 35 miles to the Bristol Channel at Cardiff. The Rhymney has several small tributaries which flow into the river, and are each measured as sections and given a classification as part of the Water Framework Directive. The river Rhymney flows past the settlements of New Tredegar, Bargoed, Ystrad Mynach, Llanbradach, Caerphilly, Bedwas, Trethomas, Machen, Draethen and finally Llanrumney and Rumney in Cardiff.

The River Rhymney and its tributaries is broken up into ten sections these are shown in **Table 2** and **Diagram 2**. Recent analysis of the ten sections of the River Rhymney identified that three sections were categorised as 'Good'; six sections were categorised as 'Moderate' and one section was categorised as 'Poor'.

The sections of the river that have been given 'Moderate' as its "overall status" have varied reasons for its failing elements. In four of these waterbodies (as shown in **Table 2**) specifically the, "Nant Glandulas from its source to confluence with the River Rhymney" section, the "Roath Brook", "Broadway Reen from its source to the River Severn Estuary", the "Rhosog Fach Reen from its source to Seven Estuary" the existing conditions at the time of reporting required mitigation measures because they are Heavily Modified Water Bodies for flood protection, urbanisation and land drainage uses. It is also recognised that they are Sites of Special Scientific Interest (SSSI) so any mitigation measures implemented for WFD must not impact negatively upon the SSSI features.

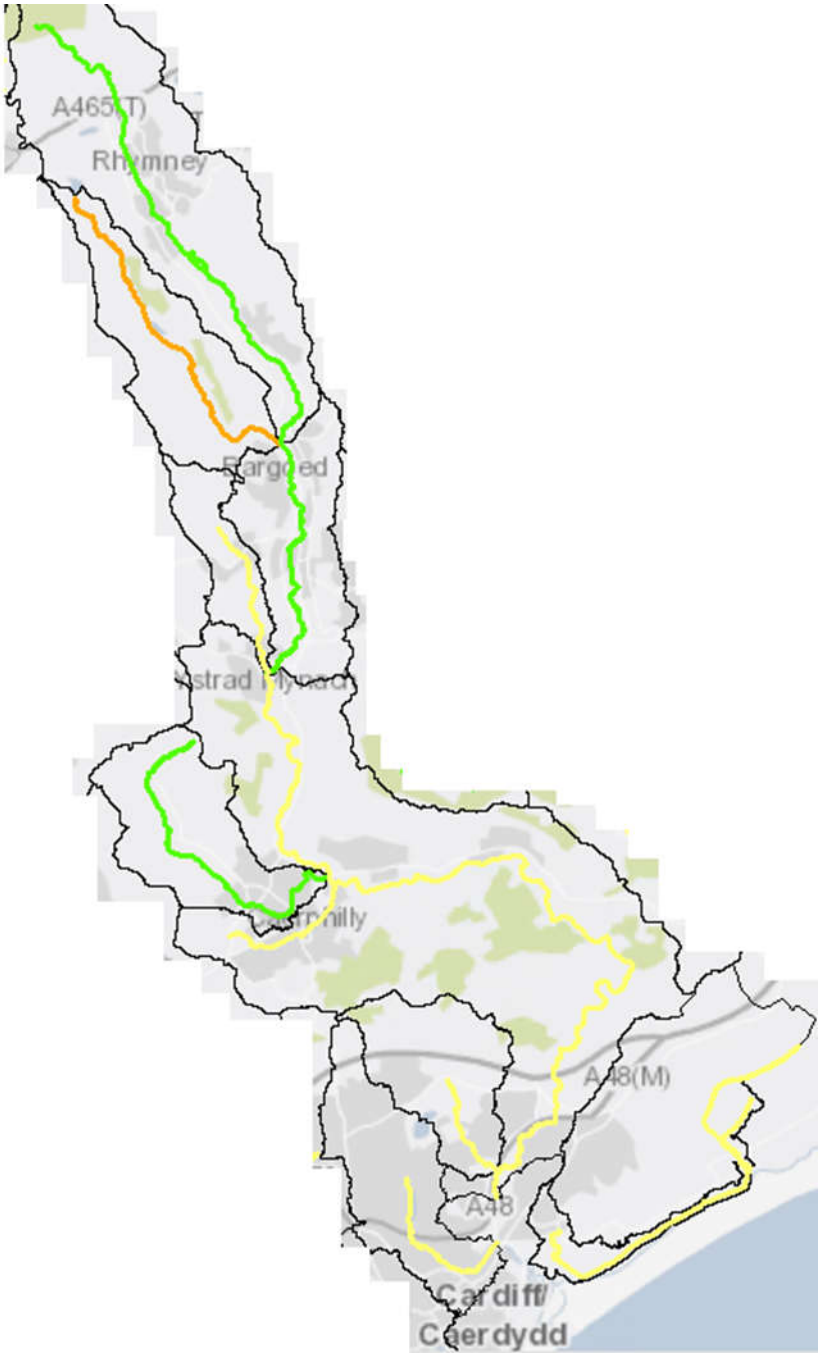
In three sections of the river there are issues around depleted fish stocks: specifically for trout and eel at the "Nant Glandulas source to its confluence Rymney River" section; and for salmon and bullhead populations at the "Nant Cylla source to confluence with Rhymney River" section. These sections both have a status of "Moderate" as a result. The section from "Nant Bargoed Rhymni's source to its confluence with the River Rhymney" has an overall status of "Poor" with fish populations (specifically salmon, trout and bullheads) as its failing element and mainly due to barriers in the watercourse.

The report specifically cites that there are weirs in some sections of the River Rhymney that create barriers between fish and their spawning grounds and that

these fish populations are further susceptible to and can be affected by sewage, combined sewage overflows, misconnections and industrial estates.

It is recognised that further urban development may compound these issues; however, Natural Resource Wales reports that they are working with partners to address these concerns.

Diagram 2 – The River Rhymney



High	
Good	
Moderate	
Poor	
Bad	

- 10 sections: 3 ‘Good’ 6 ‘Moderate 1 ‘Poor’.
- Several water bodies on the river modified for flood protection, urbanisation and drainage
- The ‘Poor’ section fail on fish populations.
- Barriers in the watercourse the contributing factors.

Table 2 - River Rhymney Framework Directive Status 2015 Cycle 2

Waterbody Name	Overall Status	Failing elements	Fish supply driving failure	Reasons for Failure
Rhosog Fach Reen - source to Seven Estuary	Moderate	Macrophyte, Mitigation measures		Suspected Diffuse Agri, Mitigation Measures for Land Drainage & Wider Environment (SSSI)
Broadway Reen - source to R Severn Estuary	Moderate	Ammonia, DO, Mitigation measures, Phosphate		Mitigation Measures for Land Drainage & Wider Environment (SSSI), Trunk Sewer issues, suspected diffuse agri
Roath Brook	Moderate	Inverts, Macrophyte, Mitigation measures, Phosphate, Diatoms		Mitigation Measures (Water Resources, Urban, Wider Environment – SSSI reservoir), Misconnections / sewage pressure
Nant Glandulas - source to conf Rhymney R	Moderate	Fish, Hydrology, Diatoms	Trout, Eel	Barriers (and should also be failing for Mitigation Measures)
Nant y Aber - source to conf Rhymney R	Good	None	N/A	N/A
Nant Cylla - source to conf Rhymney R	Moderate	Fish, Phosphate	Salmon, Bullhead	barriers and sewage / misconnections.
Rhymney R - Nant Bargod Rhymni to conf Nant Cylla	Good	None	N/A	Despite good classification has Minewaters pressure
Rhymney R - conf Nant Cylla to Chapel Wood	Moderate	Benzo(a)pyrene, Benzo (a) and (k) fluoranthene, Benzo (ghi) perelyene and indeno (123-cd) pyrene, Fluoranthene	N/A	Unknown sources of combustion
Nant Bargod Rhymni - source to conf Rhymney R	Poor	Fish	Salmon, Trout, Bullhead	barriers
Rhymney R - source to conf Nant Bargod Rhymni	Good	None	N/A	N/A

- **The River Taff**

The River Taff rises as two rivers in the Brecon Beacons National Park and runs for a distance of 40 miles to the Bristol Channel at Cardiff. The River Taff is formed from the Taf Fechan (Little Taff) and the Taf Fawr (Big Taff); the two rivers merge just north of Merthyr Tydfil. The Taff has seven major tributaries which flow into the river, including Nant Ffrwd; Nant Morlais; Nant Rhydycar; Taff Bargoed; Cynon; Nant Clydach and Rhondda. The river Taff flows past the settlements of Merthyr Tydfil, Treharris, Pontypridd and Cardiff.

The River Taff and its tributaries is broken up into fifteen sections these are shown in **Table 3** and **Diagram 3**. Recent analysis of the fifteen sections of the River Taff identified that three sections were categorised as 'Good'; seven sections were categorised as 'Moderate' and five section was categorised as 'Poor'.

There are seven sections (water bodies) that have been given a 'Moderate' overall status. There are a variety of factors that have been identified as the "failing elements" for these water bodies with most of these around fish populations and mitigation measures.

The Natural Resources Wales report further explains that some of the issues or challenges in many of these water bodies, are associated with or are a result of the Taff having been modified for flood protection, public water supply, urbanisation. Natural Resources Wales recommends that modifications need to be made to offset these changes and achieve a good ecology and it will be working on this as part of its 2015-2020 programme.

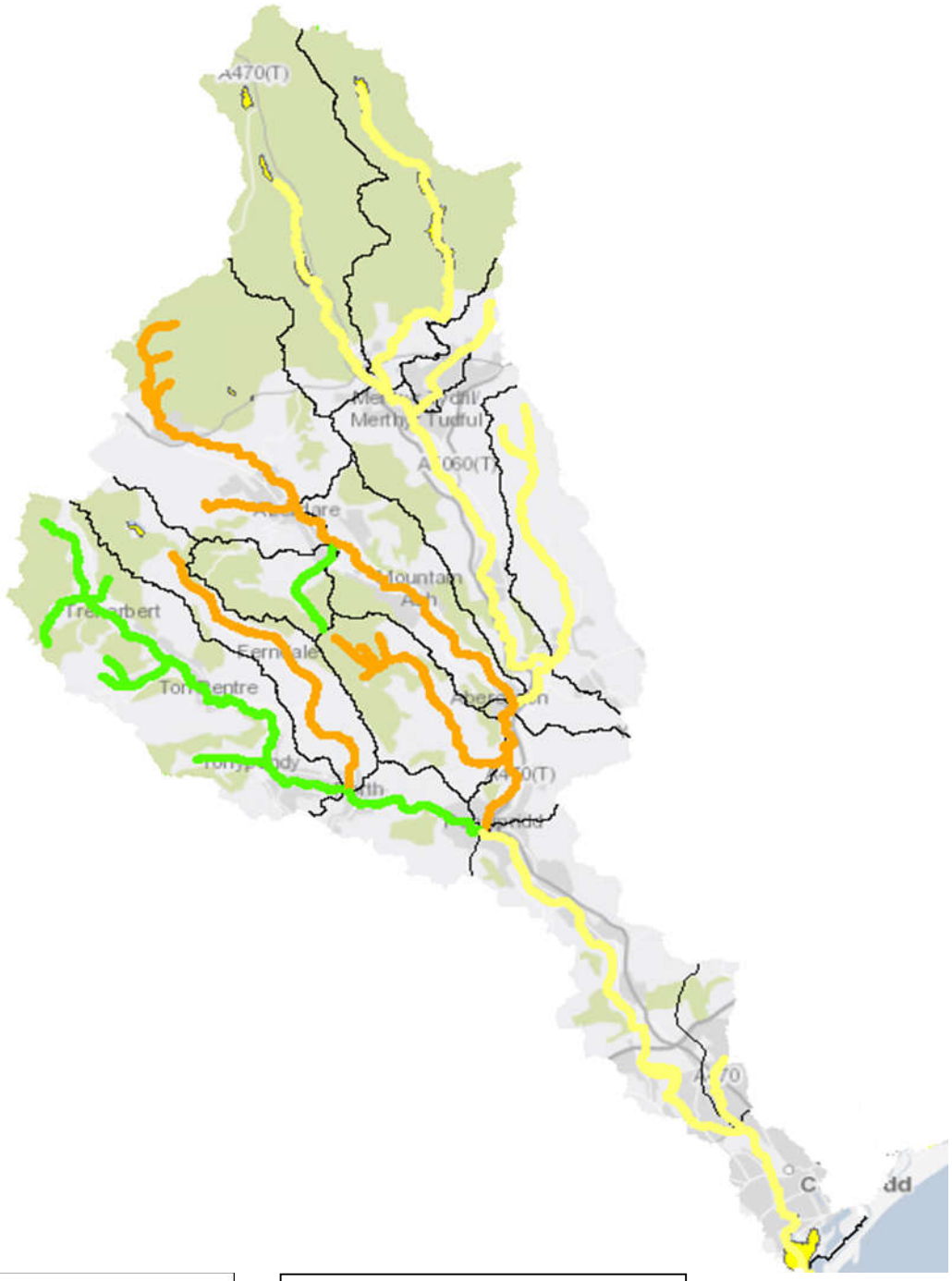
Table 3 shows that there are five sections (water bodies) that have been given a classification of (overall status) 'Poor' and have fish levels identified as the "failing elements" with issues around the populations of salmon and trout. A variety of reasons for these "failing elements" are cited in the Table below, including "barriers" in 5 of the sections/ water bodies. Additionally, sewage and misconnections were also cited as a reason for the sections at the "Cynon confluence to Aman River to confluence with River Taff"; the "Afon Rhondda Fach source to confluence with Rhondda River"; and "Afon Cynon source to confluence with Aman River" water bodies.

Table 3 further identifies a range of other failing elements at various points of the river to include: macrophyte levels, high presence of chemicals such as phosphates in some sections/waterbodies of the river as can be shown seen in the Table above.

The Natural Resources Wales report also cites various ”reasons for failure” or issues such as barriers, sewage, misconnections and unknown sources of pollution that have a detrimental effect to the overall status of the river. The report further explains that these sources of pollution are plentiful and therefore difficult to target but lead to increased levels of chemicals such as Fluoranthene or Benzopyrene. It is suggested in the Water Framework Directive that reducing emissions or intercepting diffuse sources could help with this by using sustainable draining systems.

The Natural Resources Wales report also states that water quality in the river is affected by sewage, combined sewer overflows, misconnections and industrial estates. These can affect the ecology of the river and have a negative effect on fish populations. In the case of the Taff, these factors have affected bullhead and especially salmon and trout populations. Natural Resources Wales also recognises that increased urban development along the river escalates these issues and they are working with partners (Dwr Cymru, South East Wales Rivers Trust and Cardiff Council) to try and address them.

Diagram 3 - River Taff Framework Directive Status 2015 Cycle 2



High	
Good	
Moderate	
Poor	
Bad	

- 15 sections: 3 ‘Good’ 7 ‘Moderate 5 ‘Poor’.
- Has been modified for flood protection, public water supply, urbanisation and alterations to Cardiff Bay
- The ‘Poor’ sections fail on fish populations.
- Barriers, pollution and misconnections the contributing factors.

Table 3 – River Taff Framework Directive Status 2015 Cycle 2

Waterbody Name	OverallStatus	Failing elements	Fish supply driving failure	Reason for Failure
Aman R - source to conf Afon Cynon	Good	None	N/A	N/A
Cynon - conf Aman R to conf R Taff	Poor	Fish	Salmon, Trout	Barriers, sewage/misconnections, Industrial estates.
Rhondda Fawr	Good	None	N/A	Although passing has barriers, sewage /misconnections pressures
Afon Rhondda Fach - source to conf Rhondda R	Poor	Fish, Hydrology, Mitigation measures	Salmon, Trout, Bullhead	Barriers, Water Resources, sewage/misconnections pressure, Mitigation Measures for Water Resources & urban
Whitchurch Bk - source to conf R Taff	Moderate	Fish, Mitigation measures, Phosphate	Salmon, Trout	Barriers, Mitigation Measures for urban & sewage/misconnections.
Rhondda R - conf Afon Rhondda Fach to conf R Taff	Good	Hydrology	N/A	Although passing, hydrology pressures.
Taff - conf R Cynon to conf Rhondda R	Poor	Fish	Salmon, Trout	Barrier on minor trib.
Nant Clydach - source to conf R Taff	Poor	Fish	Trout	Barriers
Taff - conf Rhondda R to Castle Street	Moderate	Benzo(a)pyrene, Benzo (a) and (k) fluoranthene, Fluoranthene, Mitigation measures.	N/A	Unknown sources of combustion and Mitigation Measures flood protection / urban.
Taff - conf Taf Fechan to conf R Cynon	Moderate	Mitigation measures	N/A	Barriers, Mitigation Measures urban
Afon Cynon - source to conf Aman R	Poor	Fish	Salmon, Trout	Barriers, sewage/misconnections, water resources.
Taff Bargoed	Moderate	Fish, Mitigation measures	Salmon, Bullhead	Barriers, Mitigation Measures Flood

Nant Morlais - source to conf R Taff	Moderate	Inverts, Macrophyte, Mitigation measures	N/A	sewage/misconnections / Culverts, Mitigation Measures urban,
Taf Fechan - source to conf Afon Taf Fawr	Moderate	Mitigation measures	N/A	Mitigation Measures Water Resources, barriers pressure
Afon Taf Fawr - source to conf Taf Fechan	Moderate	Fish, Inverts, Mitigation measures	Salmon, Trout	Mitigation Measures Water Resources, barriers

KEY FINDINGS & RECCOMENDATIONS

MEASUREMENT & BENCHMARKING

As previously stated the Scrutiny Research Team was commissioned to write a report titled 'River Pollution in Cardiff: Background on the Ely, Rhymney and Taff' (attached as **Appendix 1**). The three main aims of the report were to provide:

- General background profile information on the three rivers;
- Background information on water quality assesement methodologies;
- Information on key water quality indicators and assessment results.

A summary of this report was provided at a meeting on the 7th December 2016.

Recommendation 1

Cardiff Council's Scrutiny Research Team has created a report to support this task & finish exercise titled 'River Pollution in Cardiff: Background on the Ely, Rhymney and Taff'. This report documents the current condition of the three rivers (particularly the Ely) and highlights the issues that they currently face. The task group recommends that this report is used as a starting point against which the achievements of the Restore Our Rivers task & finish exercise can be measured. A copy of 'River Pollution in Cardiff: Background on the Ely, Rhymney and Taff' has been attached to this report as **Appendix 1**.

KEY FINDINGS & RECOMMENDATIONS

PREVENTION OPPORTUNITIES

Two meetings were held to consider issues relating to pollution prevention; these were held on Monday 12th September and Thursday 15th September 2016. Evidence was provided by witnesses from Dwr Cymru, Natural Resources Wales, Keep Wales Tidy and Cardiff Council. The following topics were addressed in this section:

- Pollution Prevention;
- Misconnections & Sewer Abuse;
- River Survey & Clean;
- Pollution Identification, Investigation & Enforcement;
- Farm Pollution;
- Diffuse Pollution Prevention.

During these items the group identified a number of key findings and recommendations which can be seen below.

Key Findings & Recommendations

- **Key Finding 1** – Dwr Cymru has made progress in recent years in identifying and dealing with misconnections, sewer abuse and other pollution sources. To continue to drive improvements in this area Dwr Cymru is looking to raise the profile of self-reporting on misconnections, sewer abuse and other pollution incidents through a campaign called ‘See it – Report it – Stop it’. They believe that improved communication through a partnership network approach is the best way to raise the profile of self-

reporting and other important issues which impact on the rivers and watercourses in the South East Wales River Basin.

- **Key Finding 2** – Dwr Cymru identified a number of campaigns which they felt could be promoted through a partnership network approach. Suitable issues / campaigns which could be promoted included:

  - 'See it – Report it – Stop it';
  - Stop the Block;
  - Natural Resources Wales;
  - Restore Our Rivers – Ely River Clean.

- **Key Finding 3** - During the meeting Dwr Cymru made the point that they have a vast water and sewage network across Wales and that keeping on top of its maintenance is a major challenge. Getting the public to help spot problems (i.e. self reporting) will be a significant step forward in terms of improving the network.

- **Key Finding 4** - Natural Resources Wales is the public face of the National Misconnections Strategy Group. It's a partnership of organisations who are working to reduce water pollution from drains and sewers. Dwr Cymru and Natural Resources Wales are involved with the National Misconnections Strategy Group. The group undertakes a number of functions including:

  - Sharing best practice and raising awareness and understanding of misconnections, sewers and drains and the environmental problems that they cause;
  - Helping property owners and professionals to check drainage connections and take action;
  - Ensuring new drainage is connected right;
  - Helping to develop and support effective practice, policy and regulation;
  - Sharing information and evidence about the problem and supporting research and development of long-term solutions.

- **Key Finding 5** – The importance of engaging with angling groups to raise the profile of campaigns like 'See it – Report it – Stop it' was stressed.

Angling and other groups who frequently access local rivers and watercourses were viewed as an essential source in terms of identifying river pollution issues.

- **Key Finding 6** – Dwr Cymru has recently run campaigns which are aimed at national white goods companies to raise the profile of misconnecting items like dish washers and tumble dryers. Commonly used white goods such as dish washers and tumble dryers are often incorrectly connected to the drainage system (sometimes by mistake and sometimes by design) and, therefore, become a pollution issue. Dwr Cymru has also run a misconnections campaign with the support of Jewson the builders merchant. The impact of these campaigns has yet to be assessed.

- **Key Finding 7** – It was suggested that circulating information about misconnections to angling clubs around Wales would be a really positive step forward. They would be one of the best stakeholders for identifying misconnections.

Recommendation 2

The partners involved with the task & finish exercise and other public bodies need to work closely with Dwr Cymru to raise the profile of pollution issues by supporting the following campaigns:

- 'See it – Report it – Stop it' – a campaign aimed at raising the profile of self-reporting on misconnections, sewer abuse and other pollution incidents;
- 'Let's Stop the Block' – a campaign which raises the profile of what can and can't be flushed down the toilet;
- 'ConnectRight' – a campaign which raises the profile of ensuring that properties are properly connected to the drainage system;
- 'Restore Our Rivers – River Ely Survey & Clean' – a survey and clean of the River Ely which is to be led by Keep Wales Tidy and supported by the partners involved with the task & finish exercise.

It was felt that a partnership approach which integrated the voice of all the task & finish exercise partners and other public bodies would be the best way to project these messages to the largest possible audience. In particular, integrating the messages through the communications functions of all of the bodies was seen as essential; they would all be able to use existing systems to share the messages through formats like social media, email networks, internal publications, press briefings and websites.

This recommendation is supported by key findings 1 to 7.

- **Key Finding 8** – It was felt that establishing an effective communications network and gaining support for other tasks linked to the Restore Our Rivers task & finish exercise would require support political support from across the South East Wales River Basin. The group felt that Cardiff Council was best placed to develop these connections to support the group.
- **Key Finding 9** – A Dwr Cymru 'Pollution Champion' explained that addressing water pollution issues was best achieved through partnership working and closer collaboration with all of the relevant parties. He explained that the level of engagement with local authorities in the South East Wales River Basin was mixed and that improvements in this area would improve the necessary multi agency approach. Ultimately it was felt that all partners from within the South East Wales river basin should function as a single partnership.

Recommendation 3

Improving the water quality of the rivers in Cardiff involves taking a whole river catchment approach and not just addressing specific problems in Cardiff. As a consequence, the partners involved with the task & finish exercise need to work together to gain the support of all of the local authorities within the South

East Wales River Basin, i.e. Cardiff, the Vale of Glamorgan, Rhondda Cynon Taff, Merthyr Tydfil and Caerphilly. Only by working across the whole South East Wales River Basin can real long term improvements be achieved. Working in this type of collaborative way would help build connections and enhance the multi-agency working approach.

This recommendation is supported by key findings 8 & 9.

- **Key Finding 10** – Dwr Cymru, Natural Resources Wales and the other parties involved with the task & finish exercise felt that developing a water pollution contact data base for the South East Wales River Basin was essential to improve partnership working and drive improvements in water quality in local rivers and watercourses. Key contact points to be added to such a data base should include representatives from Dwr Cymru, Natural Resources Wales and all local authorities from within the South East Wales River Basin.

Recommendation 4

The partners involved with the task & finish exercise should work establish a common water pollution contact data base for the whole South East Wales River Basin. This it was felt should improve partnership working and ultimately drive water quality improvements in our rivers. The data base should include details of all key contacts from each of the partners involved with the task & finish exercise and all local authorities within the South East Wales River Basin. Each of the partners and other local authorities should provide a list of relevant staff along with a contact number and address.

This recommendation is supported by key finding 10.

- **Key Finding 11** – Natural Resources Wales, Dwr Cymru and Swansea City Council have recently delivered a misconnections and sewer abuse project called 'Loose Connections'. This aimed to identify and address misconnections which directed various pollutants into watercourses feeding into Swansea Bay which was identified as having the worst water quality in Wales. Due to the popularity of beach tourism in the area having poor water quality in Swansea Bay was viewed as an unacceptable position which Swansea Council decided to address as a priority. The problem was highlighted from three key areas of failure, these were:

  - Water Framework Directive;
  - Bathing water quality;
  - Shellfish water quality.

  The problem contributed directly and indirectly to local health and well-being.

- **Key Finding 12** – Natural Resources Wales views water to be at the centre of the new Wellbeing of Future Generations (Wales) Act and that people were now starting to realise that there are significant economic costs associated with poor water quality, for example, health risks and loss of tourism.

- **Key Finding 13** - Misconnections are viewed as a continuous problem which requires ongoing funding to address. In broad terms Natural Resources Wales resources are reducing.

- **Key Finding 14** – Dwr Cymru now employs ten Pollution Technicians in Wales; a key part of their role is to work with Natural Resources Wales and local authorities to reduce pollution incidents. The Swansea based Dwr Cymru Pollution Technician played a very active role in supporting the Swansea Loose Connections Project.

- **Key Finding 15** – Swansea City Council allocated two full time members of staff to the 'Swansea Loose Connections Project' who worked closely with the Dwr Cymru Pollution Technicians and officers from Natural Resources

Wales. Swansea City Council staff were involved with visiting local properties to establish if they were properly connected to the correct drainage / sewer system. Results from the exercise estimated that 10% to 15% of properties were incorrectly plumbed into the wrong drain or sewer, for example, toilets were commonly plumbed into a surface water sewer instead of a foul water sewer. Once a misconnection was identified appropriate advice was provided regarding how to rectify the problem.

- **Key Finding 16** – The funding for the Swansea City Council dedicated team lasted for the period of the project, i.e. approximately six months. Funding for the project has now been removed.

- **Key Finding 17** – Natural Resources Wales stressed that managing misconnections on the Ely was carried out on a reactive basis when compared to the proactive approach taken in the Swansea Loose Connections Project.

- **Key Finding 18** – There was no particular trend in terms of property age or type for the misconnections identified during the Swansea Loose Connections Project, i.e. misconnections can arise from any type or age of property.

- **Key Finding 19** – Cardiff has an old Victorian combined sewer in the inner city so misconnections are less of a problem in this area, i.e. all water is (foul & surface) assumed dirty and processed accordingly. Misconnections are more of a problem in the outer areas with new housing stock as they operate dual sewer systems which, therefore, create the opportunity for misconnections.

- **Key Finding 20** – The 'Swansea Loose Connections Project' was deemed a great success as it increased water quality in the Swansea Bay area from 'Poor' to 'Good'; an improvement of two categories.

- **Key Finding 21** - Quite often properties are misconnected to cut corners; sometimes properties are bought with existing misconnections; sometimes

the people creating the misconnection just do not know what they are doing.

- **Key Finding 22** – It was asked if any misconnection fines from the Swansea Loose Connections Project had been or could be used to cover the cost of delivering the misconnection work. The consensus was that funds from penalty charge notices were ring-fenced for particular tasks and, therefore, could not be used. In addition to this any revenue generated by penalty change notices resulting from this project would be very small; the aim of the project was to work with people to reduce misconnections and not raise funding via penalty charge notices.

- **Key Finding 23** - Running the Swansea Loose Connections Project did have a specific resource implication for Swansea City Council; however, they saw it as a political priority and, therefore, were willing to fund the work. It is important to remember that at the start of the exercise Swansea Bay had the worst water quality in Wales, since the project it has jumped from ‘poor’ to ‘good’ (moving up two categories of improvement).

Recommendation 5

The Swansea Loose Connections Project is an excellent example of how partnership work can improve water quality. Surveying a river system to identify misconnections and then addressing the problems at source is a very effective way to achieve quick improvements in water quality. The partners involved with the task & finish exercise should in part look to copy this approach and conduct a river survey to identify any misconnection issues. Should any misconnections be identified then appropriate action should be taken to address the problem.

This recommendation is supported by key findings 11 to 23.

- **Key Finding 24** – Dwr Cymru and Natural Resources Wales have historically held quarterly meetings with local authorities to discuss misconnections; although recently such meetings have become less successful and frequent. It was felt that increasing the frequency of such meetings in future would help improve the management of water quality issues.

Recommendation 6

Dwr Cymru, Natural Resources Wales and the five local authority areas should reinstate the historic quarterly meetings to discuss the issue of misconnections. It was felt that this approach would improve partnership working and help identify problem misconnections.

This recommendation is supported by key finding 24.

- **Key Finding 25** – The group felt that raising Councillor awareness on the issues of misconnections, sewer abuse and water quality in rivers and other watercourses was very important. They felt that some type of presentation or training exercise to support this cause would be very worthwhile.
- **Key Finding 26** – The group felt that raising the profile of misconnections and sewer abuse with community councils and planning committees was very important as they are stakeholders who have a direct input into the planning process which has a large effect on sewer and drainage systems. In addition to this it was felt that the profile of misconnections should also be raised within the Building Control teams of local authorities to ensure that drainage plans are properly completed by developers.

Recommendation 7

Councillor awareness around the issue of misconnections, sewer abuse and

river water quality should be improved. The partners involved with the task & finish exercise should work together to create a short presentation or training package which could be made available to Councillors in the five local authorities of the South East Wales River Basin. Such a presentation or training package should be made available as part of the 'Member Induction' process which will be rolled out after the local government elections in May 2017. The presentation or training package should also be made available to community councils and planning committees. The profile of misconnections should also be raised within the Building Control teams of local authorities to ensure that drainage plans are properly completed by developers.

This recommendation is supported by key findings 25 & 26.

- **Key Finding 27** – Dwr Cymru and Natural Resources Wales felt that working closely with Environmental Health in all local authority areas was an effective way to target misconnections and sewer abuse. For example, they are able to establish if takeaways are connected to the correct drainage and sewer systems. They are then able to provide advice and potentially take action against those who breach any rules or requirements.

- **Key Finding 28** – If local authorities cannot afford to allocate designated officers for an identification of misconnections exercise then, as an alternative, they could look at the options of building tasks applied in a misconnections exercise into the everyday work of Environmental Health. For example, a sewer or drain connection check could be included in a food safety visit.

- **Key Finding 29** – An officer from Dwr Cymru advocated that all catering premises should have a 'fat trap box' fitted at a point prior to accessing the drainage / sewer system. At the moment advice only mandates the use of enzyme strips for catering premises (these are designed to only remove bacteria). It was felt that making the implementation of 'fat trap boxes' mandatory would reduce the likelihood of blockages in the sewer network as less fat would access drainage systems and, therefore, this would

reduce the number of pollution incidents which would help improve water quality in the natural water course.

- **Key Finding 30** – During the meeting a Dwr Cymru officer explained that recycling fat from catering establishments is much easier if they have a fat funnel. The group felt that providing catering establishments free fat funnels would help increase the recycling of fats and oils, while at the same time contribute to water quality improvements.

Recommendation 8

Dwr Cymru and Natural Resources Wales felt that working closely with local authority environmental health services was a highly effective way of target and deal with misconnections and sewer abuse. The partners involved with the task & finish exercise agreed with this approach. As a consequence, they would like Dwr Cymru, Natural Resources Wales and the environmental health teams of the five local authority areas to discuss the feasibility of:

- Carrying out a check to ensure that all food establishments have grease / fat traps and enzyme dosing systems in place and to carry out a check for general misconnections – they currently only check to see if used oil is collected and taken away;
- Establishing closer working links between Environmental Health Officers and Dwr Cymru Sewer Network Abuse Protection Technicians – in particular around fat oil and grease issues where the Dwr Cymru officers are able to provide valuable support;
- Where the need arises, Environmental Health Officers and Dwr Cymru Sewer Network Abuse Protection Technicians carry out joint inspections;
- Environmental Health Officers carrying Dwr Cymru 'Let's Stop the Block' literature so that they can provide copies to food establishments where they deem appropriate;
- When there is a change of premises use to a class A3 food establishment, the occupants are made aware of their responsibilities in terms of fat, oil and grease management;

- Issuing all food establishments with free fat funnels to help increase the recycling of fat, oil and grease.

This recommendation is supported by key findings 27 to 30.

- **Key Finding 31** – It was noted that obtaining third party funding to carry out statutory work was almost impossible; getting monies to raise the profile of something was much easier.

- **Key Finding 32** – All members of the group supported running a river survey and clean exercise. They agreed to prioritise a survey and clean of the river Ely and its tributaries as it currently has the worst water quality and it because it is the shortest of the three rivers.

- **Key Finding 33** – A river survey and clean exercise would provide an opportunity for different organisations/agencies and the public to join forces to survey and clean up the entire river Ely catchment. It would be an example of partnership working which is currently being encouraged in Wales. Benefits of such a partnership approach would include:

  - Engaging relevant Local Authorities;
  - Making use of the different skills of partners, for example, Dwr Cymru information, Natural Resources Wales equipment;
  - Forging new partnerships and engaging with other organisations / interest groups, for example, boat clubs/canoeists for water-based assistance (crucial in the Cardiff area);
  - Encouraging public participation and gaining new volunteers and formation of new voluntary groups;
  - Gathering together litter champions;
  - Creating a positive news story and raising the profile of the importance of rivers.

- **Key Finding 34** – Keep Wales Tidy can deliver and has experience of delivering river survey and clean exercises. Key tasks for delivering such a project would include:

- Creating a task list and allocating activities;
- Coordinating activities;
- Coordinating a survey – this would focus on identifying outfalls, hotspots and undertaking risk assessments;
- Contacting groups/user groups to ascertain interest;
- Collation of volunteers;
- Mapping activities (who where, areas of need);
- Purchasing equipment, for example, PPE and tools;
- Undertaking health and safety/risk assessment;
- Offering insurance – KWT insurance covers activity if officers are present via a group insurance scheme;
- Organising a high profile event launch;
- Coordinating publicity and promotion – e-mail, local press, posters, media, social media.

- **Key Finding 35** – The main roles and responsibilities of local authorities in a river survey and clean could include:

  - Providing details of land ownership information;
  - Granting permissions for land access;
  - Provide staff to support such exercises (to cover a wide range of tasks);
  - Arranging the removal and disposal of waste;
  - Helping to promote the exercise;
  - Encouraging partners to take part in the exercise;
  - Identifying areas of need;
  - Support mapping and collation of other information;
  - Providing or facilitating specialist practical assistance (staff and equipment).

- **Key Finding 36** - The main costs associated with running a river survey and clean are:

  - Staff time – this includes undertaking surveys and risk assessments; coordination and mapping, running events, feedback and reporting;

providing Project Officers to support the task; the general provision of central administration and support.

- Provision of specific specialist tools, PPE and Safety equipment – for example, waders, throwlines, buoyancy aids, grappling hooks, litter pickers, nets etc… The cost of equipment for the Great Taff Tidy was £4,188.

- **Key Finding 37** – The main risks / threats associated with delivering a river survey and clean of this scale were identified as:

  - Weather - this would need to be monitored prior to and on the day as high or fast water levels could potentially create unacceptable safety risks for the exercise;
  - Access – access to private land, lack of engagement by landowners and inaccessible stretches of river could all compromise such an exercise;
  - Health & Safety – ensuring the safety of everyone involved with the exercise would be a priority.
  - Lack of Participation – a river clean on this scale would only work with public support – ensuring strong volunteer support would be essential. Identifying when volunteer support is available would be very important, for example, sometimes volunteer support is difficult to obtain during the working week, while it is often better on the weekends;
  - Too Much Participation – Organising how and where volunteer resources are allocated – important not to allocate too many volunteers on the same stretch of river;
  - Insufficient level of commitment by local authorities - particularly around the removal of rubbish;
  - Major Obstacles - agreeing what to do with challenging obstacles in the river, for example, the removal of cars dumped in the river.

- **Key Finding 38** - Funding would need to be secured before any firm timescales could be identified. From experience project planning would take approximately three months and that the best months for running such

a river clean are January, February and March. The river survey needs to take place at least one month before the start of the actual river clean.

- **Key Finding 39** – KWT identified the main 'next steps' of delivering the river survey and clean as:

  - Gaining commitment from all parties to take the river survey and clean forward;
  - Identifying a funding source(s) to support such and exercise;
  - Identifying the timings for delivering the work;
  - Identifying and appointing a specified project manager;
  - Establishing target dates for delivering the work;
  - Agreeing an approach for overseeing (steering) the project, i.e. identifying a group to which the project manager would report.

- **Key Finding 40** – Dwr Cymru offered to provide details of all the combined sewer outflows (CSO's) on the river Ely and its tributaries for the mapping exercise that will take place during the river survey. Dwr Cymru also confirmed the importance of cutting back trees which can cause or support river blockages (although it was acknowledged by the group that some tree overhangs were important for supporting biodiversity). It was felt that this information could be well used if it was placed into an app / map that the public was able to access.

- **Key Finding 41** – It is vitally important to understand the costs involved with running a river survey and clean prior to submitting a bid for funding. It is also essential that a project plan for running the exercise is created.

- **Key Finding 42** – Natural Resources Wales is providing support to continue with the 'Clean the Clun' project which had stalled a few years ago due to a lack of funding. Elements of this exercise will tie in directly to the river Ely survey and clean which is being discussed by the 'Restore Our Rivers' task & finish exercise. Natural Resources Wales with support from SEWRT had identified a Welsh Government funding source (the Sustainable Management Fund) that they were looking to access, however, they were yet to write or submit a bid. This would probably start in the

coming months; however, accessing funding from this source could take a long time.

- **Key Finding 43** – A number of funding options for the river Ely survey and clean were mentioned during the meeting, they included:

    - Accessing funds from the Tesco carrier bag charge fund – Groundwork is responsible for managing bids for this funding. Tesco, for example, will pay out between £1,000 and £5,000 a month to support projects that meet their criteria.
    - Accessing a part of the £30m dividend which Dwr Cymru / Welsh Water has identified to reinvest back into Wales. They are currently running a consultation exercise which will identify how this funding will be allocated – there are six priority areas which have been consulted on, these are 'Money off customer water and sewerage bills'; 'Extra help for people who struggle to pay their bills'; 'Investing more in our pipes, pumps and water treatment works to continue providing high-quality services'; 'Investing now to help save money in the future through renewable energy and innovation'; 'Supporting educational, recreational and environmental projects in our communities' and 'Speeding up improvements for people who experience repeat problems with their services'.
    - Dwr Cymru's Water Framework Directive (WFD) funding scheme can be used to provide financial contributions to not-for-profit organisations for projects that will deliver improvements to Welsh rivers, lakes and waterways. The aim is to create a more vibrant and healthy environment for people and wildlife.

- **Key Finding 44** – Dwr Cymru explained that submitting a bid into the Dwr Cymru £30 million fund could be looked into; however, the consultation exercise would ultimately shape the areas where the monies were allocated and the projects which were funded. The river Ely survey and clean would need to be considered alongside a long list of other projects applying for the funding. It was suggested that writing an article for the Dwr Cymru magazine would be a good starting point as it would raise the profile

of the exercise within the organisation. A recent beach clean project had submitted such an article and Dwr Cymru sent them a £250 cheque to support the work.

- **Key Finding 45** – The Chair of the task & finish exercise volunteered to write to each of the local authorities within the South East River Basin to gain support and raise the profile of the river Ely survey and clean along with the wider work of the 'Restore Our Rivers' task & finish exercise. Examples of local authority support should include litter removal and helping with communications.

- **Key Finding 46** – Groundwork suggested that the group should contact local housing associations to promote the river Ely survey and clean. They were very positive about supporting community projects; good at involving tenants and were often able to provide resources to support such work.

- **Key Finding 47** – Dwr Cymru is willing to support river clean exercises by allocating staff to walk along sections of rivers to identify any sewer and drainage misconnections. Once any sewer and drainage misconnections are identified then they will support investigations into these and work with partners to resolve issues based on environmental need. This approach helps to improve the water quality in our rivers.

Recommendation 9

The partners involved with the task & finish exercise agreed with the need to undertake a survey and clean of the River Ely. This exercise should be project managed by Keep Wales Tidy with support being provided by the partner groups associated with the task & finish exercise. Keep Wales Tidy should explore a range of funding options to support this work and engage with volunteer groups to deliver a survey and series of prioritised tasks. The exercise should involve a survey, litter picks, river blockage removals, habitat management work, invasive species management and educational initiatives. The river survey should take place in January / February 2017 and the results

from this work should then be used to prioritise tasks for river clean events which should take place in spring 2017.

This recommendation is supported by key findings 31 to 47.

- **Key Finding 48** - OFWAT claims that the principle that sewerage systems should accommodate future flows is unsustainable in the long term context of climate change. This statement suggests that alternative approaches to managing surface water need to be identified.

- **Key Finding 49 -** Greener Grangetown is a partnership initiative between the City of Cardiff Council, Dwr Cymru and Natural Resources Wales to help make Grangetown a greener, cleaner place to live. It is an example of how surface water can be better managed through retrofitting and using a biological planting approach to process water and allow it to filter naturally into the nearby water course (the river Taff). The project covers an area of approximately 500 homes in the ward of Grangetown in Cardiff. CCC funded £50,000 for design and £750,000 for the development. Dwr Cymru funded £1 million for the development and £50,000 for the design. Natural Resources Wales provided £50,000 for the design phase.

- **Key Finding 50** - The aims of the Greener Grangetown project are to:
  - Achieve a more sustainable approach to water management;
  - Remove surface water from the sewer;
  - Demonstrate wider benefits;
  - Develop a toolkit for future projects;
  - Demonstrate the success of partnership working.

- **Key Findings 51 -** The project is designed to deliver multiple benefits, these include:
  - The removal of 42,000m2 of impermeable area (current phase);
  - Realising annual monetised benefits;
  - An increase in green space and additional tree planting;

- Improved air quality;
- Habitat creation and increase in biodiversity;
- Improved urban environment;
- The scheme is working in conjunction with the EU funded WISDOM project;
- The venture is a CEEQUAL assessed project.

- **Key Finding 52 -** Grangetown had used an old Victorian brick system which dealt with both surface and foul water. The system would be cleaned out twice a day at high tide when the sewer would empty its contents into Cardiff Bay. In 1999 the Cardiff Bay Barrage was built and so the old Victorian brick system had to be connected to a sewer – foul and surface water then had to be pumped out of Cardiff to a Dwr Cymru wastewater treatment works outside Dinas Powys. Flows are pumped to the treatment works and this poses a significant cost for Dwr Cymru as energy is single largest cost for the company.

- **Key Finding 53 -** The Greener Grangetown project aims to remove a significant amount the surface water falling on Grangetown and then by using biology (plants & trees) the water will be naturally cleaned and transferred directly into the river Taff. This will reduce the volume of water being pumped to Dinas Powys and, therefore, reduce the energy bill of Dwr Cymru. The plants and trees will in effect remove and break down the pollutants. The scheme will include seven very large Italian rain gardens / filter beds. The schemes will be highly visible and a feature. The whole scheme is designed to highway standards and will break down / remove any hydro carbons. The scheme meets Natural Resources Wales standards.

- **Key Finding 54 -** The scheme is the first of its kind in Europe, i.e. it is specifically designed for Grangetown and isn't an off the shelf option. It could work well in other parts of the city where there are problems with pollution and rain run off – for example, the Roath Park area has a series of gulleys which are not great at removing pollution – such a scheme would

work well there. Long term it could be possible to ‘retro fit’ large parts of Cardiff in the same way – this would lead to water quality improvements.

- **Key Finding 55** – The City of Cardiff Council is looking to put information around biological / sustainable drainage systems into two Supplementary Planning Guidance documents that it is currently developing – this will be presented to developers in the future with a view to such techniques being implemented around new developments.

- **Key Finding 56** - Using vegetation in a well designed manner is far more effective than concrete drainage filter systems – they clean themselves instead of having to be cleaned by the local authority. This is particularly relevant at a time when local authority budgets are shrinking. Developers are being encouraged to look into this approach. Some are very receptive to implementing such sustainable drainage systems as they are aware of the long term benefits that they can bring to their developments (and of course push house prices up); others are reluctant to embrace this sustainable drainage approach as they are concerned that it will take up valuable space. Some developers have described the approach as ‘hippy technology’.

- **Key Finding 57** - Highways routes put more water into the sewer than any other source – it is important to work with Dwr Cymru to reduce the volume of water getting into our sewers. Using the natural / biological approach to managing diffuse water pollution is much cheaper than the concrete approach. Also once installed it doesn’t need ongoing maintenance as it works naturally – very useful approach at a time of shrinking budgets.

- **Key Finding 58** - The methods being used in the Greener Grangetown project are a tried and tested scientific / engineered approach which has been in existence for hundreds of years. The science and technology are supported by the Welsh Local Government Association and the Wales SuDS (Sustainable Drainage Systems) board.

- **Key Finding 59** - A Master SuDS scheme using this technology to support green and blue corridors could work well. Using areas like Pontcanna fields

as a natural flood defence is an excellent approach – this is already being used as a part of a natural flood management scheme.

- **Key Finding 60 -** It is very important to push / sell the sustainable drainage approach at the pre development phase. Developers need to think about quality of the developments and not just the density / profit from a development.

- **Key Finding 61** - Ideally it is best to have open drains (for surface water) near developments so that problems can be easily spotted. Also it is cheaper to manage and fix as there isn't a cost to open it up. Water around developments should be viewed as an opportunity and not a threat. It has been proved that good water features add value to developments.

- **Key Finding 62** - The water held on the surface during a flood is only the tip of the iceberg, the saturated land / soil beneath will hold vast quantities of water. Managing the unseen water is the key.

- **Key Finding 63** - In the greater part most residents have bought into the Greener Grangetown scheme. There have been some parking issues. There was a 25% consultation response rate and real people had made a real input into the design of the scheme.

- **Key Finding 64** – It was explained that the rainscape scheme in Llanelli (a similar type of scheme to Green Grangetown) had received some complaints after implementation; however, overall feedback had been positive.

- **Key Finding 65 -** Greener Grangetown removes surface water in Cardiff – Dwr Cymru has a wider aim to remove surface water for a town the size of Merthyr Tydfil from the sewer system. Dwr Cymru considered the scheme as a flood management scheme that would help reduce energy costs.

- **Key Finding 66** - Council is producing two new Supplementary Planning Guidance documents which could be used to support this type of green

infrastructure. They are the Planning Obligations Supplementary Planning Guidance (currently being consulted upon) and the Green Infrastructure Supplementary Planning Guidance (due to be written in 2017). Such documents could be used to formalise / mandate the use of sustainable drainage systems and approaches similar to those used by Greener Grangetown.

Recommendation 10

All the partners in the task & finish group agreed that promoting best practice in the uses of SUDS (sustainable urban drainage systems) as highlighted in the Welsh Government non-statutory guidance (December 2015), was the best way forward. Projects like Greener Grangetown provided clear evidence of the multi-benefits of using natural vegetation and the environment to better manage surface water. Consistent design standards and achievable maintenance schedules would give greater confidence for local authorities to promote more vegetation based SUDS systems within SPG documents. The group would recommend that all five authorities adopt a consistent approach to SUDS design and management.

This recommendation is supported by key findings 48 to 66.

- **Key Finding 67 -** Natural Resources Wales has the responsibility to investigate any pollution incidents – the main reporting source for theses is the public, although in recent years the number of publically reported incidents has reduced; it was suggested that the reason for this was that more people are now reporting pollution incidents directly to Dwr Cymru has recently started to raise the profile of self-reporting. Natural Resources Wales is also responsible for the routine monitoring of river water quality in Wales. The benefit of reporting incidents directly to Dwr Cymru is that they can respond to the incident faster, Natural Resources Wales are notified of all incidents reported to Dwr Cymru.

- **Key Finding 68** - It was suggested that frequent river users (particularly anglers) were not always aware of who to contact to report a pollution incident. It was suggested that a one point of contact approach would help improve reporting. This could include a single freephone number that could record and redirect calls appropriately.

- **Key Finding 69** - It was explained that the routine monitoring undertaken by Natural Resources Wales is used for river quality classification. Natural Resources Wales is also responsible for ensuring ongoing compliance after an incident is identified, i.e. they monitor assets post discharge. A programme management approach for driving river quality improvements is separate to this and would need additional funding.

- **Key Finding 70** - New technology has improved the accuracy and detail of reporting pollution issues, for example, smart phones can now be used to take photos of pollution incidents.

- **Key Finding 71** - It was felt that creating a wide list of river stakeholders (for example, canoeists, anglers and volunteers) would be very useful and that this list could be used to drive a communications strategy and build awareness of river pollution issues. Dwr Cymru Pollution Technicians could be available to support such a list and build further links across Wales.

- **Key Finding 72** - Enforcement has been tried to address pollution problems. This has mainly consisted in issuing advice, guidance and warning letters. When such incidents are reported it is very important to properly categorise the type of pollution. In terms of enforcement notices Natural Resources Wales tends to use ‘anti pollution works notices’ – these can only be issued where there is a real risk of serious pollution. Compliance notices can be issued when problems are identified – when these are issued the party has to comply with the process.

- **Key Finding 73** – A company based in Treforest was identified as a constant source of pollution for the Taff. Action was taken and they immediately offered an enforcement of undertaking – i.e. they offered money and to address the issue. Natural Resources Wales saw this as a good result. The money resulting from this 'enforcement of undertaking' was used to fund other environmental improvement projects.

Recommendation 11

The partners involved with the task & finish exercise agreed with the view that it was important to target frequent river users as a valuable source for reporting river pollution incidents. Anglers, canoeists, walkers and volunteer groups were all suggested as a good source for reporting river pollution incidents. The task & finish partners, therefore, recommend that Dwr Cymru and Natural Resources Wales work with the other partners to build up a key stakeholder contact list with a view to using it to distributing regular updates and other information relating to the self-reporting of river pollution incidents. The group also felt that Dwr Cymru should review the potential role of using new technology (for example, smart phones and apps) to make self-reporting quick and easy.

This recommendation is supported by key findings 67 to 73.

- **Key Finding 74 -** The Taff is fairly clear of farm pollution as it has very little in the way of farming taking place on its banks. The Ely does experience some farm pollution; however, this isn't the only source of pollution on the river.
- **Key Finding 75** - The main sources of pollution from farming are silting, slurry run off, leaching / run off of silage liquid and other forms of diffuse pollution produced as a result of chemicals used on farmland.

- **Key Finding 76** - In the last year (2015/16) there have been 24 reports of farm pollution on the Clun.

- **Key Finding 77** – It is very important that farmers use silage clamps when producing silage – when they aren't used then it is very easy for the liquid produced as a part of the process to seep out and work its way into the river course. When this type of pollution is identified it is important to undertake farm visits to identify the pollution source and then address the problem. Further to this follow up visits should take place to the same farms to ensure that they don't fall back into the same bad habits.

- **Key Finding 78** - A river survey and clean could be used as a vehicle for identifying and logging farm pollution. This information could then be used to target farmers who are suspected of creating the pollution. Such a survey and clean needs to cover an entire river catchment.

- **Key Finding 79** - Selling the economic benefits of better pollution management to farmers is very important.

- **Key Finding 80** - The report produced by the group should reference farming pollution incidents and then refer to best practice case studies to illustrate the benefits of farming compliance.

- **Key Finding 81** – Natural Resources Wales is told which farms that they have to visit – they are only able to visit 5% of Welsh farms every year. Improved coverage could reduce pollution, for example, reduce silt run off and ensure that buffer strips are put in place for silage production.

- **Key Finding 82** - Estimated that it would cost £14,000 to provide buffer strips for 500m of river bank. It was suggested that if volunteers received training on how to build buffer strips then a considerable saving could be achieved. Potentially grant funding could be made available for such training.

Recommendation 12

The River Ely Survey and Clean should be used as a tool to identify and record if there are any farm pollution problems on the river system. If any farm pollution issues are identified, then the task & finish partner organisations should review what can be done to address the problem(s). Any significant farming pollution problems should be reported to Natural Resources Wales who are the best placed organisation for dealing with such problems.

This recommendation is supported by key findings 74 to 82.

KEY FINDINGS & RECOMMENDATIONS

EDUCATIONAL OPPORTUNITIES

A meeting was held on the 17th October 2016 to consider topics relating to the work package theme of Educational Opportunities. Evidence was provided by witnesses from Dwr Cymru, Natural Resources Wales, Keep Wales Tidy and Cardiff Council. During the meeting the following topics were addressed:

- Educational Messages;
- Message Communication.

During these items the group identified a number of key findings and recommendations which can be seen below.

- **Key Finding 83** - During the meeting the group identified 14 campaigns and educational promotions which they felt could provide additional benefits / support to rivers and watercourses in the South East Wales river basin (and indeed right across Wales). These were:

    - The Yellow Fish Campaign;
    - The Hydro Power & Schools Campaign;
    - The Salmon Homecoming Project;
    - The Eel Programme;
    - The Natural Resources Wales 'Healthy Rivers Campaign';
    - The Capital Investment Campaign;
    - The 'Stop the Block' Campaign;
    - The 'Clean Water Campaign';
    - The Keep Wales Tidy 'Great Taff Tidy within Cardiff';
    - The Ely top to toe survey and river clean;
    - The Natural Resources Wales 'Slurry Pollution Campaign';
    - The 'See it – Report it – Stop it' campaign;
    - The 'Natural Resources Wales' programme.

It was felt that working as a group and sharing resources would be a far more effective method of communicating the key messages of these important projects.

- **Key Finding 84** - The group acknowledge the benefits of promoting the Yellow Fish Campaign and recognised how it could be used to prevent pollution entering the rivers and watercourses of the South East Wales River Basin. The campaign was straightforward and simple to follow and it was particularly felt that targeting young people and developers of new housing developments would deliver significant benefits.

- **Key Finding 85** - The group believes that improving the quality or rivers and watercourses is actually about delivering against a much wider range of benefits which include sustainable management; health & wellbeing; economic development and biodiversity.

- **Key Finding 86** - Promoting important messages about water quality has in recent years helped to deliver excellent results in Wales, for example, the Swansea Loose Connections project improved the standard of water quality in Swansea Bay from ’poor’ to ‘good’ – an increase of two categories.

- **Key Finding 87** - While businesses could be targeted through one co-ordinated approach it would seem sensible to identify methods of specifically targeting businesses with messages about the importance of maintaining clean and healthy rivers and waterways; this is particularly important for businesses that have the potential to pollute.

Recommendation 13

During the task & finish exercise 14 awareness raising campaigns and educational promotions were identified which the group felt could provide additional benefits / support to rivers and watercourses in the South East Wales River Basin. These were:

- The Yellow Fish Campaign;
- The Hydro Power & Schools Campaign;
- The Salmon Homecoming Project;
- The Eel Programme;
- The Natural Resources Wales 'Healthy Rivers Campaign';
- The Capital Investment Campaign;
- The 'Let's Stop the Block' Campaign;
- The 'Clean Water Campaign';
- The Keep Wales Tidy 'Great Taff Tidy within Cardiff';
- The Ely top to toe survey and river clean;
- The Natural Resources Wales 'Slurry Pollution Campaign';
- The 'See it – Report it – Stop it' campaign;
- The 'Natural Resources Wales' programme.

All of the task & finish partner organisations and the five local authorities from within the South East Wales River Basin should work together to amplify the key messages of these and other new campaigns across the whole area using a combined and well-structured communications approach, for example, if Dwr Cymru is looking to spread the message of the 'Let's Stop the Block' campaign then they should not do it in isolation. Instead they should pass the message onto all of the other partner groups for communication across a wide range of distribution channels, for example, social media, internal briefings & messages, websites, press releases, etc..

This recommendation is supported by key findings 83 to 87.

- **Key Finding 88 -** Members of the group felt that elements of the Yellow Fish Campaign and parts of the Eco Schools message should be added to the Welsh Baccalaureate curriculum. This they believe would raise the important issue of maintaining healthy rivers and watercourses, particularly to the younger generation.

- **Key Finding 89** - The group felt that educational campaigns were most effective when they included good interaction elements to help stimulate interest in the message being put forward. This is particularly true when promoting the message to younger people.

Recommendation 14

The task group felt that elements of the Yellow Fish Campaign and messages from the Echo Schools educational programme should be added to the Welsh Baccalaureate curriculum. This they believe would help raise the profile of the importance of maintaining healthy rivers within the younger generation. The task group, therefore, recommends that the partner organisations involved with the task & finish exercise contact the WJEC with a suggested educational proposal based upon healthy rivers and discuss the possibility of having this included as an element within the Welsh Baccalaureate curriculum.

This recommendation is supported by key findings 88 & 89.

- **Key Finding 90** – It was stressed that there appeared to be lots of campaigns worthy of promotion and that they somehow need to be focused on one central website, i.e. a single point of contact to store or signpost to the relevant information sources.

- **Key Finding 91** - All partner groups involved with the exercise agreed that a well co-ordinated partnership approach was the best way to effectively communicate the key messages of the various campaigns and educational promotions. In addition to this they felt that it was important to have:

    - A single point of contact to store or signpost visitors to the relevant information or messages provided by each of the partner organisations, for example, a single website or blog page;

- That one partner should probably have responsibility for hosting the site, however, all partners should have the ability to upload or post any new information onto the site;
- That an information sharing protocol should be established between the partners - any new organisations joining the partnership should also be bound to this information sharing protocol;
- That all legalities of establishing such a partnership website should be explored and understood at the outset;
- That there are opportunities to learn from similar exercises that have been delivered in Wales, for example, Cardiff Council's 'Love Where You Live';
- For practical purposes such a system would need to be cost effective, simple and quick to use.

- **Key Finding 92** - 'Love Where You Live' is a city-wide campaign to clean up the streets and neighbourhoods of Cardiff. The campaign has five key elements, these are:

  - Harnessing people power;
  - Neighbourhood cleaning;
  - Zero tolerance approach to littering;
  - Raising recycling awareness;
  - Student education.

  The group was informed that the organisational structure and promotional approach adopted by 'Love Where You Live' was something that could be applied to coordinating water quality messages in future.

- **Key Finding 93** - Suggested that a simple strategy (supported by a terms of reference) would need to be established for information sharing and storing. This could involve a single site that all supporting partners could independently access to upload information onto for all partners to view. For practical purposes such a system would need to be cost effective, simple and quick to use. A blog type site was suggested.

- **Key Finding 94** - The idea of having one site to communicate and store all South East Wales River Basin related messages was discussed and generally well received – although there was a question around how such a site could be funded. It was felt that for ease of use a combined moderators approach could be applied to any site which was developed – this would allow representatives from each of the groups to update any messages that they might have onto the site and, therefore, allow the messages to be circulated around the rest of the group. Upon viewing any new messages each of the group representatives could circulate details to their email contacts, share on social media and distribute via their internal communications system. A site supported by a range of partner stakeholders would need to have a proper protocol in place and the legalities would need to be explored.

Recommendation 15

During the task & finish exercise it became clear that a number of different groups and organisations were promoting a diverse range of campaigns and educational initiatives aimed at improving the health of our rivers and watercourses. While all of this work was viewed as positive there was no single point to gather, distribute and effectively amplify the messages across the whole South East Wales River Basin. As a result, the task & finish exercise recommends that a central website is created to act as a single point of contact for people and groups interested in improving the health of our rivers and watercourses. To ensure that the site website works effectively key features of the site should include:

- The site should act as a single point of contact to store or signpost visitors to the relevant information or messages provided by each of the partner organisations;
- When a partner organisation posts a new message or piece of information it should trigger an automatic notification to the partner organisations informing them of the new posting. This would then allow the partner

organisations to circulate the message via their communications function;

- That one partner should probably have responsibility for hosting the site, however, all partners should have the ability to upload or post any new information onto the site;
- That an information sharing protocol should be established between the partners - any new organisations joining the partnership should also be bound to this information sharing protocol;
- That all legalities of establishing such a partnership website should be explored and understood at the outset;
- For practical purposes such a system would need to be cost effective, simple and easy to use.

This recommendation is supported by key findings 90 to 94.

- **Key Finding 95** - The group agreed that establishing a contact list of angling groups was a good idea and that it could be a highly effective way of delivering important messages to this key group of stakeholders. South East Wales Rivers Trust and Glamorgan Anglers have offered to obtain and provide these contact details to support the communications campaign.

- **Key Finding 96** - Several cost effective communications tools were identified which the group felt could be used to promote key messages and other promotional material relating to the water quality in rivers and other watercourses, these were:

    - **Social Media** – in particular linking the coverage of all of the partner organisations would significantly amplify the message being circulated across the South East Wales River Basin area. For example, if Natural Resources Wales issued a message on its own they would currently reach 10,600 Twitter followers and 3,542 Facebook users. Alternatively if they worked with Cardiff Council and Dwr Cymu they would automatically reach 88,754 Twitter followers and 18,520 Facebook users.

- **Internal Publications** – newsletters, intranet pages, internal emails and other internal documents could be used to promote any relevant messages. For example, if Natural Resources Wales circulate a message only to their own staff then they could potentially reach 1,900 people. If on the other hand they worked with Cardiff Council and Dwr Cymru then they could potentially reach 16,741 people.
- **Media Stories** – where appropriate media and communications officers could notify the local press of any potential stories or messages which might create a positive news story.
- **Stakeholder Communication** – the partner organisations could distribute appropriate messages via their established stakeholder communication networks.

- **Key Finding 97** - The group was told that the promotion of the 'Healthy Hillsides' campaign had been very successful. It was felt that the 'Restore Our Rivers' work would benefit from adopting a promotional approach similar to that used for the 'Healthy Hillsides' campaign.

Recommendation 16

Due to ongoing budget pressures the task group recommends that the communications functions of each of the partner organisations should use cost effective communications tools to promote information and messages around improving the health of our rivers and watercourses. In particular each of the groups could use social media, internal publications / communications, organisation websites, media briefings and other stakeholder communication tools.

This recommendation is supported by key findings 95 to 97.

KEY FINDINGS & RECOMMENDATIONS

IMPROVEMENT OPPORTUNITIES

A meeting was held on the 15th November 2016 to consider topics relating to the work package theme of Improvement Opportunities. Evidence was provided by witnesses from Keep Wales Tidy, the City of Cardiff Council, Cardiff Rivers Group and Groundwork Wales. In addition to this, an officer from Cardiff's Scrutiny Research Team delivered a summary of findings from the report titled 'Restore Our Rivers: Best Practice in Managing Ecological Issues' (attached to this report as **Appendix 2**) at the meeting on the 7th December 2016. As a result of these meetings the group identified a number of key findings and recommendations which can be seen below.

- **Key Finding 98** – Keep Wales Tidy delivers a wide range of projects across Wales; this has included a large number of river improvement projects. This work is primarily delivered by project officers in association with the Tidy Towns Initiative. The organisation regularly delivers work in partnership with other organisations, for example, the project officer in Caerphilly has recently a rivers project in association with Groundwork Wales, National Rivers Wales and Caerphilly County Borough Council. Local authorities are able to provide valuable support to such projects by organising the collection and disposal of rubbish / recycling from the sites.

- **Key Finding 99** - KWT has recently delivered six significant volunteer projects in the Caerphilly County Borough Council area. The projects relied heavily on volunteer support and removed large volumes of rubbish from each of the sites, for example, projects in Bedwas and Cwm Calon used 49 volunteers and removed 3.5 tonnes of rubbish in five and a half hours of work.

- **Key Finding 100** - The project sites for the Caerphilly based Keep Wales Tidy projects were identified by members of the public, community

groups, local authority contacts and from walkovers undertaken by Natural Resources Wales and Groundwork Wales. Such organisations have a good understanding and knowledge of local rivers. These organisations along with groups like Cardiff Rivers Group and Glamorgan Anglers also have a good knowledge of the rivers within the Cardiff area.

- **Key Finding 101 -** KWT has been very successful in pulling in volunteers to support a wide range of projects. They have achieved this by building relationships with community groups; by distributing targeted information to community groups; through awareness raising exercises and by using social media (for example, Facebook adverts). KWT view local communities as an essential element of delivering their project work and understand the benefits of achieving local ownership of local areas (for example, local people adopting sections of local rivers). They have also developed productive links with organisations like the Probation Service, Mc Donald's and United Welsh Housing.

- **Key Finding 102 -** All parties involved with the meeting agreed that there is a significant amount of work to deliver across the whole South East Wales River Basin to improve the quality of river systems. Much of the work done in upstream areas would impact on the sections of the rivers flowing through Cardiff.

- **Key Finding 103** – Dwr Cymru agreed to circulate a contact list of key Dwr Cymru staff working in the South East Wales River Basin; this it was hoped would improve communication and access to key sites.

- **Key Finding 104** - Cardiff's Green Infrastructure Group was formed in 2014 and is made up of Council Officers from different service areas including Parks, Highways (PRoW), Planning (TPO and Ecology) and Drainage. It aims to:

    - Better integrate different areas of the council across green infrastructure;

- Co-ordinate responses to planning across Green Infrastructure;
- Produce GI Action Plan and SPG (the Action plan is used to inform funding bids);
- Meet the objectives and legislation of Cardiff Council, Natural Resources Wales and Welsh Government.

- **Key Finding 105** - Until recently Cardiff Council produced and regularly updated a series of 'River Valley Action Plans'. The work around the delivery of these included:

  - Three separate action plans for each of the three rivers (Ely, Rhymney & Taff) - covering areas such as Biodiversity, Access, Recreation, invasive species;
  - Annual workshops with quarterly meetings for each river valley;
  - Partnership projects with other organisations, community groups, and land owners;
  - Three trails- creation of Ely, Rhymney trails and improvements to the Taff Trail.

  The co-ordination of the groups disbanded following the reduction in Cardiff Council's Countryside Team.

- **Key Finding 106** - In the near future Cardiff Council has plans carry out a number of environmental initiatives, these include:

  - The mapping, monitoring and maintenance of Japanese knotweed and Himalayan Balsam;
  - Roach breeding at Forest Farm;
  - Mink mapping;
  - Development of the volunteer hub at Forest Farm; The Cardiff Pollinator Project; and,
  - The Bumble Bee Training Day in 2017.

To deliver these and other projects Cardiff Council will continue to develop partnerships and work with more than 23 local organisations.

- **Key Finding 107** - The Cardiff Rivers Group is a volunteer group which was established in 2009. It currently has 350 volunteers who support the work of the group. They organise large scale clean-ups; work with Cardiff Parks; undertake habitat management; deliver stream clearing/cutting back; remove blockages; address neglected areas; provide informal coaching – this helps get people into work and helps to promote mental well-being.

- **Key Finding 108** - The Cardiff Rivers Group has achieved a number of successes since 2009, these include:

  - They were the 2015 winners of Keep Wales Tidy Award;
  - They have successfully launched the "Masked Avenger" scheme which allows the public to nominate a river or stream problem which needs removal;
  - They have delivered work stream successes in Llanishen and on the Bute Park Feeder;
  - St Mellons, Hamadryad Park – this scheme has included a total of 136 events and 5,600 volunteer hours.

- **Key Finding 109** - The Cardiff Rivers Group works in partnership with several groups, for example, Cardiff Council Parks and the Association of British Ports. The group is self-funding and relies on Council grants, Welsh Government grants, scrap sales and regular donations from volunteers. The funding provides opportunities to increase the presence of the group and allows them to run additional events, for example, mid week clearances, opportunities outside of Cardiff and increased walking/surveying opportunities (particularly streams). In future the group plans to do more including increased levels of testing/surveying/walking.

- **Key Finding 110** - The Cardiff Rivers Group has identified sewer misconnections as a significant issue in the Cardiff area (particularly around dual drainage systems). They have asked if Dwr Cymru could produce a map of the Cardiff's drainage and sewer system for the group so that they are able to use it as a point of reference.

- **Key Finding 111** - The Cardiff Rivers Group is always looking for additional pieces of work to tackle. They believe that the production of a series of 'Action Plans' based around the river system would help them identify opportunities for new work and plan new projects.

- **Key Finding 112** - The Cardiff Rivers Group wants to extend the amount of partnership work that it undertakes. This could include greater involvement in Community Groups; support with awareness raising opportunities; financial support/ support in kind and linking up with partners for lectures, meetings, etc..

- **Key Finding 113** - Groundwork Wales is an environmental regeneration charity established in 1990. The Healthy River Project was set up initially in relation to the River Sirhowy in 2012, however, it now covers all of the South Wales area – this rivers Ebbw, Llwyd, Rhymney and Rhondda.

- **Key Finding 114** - Groundwork Wales has delivered a number of significant projects in recent years these include:

    - Tredegar Culvert – building a fish pass on the River Sirhowy;
    - Graig Fawr Blockage on the River Ebbw;
    - Mill Road Weir on the River Llwyd;
    - Nant Twyn Harris – reducing flood risk; improved spawning opportunities, resting and sources of food - at Ystrad Mynach;
    - The Marine Colliery Weir – this was a Dwr Cymru funded project;
    - The Diamond Close River Care project at Caerphilly – this was a joint Keep Wales Tidy / Natural Resources Wales / Groundwork Wales and

United Welsh initiative to promote message and encourage local participation;

- Work on Nant Cylla;
- Schools Initiatives, including Nant Bargoed;
- Delivering the 'River Restoration Qualification';
- Groundwork Wales provides a mentoring element as a part of its work, this was highlighted when they played a film to the task group titled 'Jordan'.

Recommendation 17

Local authorities and the partner organisations associated with the task & finish exercise have in recent years worked well with volunteer groups to deliver a large number of projects aimed at improving local rivers and enhancing the wider natural environment. The task group endorses this work and recommends that even more is done to increase the good work that they deliver. Examples of additional support include:

- The development of a list of river improvement and environmental habitat improvement projects which as volunteer and supporting resources become available could be allocated to a suitable group, i.e. creating a situation where volunteer groups can be signposted to appropriate projects. Potential projects could be identified from the results of the River Ely survey which is scheduled for January / February 2017. The identified projects could be collated into a river improvement based action plan.
- Publicising the good work of the volunteer groups through the communications functions of the partner organisations of the task & finish exercise. This would help raise the profile of the excellent work that they deliver and potentially encourage other people to follow their example and become volunteers.
- Helping the volunteer groups form links with businesses and other organisations able to provide additional support for the work that they undertake. This it is felt would help improve partnership working in this

area.

- Helping to signpost the volunteer groups towards potential funding sources to help fund the important work that they undertake.
- Creating a group or body to provide the facilitation role for river based improvement work in the South East Wales River Basin. They could develop project ideas and oversee the resources available before arranging for the work to be delegated to the volunteer and other groups.

This recommendation is supported by key findings 98 to 114.

- **Key Finding 115** - The National Misconnections Strategy Group is a partnership of organisations including The Environment Agency, DEFRA and regional water bodies (including Dŵr Cymru). The group collectively operates through a public facing scheme known as 'Natural Resources Wales'. 'Natural Resources Wales' aims to help educate property owners and builders about the negative effects of misconnections and how to avoid them.

- **Key Finding 116** - The National Misconnections Strategy Group defines two main types of misconnections that cause pollution, these are:

  - Where wastewater and sewage is wrongly connected to clean surface water drains;
  - Where clean rainwater is connected to foul drains.

- **Key Finding 117** - Best practice identified partnership working as the best approach for tackling misconnections as collective resources and expertise can be allocated towards dealing with misconnection issues in specific areas.

- **Key Finding 118** – Agencies like the Environment Agency, Natural Resources Wales and the Scottish Environmental Protection Agency have undertaken surveys to identify misconnections leading into rivers and watercourses. Once these surveys have been completed specialist survey

contractors have been used to trace upstream from outfalls to identify sources of pollution – this then results in further surveying of individual properties with owner/occupier permission. Where misconnections are identified a formal written request will be made to ensure that the issue is resolved. Only the local authority's Environmental Health Officers or the Environment Agency have the power to enforce action.

- **Key Finding 119** – The main problems associated with misconnections surveys are:

  - That they are manually intensive and expensive; many properties require repeat visits because of uncooperative residents meaning a significant number cannot be surveyed.
  - It is often difficult to gain cooperation from residents, i.e. the realisation of residents that they might need to pay to rectify the problem.
  - A lack of staff to carry out the work; many local authorities have had to cut back on the number of EHOs.
  - New misconnections reappear; if residents and/or contractors remain unaware of consequences or of the cost of rectifying then the problem can resurface.

- **Key Finding 120** - A misconnections amnesty was considered a good way to improve resident cooperation and, therefore, tackle misconnection issues. Information could be distributed to a specific area telling them how to identify misconnections and offering free modifications if they are reported. It was suggested that the cost of repairs as a result of the misconnections amnesty could be offset by the costs of a misconnections survey.

- **Key Finding 121** – A number of best practice examples for tacking misconnections were identified in the Scrutiny Research report titled 'Restore Our Rivers: Best Practice in Managing Ecological Issues', these were:

  - The Midlands Urban Rivers Community Initiative;

- The Telford Clean Stream Team;
- The North East Living Waterways Partnership;
- Hastings Clean Seas Please;
- Thames Fixing Broken Rivers;
- Swansea Misconnections Project;
- Wessex Stream Clean team;
- Yorkshire Bathing Water Partnership.

- **Key Finding 122** - Littering can have an extremely negative effect on the ecology of a river. When dumped, litter and rubbish can endanger wildlife, block rivers and cause flooding, and make parts of the river inaccessible.

- **Key Finding 123** - Pollution has harmful effects for rivers and watercourses. The Department for Environment Food and Rural Affairs (DEFRA) published a consultation in 2012 that identified four main sources of pollution, these were:

  - Point Source Pollution – Permitted discharges from factories and wastewater treatment;
  - Pollution Incidents – One-off incidents such as a tanker accident that have acute short term impacts;
  - Unknown Sources – Where the cause cannot be identified;
  - Diffuse Pollution – Unplanned and unlicensed pollution from farming, mine water, homes and roads. The may be agricultural or non-agricultural.

- **Key Finding 124** - When tackling urban water pollution the Department for Environment Food and Rural Affairs advocates taking the following approach:

  - Adopting a whole of catchment-based approach;
  - Starting upstream and working down the river system;
  - Empowering Communities, i.e. working with community groups and coordinating other volunteer resources to undertake river cleans;
  - Following the principles of the ‘Love Your River’ campaign;

- Working alongside local flood risk management;
- Engaging with local authorities to help improve urban rivers;
- Greater clarity on local data and then identifying priorities;
- Spatial Planning, i.e. working with the national planning policy framework.

- **Key Finding 125** – The 'Keep Britain Tidy Rivercare' scheme was identified as an example of best practice examples for dealing with litter and river pollution. This contained a large number of projects across the United Kingdome including 'Rivercare Lincoln' and 'Rivercare Peterborough'.

- **Key Finding 126** – Planting trees on river banks was considered as a good way to help with the biodiversity and ecology of rivers. Benefits of this approach included:

  - Shading and cooling the air and the stream water;
  - Intercepting pollution pathways by absorbing pollutants such as phosphates as nutrients;
  - Slowing storm water runoff and reducing the threat of flooding;
  - Breaking the force of wind to help keep topsoil in place;
  - Roots binding the soil contributing to bank stabilization;
  - Creating oxygen and intercepting airborne particles, reducing heat and absorbing pollutants like carbon monoxide, sulphur dioxide and nitrogen dioxide;
  - Native trees will provide habitat for animals.

- **Key Finding 127** – An alien or invasive species was defined in the Scrutiny Research report titled 'Restore Our Rivers: Best Practice in Managing Ecological Issues as 'a species, subspecies, or lower taxon introduced outside its normal past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce'.

- **Key Finding 128** - The main invasive species found in Cardiff are Japanese Knotweed, Himalayan Balsam, Killer Shrimp and Zebra Mussel.

- **Key Finding 129** - Best practice in terms of managing Himalayan Balsam included:

  - Implementing control measures to prevent flowering – this is best achieved before June;
  - Chemical control techniques can be used near water and are most effective when the plant is small in the spring;
  - Cutting, strimming or pulling should take place at impacted sites on a regular basis – the site should be revisited for at least three years;
  - Pulling can be effective for plants with shallow roots which can be disposed by burning or composting if seeds aren't present;
  - Allowing cattle and sheep to graze at the sites from April until the end of the growing season.

- **Key Finding 130** - The Clun Himalayan Balsam Project was a strategy aimed at removing Himalayan Balsam and took the following approach:

  - It nominated a coordinating body and then gave it the responsibility to take the strategy forward;
  - It was designed to raise awareness and understanding of the Himalayan Balsam in the catchment;
  - It aimed to improve collection, management and sharing of information;
  - It raised awareness to ensure that landowners cross-compliance responsibilities were understood;
  - It developed a shared responsibility among stakeholders and commitment by land managers;
  - It provided support for those landowners working to manage Himalayan Balsam;
  - It introduced a three-stage approach: prevention, early detection and then control as the final option;

- It created a systematic approach to control by phased targeting sites affected by Himalayan Balsam;
- It advocated on-going monitoring.

- **Key Finding 131** - Best practice in terms of managing Japanese Knotweed included:

  - The flowers bloom in late summer and the root system can extend for seven metres;
  - The plant should be subjected to a single clean cut near the base of the stem;
  - A waste license is required to remove Japanese knotweed from its site;
  - It is important to avoid flailing or other cutting methods that produce fragments because stems can regenerate from nodal fragments;
  - The use of an approved chemical is the most effective treatment near water;
  - Chemical treatment is most effective in August and September and especially when applied to mature uncut growth;
  - Chemicals can be injected into the stem to avoid damaging surrounding areas.

- **Key Finding 132** - Pembrokeshire County Council's Japanese Knotweed experience and guidelines emphasises the importance of:

  - Raising the awareness of the problem;
  - Ensuring that Japanese Knotweed growing on the highway does not affect sight-lines and signage;
  - To treat all patches within Pembrokeshire County Council's limits within available resources;
  - The Council works with landowners and provides advice on appropriate treatments;
  - The Council aims to ensure that other organisations that are working within Pembrokeshire County Council controlled land will adopt good working practices to control and prevent the spread of Japanese Knotweed;

- Herbicides will be the most frequent and effective method of control, but other methods will be researched and implemented and to minimise the use of chemicals.

- **Key Finding 133** - The best practice approach for dealing with Killer Shrimp was described as:

  - Ensuring the containment of known populations;
  - Promoting bio-security measures (such as jet washing);
  - Surveillance and monitoring;
  - Managing the risks at high value nature conservation sites;
  - Commissioning and supporting key research to improve understanding of the shrimp and how best to manage its impact.

- **Key Finding 134** - The best practice approach for dealing with Zebra Mussel was described as:

  - Raising awareness of the issue among the public and target groups in order to encourage them to take action on the spread of the zebra mussel;
  - To amend and co-ordinate appropriate policy and legislation;
  - To identify sectors involved controlling zebra mussels and define their roles to ensure their activities are not responsible for the further spread;
  - To continue research on the spread, impacts and the level of awareness of the zebra mussel and ensure research is made widely available;
  - To develop contingency protocols for immediate response if new lake invasions are reported;
  - To develop a mechanism to co-ordinate action, policy and information sharing on an all island basis.

Recommendation 18

The Cardiff Scrutiny Research Team produced a report titled ‘Restore Our

Rivers: Best Practice in Managing Ecological Issues'. This focused on best practice in the management of misconnections; littering & pollution; and enhancing biodiversity & managing alien species. Having reviewed the findings of the report the task group recommends that the following best practice is followed in the South East Wales River Basin and built into the work of the Restore Our Rivers task & finish exercise:

- **Misconnections** - That the guidance and resources from the National Misconnections Strategy Group and their public face 'Natural Resources Wales' are followed to help educate property owners and builders about the negative effects of misconnections and how to avoid them.
- **Misconnections** – That the partner organisations associated with the task group work together to raise funds to undertake a survey of the river from its source to identify misconnections and seek rectifications; and consider a 'misconnections amnesty' to achieve widespread corrections.
- **Litter & Pollution** – To make use of community groups and coordinate different volunteer resources to undertake river cleans, starting upstream for most efficient practice.
- **Enhancing Biodiversity & Managing Alien Species** - Investigate the merits and feasibility of planting trees as a cost effective means of stabilising river banks and increasing biodiversity.
- **Enhancing Biodiversity & Managing Alien Species** - Note the guidance given by DEFRA and the Non Native Species Secretariat on preventing the spread of invasive species and use these to educate and inform property owners; and to produce risk assessments and develop codes of conduct to reduce risks.
- **Enhancing Biodiversity & Managing Alien Species** - Engage with landowners or make use of volunteer groups or to carefully treat Himalayan Balsam and Japanese Knotweed by the methods outlined in the Scrutiny Research Best Practice Report.

This recommendation is supported by key findings 115 to 134.

KEY FINDINGS & RECOMMENDATIONS

REGIONAL OPPORTUNITIES

A meeting was held on the 7th December 2016 to consider topics relating to the work package theme of Regional Opportunities. Evidence was gathered through a group discussion on the benefits of regional working for the management of rivers. The discussion covered a number of areas including the benefits of partnership working; how such an approach could be structured; the key partners that would need to be involved; how such a group could be supported; the scope of such a group; the aims and objectives of such a group and the frequency of meetings for such a group. As a result of this discussion the group identified a number of key findings and recommendations which can be seen below.

- **Key Finding 135 -** The Welsh Government is looking to introduce a Regional Development Plan. This could mean the introduction of common Supplementary Planning Guidance documents to support development across the whole area. The task group felt that this would be a good opportunity to implement a consistent and sustainable approach to development across the region which would support rivers and other watercourses. For example, they felt that significant improvements to rivers could be achieved if Supplementary Planning Guidance stipulated the implementation sustainable drainage solutions and that the implementation of these was properly monitored.

Recommendation 19

A new Regional Development Plan should include consistent supplementary planning guidance to support development across the whole area. The task group believes that this represents a good opportunity to implement a consistent and sustainable approach to development across the region which

would support rivers and other watercourses. For example, they felt that significant improvements to rivers could be achieved if supplementary planning guidance stipulated the implementation of sustainable drainage solutions and that the implementation of these was properly monitored.

This recommendation is supported by key finding 135.

- **Key Finding 136** - River systems do not neatly fit into local authority areas, for example, the three rivers which flow into Cardiff (the Ely, the Rhymney and the Taff) are a part of a wider South East Wales River Basin which includes five local authority areas (Cardiff, the Vale of Glamorgan, Rhondda Cynon Taff, Caerphilly & Merthyr Tydfil). It quite often follows that river issues at the top or bottom of a river system have an impact on other sections of the river system, therefore a complete river catchment approach is necessary. This means that a whole of catchment or regional approach is necessary to improve the overall quality of the rivers watercourses in the South East Wales River Basin. This means that all of the local authorities and significant stakeholders need to work together in partnership.

- **Key Finding 137** – During the discussion on regional working all parties involved with the task & finish exercise supported the idea of regional working. They felt that the local authorities and significant stakeholder groups should form some type of working group to oversee and help facilitate river and watercourse improvements across the whole South East Wales River Basin. Such group should meet on an ongoing basis (quarterly meetings were suggested) and could deliver a series of benefits including:

  - Coordinate shared resources, skills and knowledge from across the whole South East Wales River Basin;
  - Hold a documented summary on the condition of the rivers and watercourses across the whole South East Wales River Basin;

- Monitor and document changes across the rivers and watercourses of the South East Wales River Basin;
- Coordinate the development of an action plan which would set out work priorities required to drive improvement across the South East Wales River Basin;
- Provide a facilitation and allocation role for South East Wales River Basin action plan;
- Identify funding sources that can be accessed by group members (or associated stakeholders) to undertake work.

- **Key Finding 138** – The development of an action plan which contains a list of key river improvement projects was seen as vital. A South East Wales River Basin group should be responsible for holding such a list and allocating work to a wide range of groups best placed to carry out the projects. Holding a list of projects would also make the identification of funding easier over the longer term as projects could be matched to funding instead of having to create a new project to match funding opportunities.

- **Key Finding 139** – The parties involved with the task & finish exercise suggested that the South East Wales River Basin working group should include representation from the following groups / organisations:

  - The five local authorities (Cardiff, the Vale of Glamorgan, Rhondda Cynon Taff, Caerphilly & Merthyr Tydfil);
  - Natural Resources Wales;
  - Dwr Cymru;
  - Keep Wales Tidy;
  - South East Wales Rivers Trust;
  - Groundwork Wales;
  - Key volunteer groups, for example, Cardiff Rivers Group;
  - Key river user groups, for example, Glamorgan Anglers;
  - The Wildlife Trust;
  - Key community groups.

- **Key Finding 140** – The running of a South East Wales River Basin working group would need support from all of the partners. The task & finish exercise partners felt local authorities would be best placed to provide the accommodation for meetings and that the group would need to discuss funding arrangements for the secretariat and coordination roles. Costs would need to be kept at a minimum and running of the working group would have to rely on contributions in kind, for example, accommodation and staff time.

Recommendation 20

A South East Wales River Basin working group should be created to oversee the delivery of river and watercourse improvements. The task & finish exercise partners recommend that the group should:

- Coordinate shared resources, skills and knowledge from across the whole South East Wales River Basin;
- Hold a documented summary on the condition of the rivers and watercourses across the whole South East Wales River Basin;
- Monitor and document changes across the rivers and watercourses of the South East Wales River Basin;
- Coordinate the development of an action plan which would set out work priorities required to drive improvement across the South East Wales River Basin;
- Provide a facilitation and allocation role for South East Wales River Basin action plan;
- Identify funding sources that can be accessed by group members (or associated stakeholders) to undertake work;
- Include representation from the five local authorities (Cardiff, the Vale of Glamorgan, Rhondda Cynon Taff, Caerphilly & Merthyr Tydfil) and significant stakeholders (Natural Resources Wales; Dwr Cymru / Welsh Water; Keep Wales Tidy; South East Wales Rivers Trust; Groundwork Wales; key volunteer groups; key river user groups; The Wildlife Trust &

key community groups).

- Meet on a quarterly basis, keep operational costs to a minimum and rely on contributions in kind (for example, accommodation and staff costs).

This recommendation is supported by key findings 136 to 140.

WITNESSES TO THE INQUIRY

During the inquiry the task group was grateful to the following witnesses who provided verbal evidence or written contributions:

- Emma Harris, Pollution Strategy Manager, Dwr Cymru;
- Dai Walters, Team Leader (Ely & Vale), Natural Resources Wales;
- Hywel Abbott, Healthy Rivers Project Officer, Groundwork Wales;
- Charlotte Sturgess-Osborne, Placement Project Officer, Groundwork Wales;
- Edward Bennett, Network Manager Cardiff, Dwr Cymru;
- Luke Bentley, Sewer Network Abuse Protection Technician, Dwr Cymru;
- Hamish Osborn, Team Leader Natural Resource Management Swansea, Natural Resources Wales;
- Richard Davies, Sewerage Manager, Dwr Cymru;
- Pam Bacon, South East Wales Regional Manager – Central West, Keep Wales Tidy;
- Dave King, Cardiff Rivers Group;
- Gail Davies, Special Projects (Water), Dwr Cymru;
- Ian Titherington, Lead Officer Drainage, City of Cardiff Council;
- Martyn Gough, Communications Manager, Natural Resources Wales;
- Claire Roberts, Education Manager, Dwr Cymru;
- Jess Magness, Marketing & Communications Manager, Keep Wales Tidy;
- Ian Lloyd Davies, Media Advisor, City of Cardiff Council;
- Andrew King, Project Officer, Keep Wales Tidy;
- Nicola Hutchinson, Parks Conservation Officer, City of Cardiff Council;
- Dr Stephen Marsh-Smith, Executive Director, Afonydd Cymru;
- Luke Catterson, Scrutiny Research Officer, City of Cardiff Council.

LEGAL IMPLICATIONS

The Scrutiny Committee is empowered to enquire, consider, review and recommend but not to make policy decisions. As the recommendations in this report are to consider and review matters there are no direct legal implications. However, legal implications may arise if and when the matters under review are implemented with or without modification. Any report with recommendations for decision that goes to Cabinet / Council will set out any legal implications arising from those recommendations. All decisions taken by or on behalf of the Council must (a) be within the legal power of the Council; (b) comply with any procedural requirement imposed by law; (c) be within the powers of the body or person exercising powers on behalf of the Council; (d) be undertaken in accordance with the procedural requirements imposed by the Council e.g. standing orders and financial regulations; (e) be fully and properly informed; (f) be properly motivated; (g) be taken having regard to the Council's fiduciary duty to its taxpayers; and (h) be reasonable and proper in all the circumstances.

FINANCIAL IMPLICATIONS

The Scrutiny Committee is empowered to enquire, consider, review and recommend but not to make policy decisions. As the recommendations in this report are to consider and review matters there are no direct financial implications at this stage in relation to any of the work programme. However, financial implications may arise if and when the matters under review are implemented with or without any modifications. Any report with recommendations for decision that goes to Cabinet/Council will set out any financial implications arising from those recommendations.

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Appendix 1

scrutiny

Scrutiny Research Team

River Pollution in Cardiff: Background on the Ely, Rhymney and Taff

Environment Scrutiny Committee

October 2016

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1. Introduction

The Environment Scrutiny Committee commissioned the Scrutiny Research Team to provide a short report on the general water quality conditions of the Rivers Ely, Rhymney and Taff.

More specifically this report will provide:

- General background profile information on the three rivers;
- Background information on water quality assesement methodologies; and
- Information on key water quality indicators and assessment results.

General information on the river's geographical profiles and general characteristics that is presented in this report had been collected from internet-based research and from existing Committee papers. The more detailed information on water quality indicators and assessment methods and ratings have been provided by Officers from Natural Resources Wales..

2. Background

Cardiff is located mostly on a large flood plain which hosts the rivers Taff, the Ely and the Rhymney (River Pollution in Cardiff, March 2016). These three rivers flow into the Bristol Channel and along with a series of supporting tributaries they provide drainage for a large section of South East Wales.

These rivers are also recognised to have played a significant role in the economic, geographical and social development of Cardiff. They continue to provide an

important role by supporting a healthy environment, enhancing habitat, providing leisure opportunities, generating energy, supporting the local economy, facilitating drainage and generally supporting well being, as suggested in the above report.

3. Water Framework Directive

The Water Framework Directive (WFD) is a European instruction that has been taken into UK law. This document contains information on water quality measures and assessment methodologies that relate to the biology and chemical quality of surface waters and quantitative and chemical quality of groundwater.

In determining the overall water quality status, key elements are monitored as described below:

3.1 Ecological Status

The WFD prescribes that the “Ecological status” of a river is determined by examining three key aspects. These are:

1. Biological quality elements – the communities of fish, invertebrates, diatoms and macrophytes.
2. General physico-chemical conditions – levels of dissolved oxygen, ammonia, phosphate, pH , temperature.
3. 19 national pollutants - tests for the presence of 19 polluting substances agreed by advisory group UKTAG.

3.2 Chemical Status

Water quality is also monitored for its "Chemical status" which involves testing for compliance to European Standards for 41 substances.

3.3 Additional tests - Alien Species and Hydromorphological Conditions

In addition to the assessements made around the ecological and chemical conditions, further tests for "Alien species[1]" and assessements of "hydromorphological conditions"[2] are undertaken to inform the overall assessement of river water quality conditions.

3.4 Overall Status Classifications

The Ecological status, Chemical status and additional tests are combined to give an overall status described as one of five status classes which are **"High, Good, Moderate, Poor or Bad".**.

A general explanation of these five classifications follows (Communication with NRW Officer, September 2016):

High: Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.

[1] Defined by the WFD (Dept for Environment Food & Rural Affairs, 2014) as 'A species, subspecies, or lower taxon introduced outside its normal past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce'

[2] Defined by the WFD (Dept for Environment Food & Rural Affairs, 2014) as, 'is the physical characteristics of the shape, boundaries and content of a water body'

Good: Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.

Moderate: Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.

Poor: Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.

Bad: Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

The measurements used to differentiate between the different conditions described above are set in relation to what would be expected to be found in a river in its natural state. The target is to achieve at least Good status.

3.5 Overview of Common Reasons for Failing Elements

The following are some explanatory information for some of the specific reasons given for failing elements that are identified in the WFD Status Cycle 2 report. (conversation with NRW Officer).

- *Sewage/Combined sewage overflow/Misconnections* known collectively as 'urban diffuse' where the ecology can be affected by raw (but often diluted) sewage / waste water making its way into the river. This can lead to degraded habitats for the flora and fauna.
- *Point Source Sewage Treatment Works (STW)* is the final treated discharge from Sewage Treatment Works. It all enters the river via one pipe at one location.
- *Siltation* is a form of pollution from deposits of silt or clay. It can be suspended sediments or the accumulation of sediment on the river bed.
- *Mitigation measures* where water bodies are modified for uses such as flood protection, public water supply, urbanisation to such an extent that Good Status is not achievable These need to attain Good Ecological 'Potential' (as opposed to status) which means we will need to put in place measures that maximise the ecology given the modified nature of the water body
- *Barriers to fish migration* in the form of weirs, culverts or sewer pipes. Man-made weirs, culverts or pipes as a result of urbanisation can present barriers to fish migration that prevent fish from migrating upstream to their spawning grounds.

3.6 Methodology

The NRW reported that historically most physico-chemical sites were sampled on a monthly basis but to save on resources some of these are now checked quarterly. (Monitoring reviews looked at variability of results and the potential impact of more infrequent tests on the reliability of classifications in order to identify those sites for quarterly monitoring). (NRW correspondence, 2016). Ecological monitoring for

invertebrates, diatoms and macrophytes takes place on a three yearly cycle, with fish being six yearly.

With the exception of fish, classifications are based on a three year-cycle so the results shared for this report are largely informed by readings taken from 2012-2014.

4 The River Ely

The River Ely starts from Tonyrefail and runs for a distance of 24 miles to the Bristol Channel at Cardiff. The river flows past the settlements of Tonyrefail, Llantrisant, Pontyclun, Peterstonsuper-Ely, Ely, Cardiff and Penarth, and has three major tributaries which flow into the river, these are Nant Mychydd; Afon Clun and Nant Dowlais (River Pollution Report, 2016).

Table 1 below presents a summary of the the River Ely's water quality status for Cycle 2 of 2015 (Natural Resources Wales).

Table 1. River Ely Framework Directive Status 2015 Cycle 2.

Waterbody Name	Overall Status	Failing elements	Fish supplies driving failure	Reason For Failure
Nant Dowlais - source to conf Ely R	Moderate	Fish	Salmon, Trout	Diffuse Agri (siltation),
Nant Clun - source to conf Ely R	Poor	Fish, Invertebrates	Salmon, Trout	Misconnections, Sewage pollution, previous polln unknown source
Nant Mychydd - source to conf Ely R	Good	None	N/A	N/A
Ely R - source to conf Nant Clun	Moderate	Fish, Diatoms	Salmon, Trout	barriers, STW/sewage/misconnections
Ely R - conf Nant Clun to Allot Gardens, Ely	Bad	Benzo(a)pyrene, Fish, Fluoranthene, Invertebrates, TBT	Salmon, Trout, Chub, Eel.	previous polln unknown source, others unknown.

The water quality information that is presented in Table 1 above and rest of this section comes mainly from the Natural Resources Wales' report on River Ely Water Framework Directive Status 2015 Cycle 2. That report cites that the River Ely has

altered due to industrialisation and urbanisation with the introduction of man-made structures such as weirs, and these structures create barriers to fish migration to their spawning grounds leading to depleted fish stocks. In order to address this issue, Natural Resources Wales are implementing a five-year project. The above mentioned report also states that water quality in the river is put under pressure by sewage and other contaminations that affect the ecology and fish populations and cited acute pollution incidents in 2010 and 2013 that have impacted the Clun water body and downstream on the Ely. Furthermore, it states that the "Nant Dowlais source to confluence with Ely River" water body also suffers from diffuse rural pollution, notably around siltation.

The report also indentifies several areas of the river that are borderline failures for phosphates. Too much phosphate (as explained by a NRW Officer) can lead to accelerated algae and plant growth that can affect oxygen levels and disrupt the balance of the ecosystem. DCWW are looking at the potential impact from their assets on levels of phosphate, under an AMP6 funded catchment wide investigation.

The assessment of the River Ely's water quality status divides it into 5 water bodies (as shown in the Table) These are: The River Ely from its source to its confluence (junction of two rivers) with the Nant Clun, the River Ely from that point to its mouth and the three tributaries from their sources to their confluence with the River Ely. The specific location of these water bodies is illustrated in the map below as provided by NRW.

The results in Table 1 above show that the main body of the River Ely from its confluence with the Clun to its mouth has an overall status that is classified as “Bad”. This condition (status) is reflected in the population numbers for salmon, trout, chub, eel and invertebrates affected. Other failing elements are raised levels of Benzo(a)pyrene, Fluoranthene and Tributyltin (TBT). The reasons for the failing status on this part of the river are due to previous pollution incidents from unknown sources and other unknown sources.

Most of the tributaries upsteam of the river have significantly better “overall status” ranging from “Poor” to mostly “Moderate” and “Good”. The overall status of the “Nant Clun section up to its confluence with the River Ely”, has been classified as “Poor”. The failing elements of assemments are around fish and invertebrate populations. The failure in conditions on this part of the river is mainly attributed to previous pollution incidents from unknown sources, misconnections and sewage pollution.

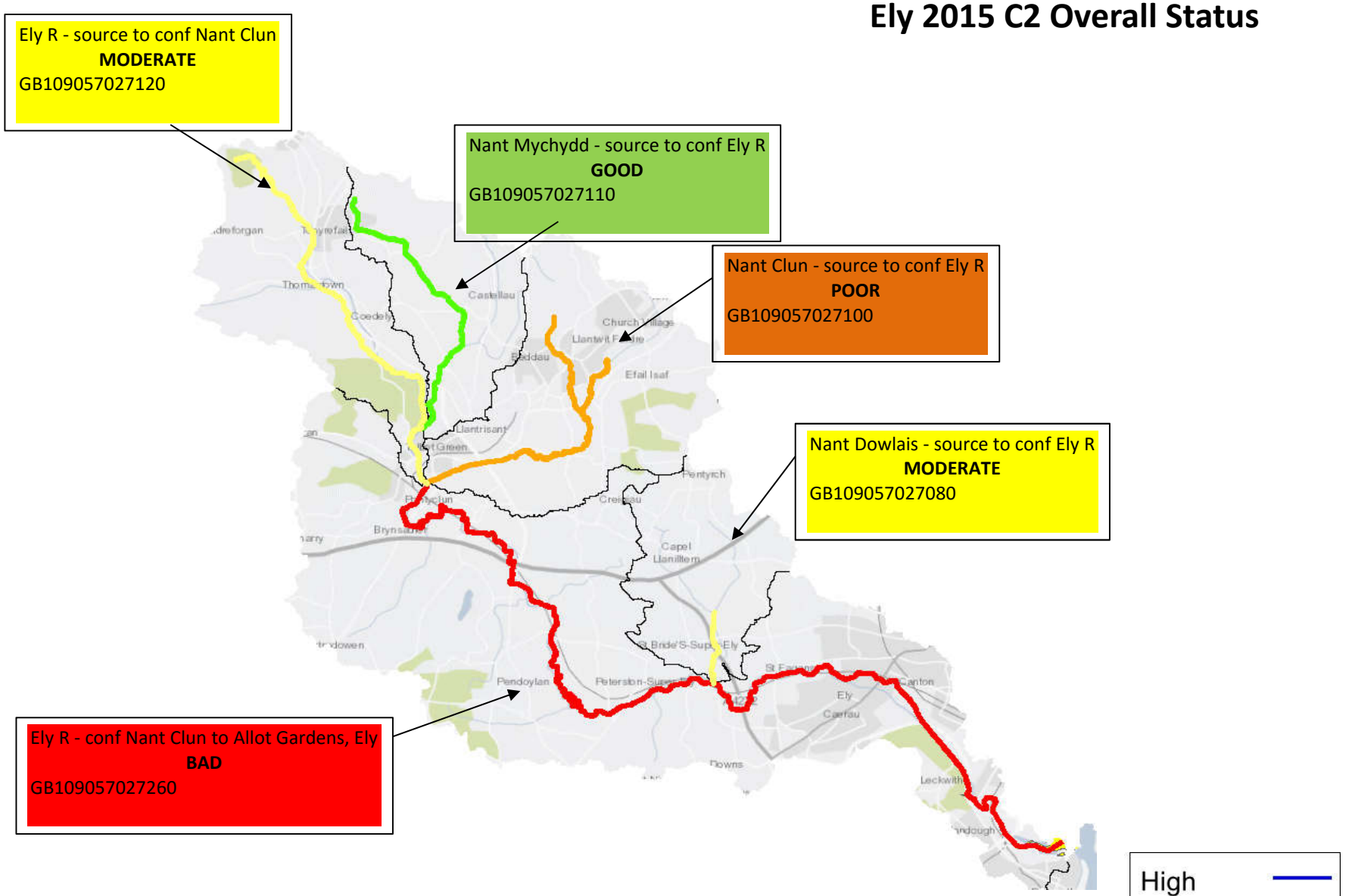
The overall status of the “Nant Dowlais source to its confluence with Ely River” and the “Ely River source to its confluence with Nant Clun” sections have both been classified as ‘Moderate’. The reduction of salmon and trout polulations in these areas of the river are key factors that has led to this classification. For the “Nant Dowlais source to its confluence with Ely River” , the main reason is due to “Diffuse Agri (siltation)”, The “Ely River source to its confluenece with Nant Clun” has barriers to fish migration, and increased levels of nutrients from STWs, sewage and misconnections.

Only the section starting from “Nant Mychydd source to its confluence with the River Ely”has a ‘Good’ overall status.

Appendix 1

Appendix 1

Ely 2015 C2 Overall Status



5 The River Rhymney

The River Rhymney rises at Odyn Fach within the Brecon Beacons National Park and runs for a distance of 35 miles to the Bristol Channel at Cardiff. The Rhymney has several small tributaries which flow into the river, and are each measured as sections and given a classification as part of the Water Framework Directive. The river Rhymney flows past the settlements of New Tredegar, Bargoed, Ystrad Mynach, Llanbradach, Caerphilly, Bedwas, Trethomas, Machen, Draethen and finally Llanrumney and Rumney in Cardiff. (River Pollution Report, 2016)

The information presented in this section of the report is taken mainly from Natural Resources Wales's River Rhymney Water Framework Directive Status 2015 Cycle 2.

Table 2 below shows the results of the assessments of the "Overall Status" of the ten water bodies comprising the river Rhymney. Most of these water bodies (6 out of the 10) have an overall status of 'Moderate'.

Appendix 1

Table 2. River Rhymney Framework Directive Status 2015 Cycle 2.

Waterbody Name	Overall Status	Failing elements	Fish supply driving failure	Reasons for Failure
Rhosog Fach Reen - source to Seven Estuary	Moderate	Macrophyte, Mitigation measures		Suspected Diffuse Agri, Mitigation Measures for Land Drainage & Wider Environment (SSSI)
Broadway Reen - source to R Severn Estuary	Moderate	Ammonia, DO, Mitigation measures, Phosphate		Mitigation Measures for Land Drainage & Wider Environment (SSSI), Trunk Sewer issues, suspected diffuse agri
Roath Brook	Moderate	Inverts, Macrophyte, Mitigation measures, Phosphate, Diatoms		Mitigation Measures (Water Resources, Urban, Wider Environment – SSSI reservoir), Misconnections / sewage pressure
Nant Glandulas - source to conf Rhymney R	Moderate	Fish, Hydrology, Diatoms	Trout, Eel	barriers (and should also be failing for Mitigation Measures)
Nant y Aber - source to conf Rhymney R	Good	None	N/A	N/A
Nant Cylla - source to conf Rhymney R	Moderate	Fish, Phosphate	Salmon, Bullhead	barriers and sewage / misconnections.
Rhymney R - Nant Bargod Rhymni to conf Nant Cylla	Good	None	N/A	Despite good classification has Minewaters pressure
Rhymney R - conf Nant Cylla to Chapel Wood	Moderate	Benzo(a)pyrene, Benzo (a) and (k) fluoranthene, Benzo (ghi) perelyene and indeno (123-cd) pyrene, Fluoranthene	N/A	unknown sources of combustion
Nant Bargod Rhymni - source to conf Rhymney R	Poor	Fish	Salmon, Trout, Bullhead	barriers
Rhymney R - source to conf Nant Bargod Rhymni	Good	None	N/A	N/A

The sections or of the river that have been given ‘Moderate’ as its “overall status” have varied reasons for its failing elements. In four of these waterbodies (as shown in the Table above) specifically the, “Nant Glandulas from its source to confluence with the River Rhymney” section , the “Roath Brook”, “Broadway Reen from its source to the River Severn Estuary”, the “Rhosog Fach Reen from its source to Seven Estuary” the existing conditions at the time of reporting required mitigation measures because they are Heavily Modified Water Bodies for flood protection, urbanisation and land drainage uses. It is also recognised that they are Sites of Special Scienetific Interest (SSSI) so any mitigation measures implemented for WFD must not impact negatively upon the SSSI features .

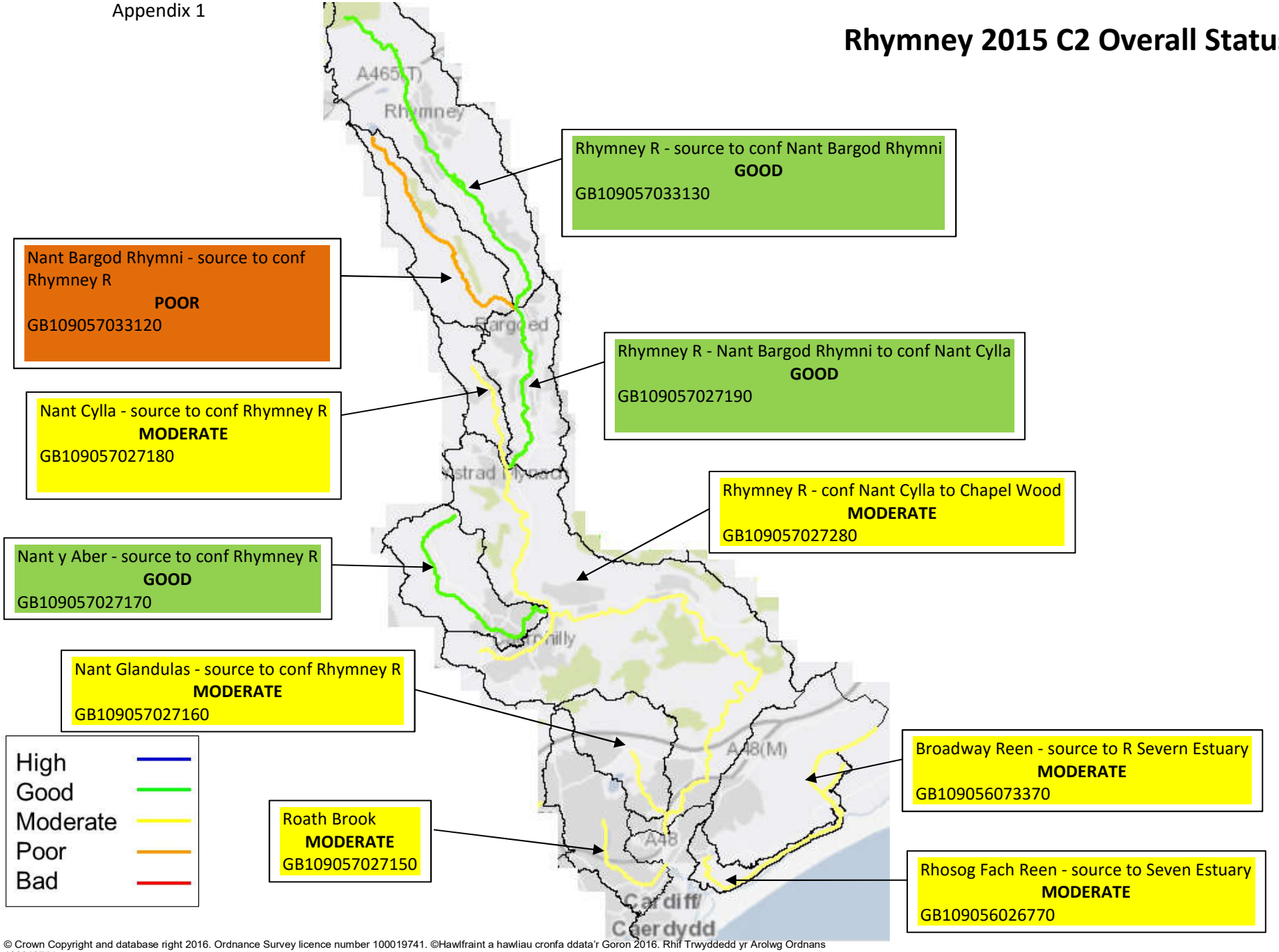
In three sections of the river there are issues around depleted fish stocks: specifically for trout and eel at the “Nant Glandulas source to its confluence Rymney River” section; and for salmon and bullhead populations at the “Nant Cylla source to confluenece with Rhymney River” section. These sections both have a status of “Moderate” as a result. The section from “Nant Bargoed Rhymni’s source to its confluence with the River Rhymney” has an overall status of “ Poor” with fish populations (specifically salmon, trout and bullheads) as its failing element and mainly due to barriers in the watercourse.

The report specifically cites that there are weirs in some sections of the River Rhymney that create barriers between fish and their spawning grounds and that these fish populations are further susceptible to and can be affected by sewage, combined sewage overflows, misconnections and industrial estates.

It is recognised that further urban development may compound these issues, however Natural Resource Wales reports that they are working with partners to address these concerns.

Appendix 1

Rhymney 2015 C2 Overall Status



Rhymney R - source to conf Nant Bargod Rhymni
GOOD
GB109057033130

Nant Bargod Rhymni - source to conf Rhymney R
POOR
GB109057033120

Rhymney R - Nant Bargod Rhymni to conf Nant Cylla
GOOD
GB109057027190

Nant Cylla - source to conf Rhymney R
MODERATE
GB109057027180

Rhymney R - conf Nant Cylla to Chapel Wood
MODERATE
GB109057027280

Nant y Aber - source to conf Rhymney R
GOOD
GB109057027170

Nant Glandulas - source to conf Rhymney R
MODERATE
GB109057027160

Broadway Reen - source to R Severn Estuary
MODERATE
GB109056073370

Roath Brook
MODERATE
GB109057027150

Rhosog Fach Reen - source to Seven Estuary
MODERATE
GB109056026770

6 The River Taff

The River Taff rises as two rivers in the Brecon Beacons National Park and runs for a distance of 40 miles to the Bristol Channel at Cardiff. The River Taff is formed from the Taf Fechan (Little Taff) and the Taf Fawr (Big Taff); the two rivers merge just north of Merthyr Tydfil. The Taff has seven major tributaries which flow into the river, including Nant Ffrwd; Nant Morlais; Nant Rhydycar; Taff Bargoed; Cynon; Nant Clydach and Rhondda. The river Taff flows past the settlements of Merthyr Tydfil, Treharris, Pontypridd and Cardiff. (River Pollution Report, 2016)

Table 3. River Taff Framework Directive Status 2015 Cycle 2.

Waterbody Name	OverallStatus	Failing elements	Fish supply driving failure	Reason for Failure
Aman R - source to conf Afon Cynon	Good	None	N/A	N/A
Cynon - conf Aman R to conf R Taff	Poor	Fish	Salmon, Trout	barriers, sewage/misconnections, Industrial estates.
Rhondda Fawr	Good	None	N/A	Although passing has barriers, sewage /misconnections pressures
Afon Rhondda Fach - source to conf Rhondda R	Poor	Fish, Hydrology, Mitigation measures	Salmon, Trout, Bullhead	barriers, Water Resources, sewage/misconnections pressure, Mitigation Measures for Water Resources & urban
Whitchurch Bk - source to conf R Taff	Moderate	Fish, Mitigation measures, Phosphate	Salmon, Trout	barriers, Mitigation Measures for urban & sewage/misconnections.
Rhondda R - conf Afon Rhondda Fach to conf R Taff	Good	Hydrology	N/A	Although passing, hydrology pressures.
Taff - conf R Cynon to conf Rhondda R	Poor	Fish	Salmon, Trout	Barrier on minor trib.

Nant Clydach - source to conf R Taff	Poor	Fish	Trout	barriers
Taff - conf Rhondda R to Castle Street	Moderate	Benzo(a)pyrene, Benzo (a) and (k) fluoranthene, Fluoranthene, Mitigation measures.	N/A	unknown sources of combustion and Mitigation Measures flood protection / urban.
Taff - conf Taf Fechan to conf R Cynon	Moderate	Mitigation measures	N/A	barriers, Mitigation Measures urban
Afon Cynon - source to conf Aman R	Poor	Fish	Salmon, Trout	barriers, sewage/misconnections, Water Resources?
Taff Bargoed	Moderate	Fish, Mitigation measures	Salmon, Bullhead	barriers, Mitigation Measures Flood
Nant Morlais - source to conf R Taff	Moderate	Inverts, Macrophyte, Mitigation measures	N/A	sewage/misconnections / Culverts, Mitigation Measures urban,
Taf Fechan - source to conf Afon Taf Fawr	Moderate	Mitigation measures	N/A	Mitigation Measures Water Resources, barriers pressure
Afon Taf Fawr - source to conf Taf Fechan	Moderate	Fish, Inverts, Mitigation measures	Salmon, Trout	Mitigation Measures Water Resources, barriers

The information presented here comes from the Natural Resources Wales report on River Taff Water Framework Directive Status 2015 Cycle 2. The River Taff has fifteen water body sections where assessments have been made of overall status.

Of the 15 water bodies comprising the River Taff, 3 of these have an overall status that is “Good”. The report however cites that the section running from the ”Rhondda River to its

confluence with Afon Rhondda Fach to its confluence with River Taff", although classified as "Good" has hydrology pressures in this water body.

There are seven sections (water bodies) that have been given a 'Moderate' overall status. There are a variety of factors that have been identified as the "failing elements" for these water bodies with most of these around fish populations and mitigation measures.

The NRW report further explains that some of the issues or challenges in many of these water bodies, is associated with or is a result of the Taff having been modified for flood protection, public water supply, urbanisation. NRW recommends that modifications need to be made to offset these changes and achieve a good ecology and it will be working on this as part of its 2015-2020 programme.

Table 3 above also shows that there are five sections (water bodies) that have been given a classification of (overall status) 'Poor' and have fish levels identified as the "failing elements" with issues around the populations of salmon and trout. A variety of reasons for these "failing elements" are cited in the Table below, including "barriers" in 5 of the sections/ water bodies. Additionally, sewage and misconnections were also cited as a reason for the sections at the "Cynon confluenece to Aman River to confluence with River Taff"; the "Afon Rhondda Fach source to confluenece with Rhondda River"; and "Afon Cynon source to confluenece with Aman River" water bodies.

The Table above further identifies a range of other failing elements at various points of the river to include: macrophyte levels, high presence of chemicals such as phosphates in some sections/waterbodies of the river as can be shown seen in the Table above.

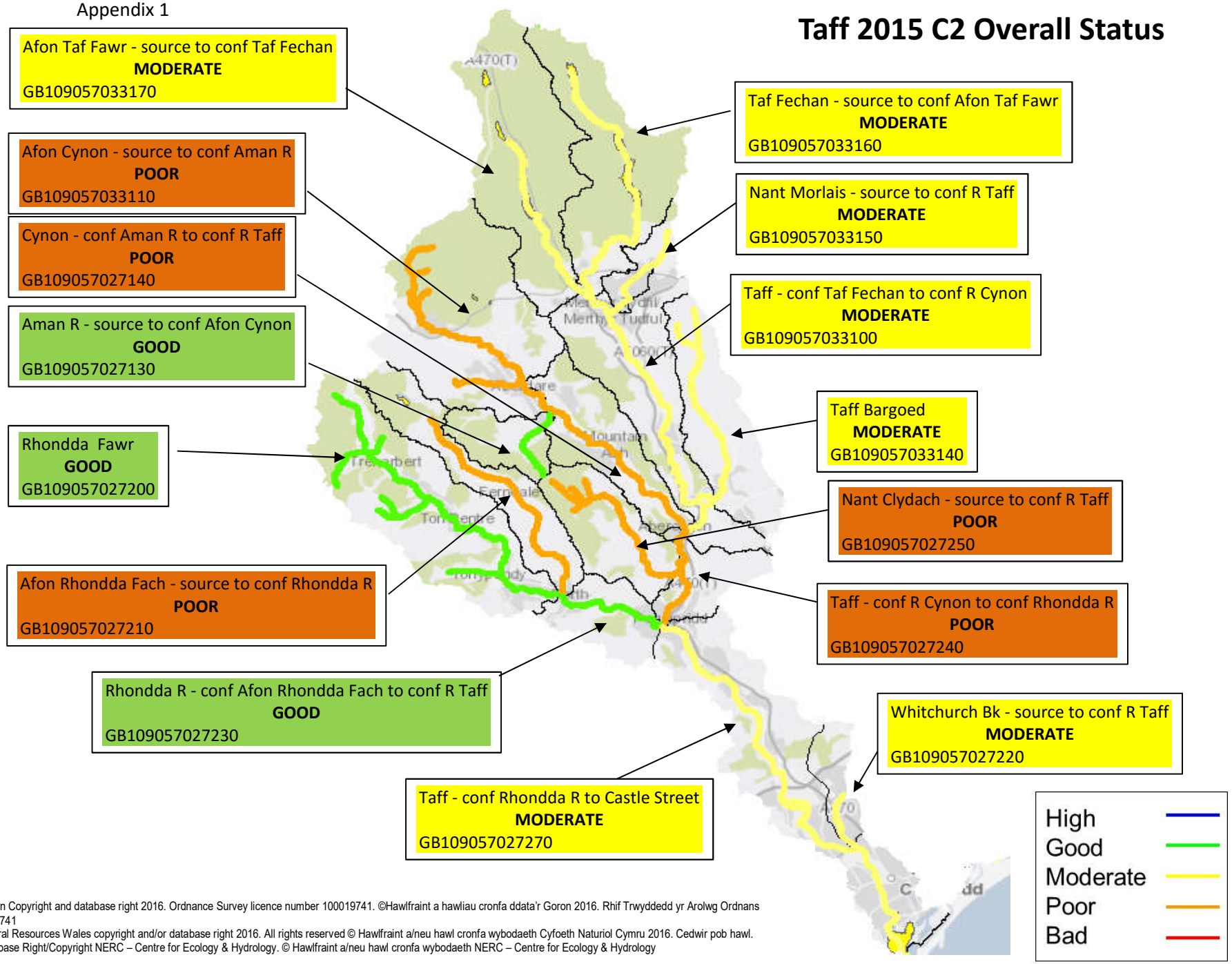
The NRW report also cites various "reasons for failure" or issues such as barriers, sewage, misconnections and unknown sources of combustion that have a detrimental effect to the overall status of the river. The report further explains that these sources of

combustion are plentiful and therefore difficult to target but lead to increased levels of chemicals such as Fluoranthene or benzopyrene. It is suggested in the Water Framework Directive that reducing emissions or intercepting diffuse sources could help with this by using sustainable draining systems (NRW, 2015).

The NRW report also states that water quality in the river is affected by sewage, combined sewer overflows, misconnections and industrial estates. These can affect the ecology of the river and have a negative effect on fish populations. In the case of the Taff, these factors have affected bullhead and especially salmon and trout populations. NRW also recognises that increased urban development along the river escalates these issues and they are working with partners (Dwr Cymru, South East Wales Rivers Trust and Cardiff Council) to try and address them.

Appendix 1

Taff 2015 C2 Overall Status



7. References:

Ely Water Framework Directive Status 2015 Cycle 2 provided by Natural Resources Wales

Rhymney Water Framework Directive Status 2015 Cycle 2 provided by Natural Resources Wales

Taff Water Framework Directive Status 2015 Cycle 2 provided by Natural Resources Wales

River Pollution in Cardiff, report to Environmental Scrutiny Committee (March 2016)

Sampling Invertebrates, https://www.biology-fieldwork.org/freshwater/freshwater-animals/fieldwork-sampling-invertebrates.aspx [Accessed Otober 2016]

Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment (2014) Department for Environment Food & Rural Affairs May

Interview with Jeremy Tanner, Natural Resources Planning Officer (Water Framework Directive) (October 2016)

Appendix 2

Scrutiny Research Team

Restore Our Rivers: Best Practice in Managing Ecological Issues

Research report for the
Environmental Scrutiny Committee

November 2016

CARDIFF
CAERDYDD

The City and County of Cardiff

1. INTRODUCTION

This research report was commissioned by the Environmental Scrutiny Committee's "Restore Our Rivers" task and finish group to provide Members with an overview of best practice in three main areas of work into river ecology. These areas are:

- Misconnections and Sewer Abuse
- Littering and Pollution
- Enhancing Biodiversity and Managing Alien Species.

Members have already been provided with a Scrutiny Research briefing paper outlining the current status of the rivers Ely, Rhymney and Taff, based on reports produced by Natural Resources Wales in accordance with the Water Framework Directive.

This second piece of research is intended to provide examples of best practice to combat the three above issues, to inform future practice in improving the status of Cardiff's rivers.

The Department for Environment, Food & Rural Affairs (DEFRA) commenced work with the Environment Agency, key environmental organisations and water companies to launch an initiative to enhance knowledge about rivers and to appreciate the link between how water is used in the home and how this impacts the nation's rivers to develop a campaign called 'Love your River (DEFRA press release[1], March 2012). Similarly, Keep Britain Tidy are managing a project called Rivercare that seeks to encourage engagement and involvement

As outlined in their press release, the idea behind these initiatives is to provide water saving tips, and also to draw attention to the community groups that do important work to care for local rivers and wildlife and provide education. As can be seen in the examples in later sections of this report, the Rivercare project seeks to address those issues affecting the ecology of rivers that have led to the commissioning of this report.

[1] https://www.gov.uk/government/news/show-how-much-you-love-your-river

2. RESEARCH REPORT METHODOLOGY

The information in this report has been gathered through desk based research. This includes a web-based search that led to relevant charitable websites, professional bodies and local authorities. The case studies and guidance presented in this report have all been taken from these sources.

In addition to this, advice was sought from Cardiff Council officers and other professionals within the water industry such as Natural Resources Wales, Dŵr Cymru Welsh Water, The Environment Agency and The Groundwork Institute. Contact was made via email and through phone calls to shape this research.

3. MISCONNECTIONS AND SEWER ABUSE

The National Misconnections Strategy Group (NMSG) is a partnership of organisations including The Environment Agency, DEFRA and regional water bodies (including Dŵr Cymru Welsh Water). (www.Connectright.org.uk, Accessed November 2016) They define two types of misconnections that both cause pollution. These are:

- Where wastewater and sewage is wrongly connected to clean surface water drains
- Where clean rain water is connected to foul drains.

The NMSG also outline some of the negative outcomes from misconnections and these include the pollution of rivers, streams and beaches, damage to wildlife and health risks.

They have a public face known as 'Connectright' which is a scheme that aims to reduce water pollution through a variety of means. As stated on the above website, this includes raising awareness about how sewers and drains function and about misconnections and the problems that they cause. The scheme will help property owners and professionals to check drainage connections are correct and take action if they are not. It will ensure that new drainage is correctly connected, and support effective practice, policy and regulation. The intention is for the scheme to be a way of sharing information and evidence about the problem of misconnections and supporting research and the development of long-term solutions.

3.1 Context and Procedure

The Chartered Institution of Water and Environmental Management (CIWEM) have issued a Policy Permission Statement (CIWEM *Misconnections*, April 2016) that gives some background information on work undertaken in England on misconnections since the 1990s. They report that there has been an extensive effort by local authorities and Water and Sewerage Companies (WaSCs) to investigate and rectify misconnections and that the focus has been on the most obviously polluted outfalls.

According to JBA Consulting – an environmental engineering consultancy company – agencies like the Environment Agency, Natural Resources Wales and the Scottish Environmental Protection Agency have identified polluted water surface outfalls and needed sewage undertakers[2] to complete surveys to identify misconnections. Specialist survey contractors will then trace upstream from outfalls to identify sources of pollution from where they will survey individual properties with owner/occupier permission. They will then be issued with a written formal request to resolve the issue with further letters issued if required. Only the local authority's Environmental Health Officers (EHOs) or the Environment Agency have the power to enforce action. (JBA Consulting, Sewer misconnections...time for a new approach, November 2016).

In a presentation for The Environment Agency by a Pollution Prevention Team Officer (The Environment Agency, *Misconnections PPS*, December 2013), some of the current good practices are outlined. These include the Environment Agency identifying outfalls and prioritising which to focus on, water companies investigating malfunctions and identifying misconnections before encouraging rectification. The local authority or Environment Agency can then enforce rectifications. The presentation acknowledges that there are some efforts to raise awareness and prevent misconnections.

3.2 Problems with Current Methods

Following work on a programme of misconnection surveys in Merseyside, JBA Consulting identified some problems with the current method and describe these in their online report. The problems they highlight are as follows:

- Manually intensive and expensive – many properties require repeat visits because of uncooperative residents meaning a significant number can't be surveyed.
- Difficult to gain cooperation – the realisation of residents that they need to pay to rectify the problem, particularly if they are a low-income household.
- Lack of staff – Many local authorities have had to cut back on the number of EHOs.

[2] "A company appointed under the WIA91 to provide sewerage services in respect of a geographical area of England and Wales." (https://definedterm.com/sewerage_undertaker, Accessed November 2016)

- New misconnections reappear – if residents and/or contractors remain unaware of consequences or of the cost of rectifying then the problem can resurface.

The CIWEM report also makes the point that the surveys needed to identify misconnections are expensive and difficult and that the legal powers of local authorities to assist are diminishing. They point to a trial by the Environment Agency of Anti Pollution Works Notices (APWNs) for use when property owners fail to act voluntarily, but suggest that they are generic and potentially not as effective as local authority powers. They also state that legal action to rectify misconnections is 'costly, cumbersome and resource intensive.'

3.3 Suggested Improvements

As a result of their project in Merseyside and identification of problems with current work on tackling misconnections, JBA Consulting identified some ways that the work could be improved in the future. They noticed that the water companies they work with all have customer engagement at the heart of their business plans, firstly to understand their needs, but also as a means of educating customers on how their water consumption, flushing habits and misconnections impact in the environment as well as their bills.

They note that water companies, regulators and local authorities have supported the Connectright website, which offers advice on how residents can check their property. JBA's survey showed that many respondents were 'genuinely unaware and shocked that their home was misconnected and concerned to learn of the impacts on their local watercourse.' (JBA Consulting Sewer misconnections...time for a new approach, November 2016). They believe that residents will be willing to help rectify the problem, they just need to be engaged and perhaps there need to be new ways of achieving this.

They propose a 'misconnection amnesty' where information could be distributed to an area, telling them how to identify misconnections and offering free modifications if they are reported. They suggest that the cost of repairs may be offset by the savings in survey costs.

Another suggestion is to use the building surveys conducted when properties are bought as an opportunity to address misconnections. They also state that sewerage undertakers are required to provide sewer maps to local authorities and make them publically available. This could be made available online, allowing building owners, plumbers and builders to understand the sewage systems and also reinforce the connection in people's minds between what leaves their house and how it affects water bodies in and around their local area.

The Environment Agency presentation also provides some recommendations such as: including drainage checks in property searches; further investigations as part of WaSC and EA business plans; engaging with professionals, manufacturers and retailers to help raise awareness and develop solutions; considering general binding rules; developing holistic water management approaches; and raising public awareness to help people value water and provide wider societal benefits.

The CIWEM report also makes recommendations for future work on misconnections. Similar to above, many of these revolve around ways to generate awareness and that different groups all need to be targeted, as follows:

- Property owners - This may be achieved by stating the type of drainage on water bills or making a drainage survey necessary when a property changes ownership. They suggest that property searches should include information on drainage systems and highlight potential risk of misconnections.

- Water bodies - local authorities, environmental regulators, OFWAT (the economic regulator of the water sector in England and Wales) and WaSCs - should prioritise areas of water quality impacts to investigate and include this in their business plans.

- Key professionals and service sectors – Building Control, surveyors, Environment Health Officers, architects, the construction industry etc should be involved in tackling the problem and part of approval schemes such as Watersafe[3].

[3] A free online directory and national accreditation body for competent and qualified plumbers in England, Scotland, Wales and Northern Ireland

- Government – Should explore statutory instruments like General Binding Rules as a way of preventing the pollution of service water systems by requiring treatment of surface water discharges if contaminated by a sustainable drainage system or at risk of contamination by misconnection.

- Manufacturers and retailers of washing machines – They could help raise awareness of misconnections at the point of sale.

- Building Control approval bodies – Could do more to ensure drainage practice follows regulation – for example requiring photographic evidence.

- DEFRA and the Scottish Government – Should require new surface water drainage systems are in the form of open channels where possible to allow quicker detection of misconnections to minimise risk.

3.4 Case Studies

The following case studies are summarised from the Connectright website,

3.4.1 The Midlands

The Midlands Urban Rivers Community Initiative has worked with the Environment Agency and partners to actively encourage communities to appreciate the local watercourse and take positive actions to help prevent the misuse of sewers and misconnections that lead to pollution.

For example, the Waterside Care project helps volunteer groups to adopt a river and smarten the nearby environment by litter picking. Working with partners, it also helps to educate groups and allow them to understand and monitor water quality and the effect of sewer misuse and misconnections. They can then further pass on this knowledge.

3.4.2 Telford

In Telford there is the Clean Stream Team which works to identify and resolve misconnections and other pollution sources in Telford. The team consists of a full-time worker from the Environment Agency and one from Severn Trent Water with support from the Shropshire Wildlife Trust and Telford & Wrekin Council. They also receive support from a trained volunteer group, the local community who are educated through leaflets, the local business community who have a line of communication through the Business Environmental Support Scheme for Telford, and schools where the Shropshire Wildlife Trust worked in ten schools in Telford either through a short session or a full six week River Ranger Programme to teach Telford's children about habitat, water pollution and how to identify and report it.

3.4.3 The North East Living Waterways

The Living Waterways project is a partnership between the Durham, Northumberland and Tees Valley Wildlife trusts and the Environment Agency. Part of their work includes a misconnections pilot with Northumbrian Water. It focusses on highlighting the problems caused by misconnections through community events, sessions in schools, free community fun days and a public consultation on the possibility of installing instructional plaques near drains,

3.4.4 Hastings Clean Seas Please

Clean Seas Please is a project funded by the Environment Agency and managed by Hastings Voluntary Action and Rother Voluntary Action. They seek to combat high bacteria concentrations that are predominantly caused by problems with the sewer infrastructure and misconnections. A school programme called 'The Shore Academy' is being developed and works on small projects with plumbers, catering outlets, parents, and the hotel trade and also runs a full programme of community events in spring and summer.

3.4.5 Thames Fixing Broken Rivers

A four-year project to tackle urban pollution in the Lower Lea Valley has been made possible with funding from the HSBC water programme ‘Fixing Broken Rivers’. The project includes a school-based education project, new and regeneration of river beds and the creation of mini sustainable drainage systems. The schools will also work with HSBC staff and community volunteers to create and monitor these beds and systems.

3.4.6 Bishops Stortford

The Stort Navigation (canal section of the River Stort) was identified as an area impacted by pollution by the Environment Agency. They installed electronic data loggers to monitor water quality and identify the sources of the pollution. This was found to be from polluted surface water outfalls. Working in partnership with Thames Water and its contractors, they were able to trace and resolve the offending misconnections.

3.4.7 Swansea Cleaner Bathing Water

Natural Resources Wales and The City and County of Swansea worked in partnership to on investigations into the causes of bad water quality in the Bay and misconnections were identified as one of the major sources of pollution. In response to these findings, Council and NRW set up the Swansea Misconnection Project. The aim of the project is to track down and eliminate misconnections and ensure that the streams and rivers that flow into the bay are free from sewage pollution.

A dedicated misconnection team was set up and over the last three years they have inspected well over 4000 houses in West Swansea. So far they have found around 300 houses with misconnections.

Nearly all the misconnections identified have now been corrected, meaning the nearby river Clyne is running much cleaner than it has in years. Recent sample results now show that the bay is passing the new bathing water standards and that the water quality is continuing to improve.

3.4.8 Wessex Streamclean Team

Wessex Water, Bristol City Council and the Environment Agency formed a partnership to reduce pollution to the watercourses in Bristol and, following early success, launched a Streamclean Team. The team of four works across the Wessex Water region able to trace the cause and reduce the risk of pollution from water company assets.

They carry out routine and reactive investigations of public surface water outfalls and have noticed that pollution from misconnections is often worse in the cold because of an increase in oil which can spill of overflow and end up in drains. This may be the result of deliberate actions or poor maintenance.

When a misconnection is discovered the team contacts the home owner and explains the findings, leaving a survey form and a letter asking them for a correction to be made within 30 days or longer if the misconnection is more complicated. They have found that in 99% of cases the homeowner rectifies the plumbing but on occasions where they don't, the team can notify the local environmental health office or Environment Agency to enforce action.

3.4.9 Yorkshire Bathing Water Partnership

The Yorkshire Bathing Water Partnership is a multi-agency group made up of the Environment Agency, Yorkshire Water, local councils and Welcome to Yorkshire. As part of their work to make beaches reach new European standards, the group identified misconnections as a key polluter of bathing waters. Following detailed modelling the partnership were able to identify which beaches may be suffering from misconnections. The modelling was funded by Yorkshire Water and highlighted several watercourses which run onto bathing beaches as carrying bacteria to the bathing beaches. Samples were taken to find a more precise location of the source. The partnership agreed for the water company to fund further investigations to physically look into the drainage systems in these residential areas.

Contractors, DrainsAid, were appointed to survey the sewers using remote cameras and harmless dye to locate misconnections. They reported the results to the partnership and

the local authorities contacted individual property owners. Approximately 25 cross-connections were identified along the Yorkshire coast. The project is ongoing.

4. LITTERING AND POLLUTION

Littering can have an extremely negative effect on the ecology of a river. When dumped, litter and rubbish can endanger wildlife, block rivers and cause flooding, and make parts of the river inaccessible. Pollution also has harmful effects and the Department for Environment Food and Rural Affairs (DEFRA) published a consultation in 2012 (DEFRA, *Tackling water pollution from the urban environment*, November 2012) giving some background on the challenges facing rivers in terms of pollution. In it, they identify four main sources of pollution as follows:

Point Source Pollution – Permitted discharges from factories and wastewater treatment.

Pollution Incidents – One-off incidents such as a tanker accident that have acute short term impacts.

Unknown Sources – Where the cause can't be identified.

Diffuse Pollution – Unplanned and unlicensed pollution from farming, mine water, homes and roads. The may be agricultural or non-agricultural.

This section summarises some of the approaches taken across the UK to combat these issues and also some advice issued by relevant bodies such as DEFRA and The Environment Agency.

4.1 Keep Britain Tidy – Rivercare

Keep Britain tidy is an independent environmental charity that set up a programme focussing on rivers (www.keepbritaintidy.org/rivercare, Accessed November 2016). Funded by Anglian Water, the programme encourages local communities to "maintain and enhance rivers for future generations". Advice is available from organisations such as Wildlife Trusts, RSPB, Environment Agency, Natural England, National Parks Authority and district and county councils.

There are more than eight hundred volunteers working across forty five projects. Each group has a different focus tailored to the local river but activities include litter picking, removing invasive plants, habitat management, water quality testing, freshwater invertebrate counting and providing education to schools and other groups.

The Anglian Water website (http://www.anglianwater.co.uk/environment/our-commitment/our-projects/rivercare.aspx, Accessed November 2016) describes the way that they groups work. They each establish a stretch of the local watercourse to take responsibility for and undertake the above activities, often through engagement and collaboration with the local Wildlife Trust and local councils. Group leaders will explain what is needed, assign tasks suited to ability, demonstrate any necessary equipment and be available for help or guidance.

Lists of the active groups are available on the Keep Britain Tidy website referenced above; examples of a couple of these are summarised below.

4.1.1 Rivercare Lincoln

Two Rivercare groups based in Lincoln conducted events on July 2nd 2016. The Sincil Drain group were joined by Lincoln Fire and Rescue crews to clear litter from inaccessible areas. The Lincoln Witham group also conducted a clean-up on the same date. After meeting at an agreed time, basic training was given and refreshments provided after the stretch of river had been attended to.

4.1.2 Rivercare Peterborough

The Peterborough City Centre Rivercare Group have training sessions, guided walks along the river and regular litter picks, but are also working on a new project monitoring the health of the Werrington Brook in the city. As part of a larger river restoration project with The Environment Agency, Peterborough City Council and Peterborough Environment City Trust, volunteers are being trained in biological recording techniques such as checking dissolved oxygen levels and carrying out fixed point photography.

4.2 DEFRA Guidance on Tackling Urban Pollution

In 2012, DEFRA produced a consultation document as part of their development of a strategy to deal with urban water pollution (Tackling water pollution from the urban environment, November 2012). In this they describe the principles of the strategy they wish to put forward. These are:

- To prioritise the reduction in sources of non-agricultural diffuse pollution that most cost effectively improves river ecosystems.

- To encourage ‘no regrets’ 6 solutions, highlighting future risks to take possible preventative actions, and where possible seek to encourage actions which deliver multiple benefits e.g. surface water management actions for flood control which also improve water quality.

- To follow the ‘polluter pays’ principle when tackling sources of non-agricultural diffuse pollution. Where the polluter cannot be identified or effectively regulated look to the beneficiaries instead, applying ecosystem services principles to value benefits.

- To seek to reduce the source of pollutants, where this offers the most cost effective solution, before addressing the where and how it travels or where it goes to.

- To focus on a ‘bottom-up’, locally-driven, catchment-based approach to help identify and reduce non-agricultural diffuse pollution. Lessons learned from on-going catchment-based pilots with urban diffuse problems will be used to inform specific guidance and advice; however, it is recognised that national interventions could be more cost effective in certain cases.

- In order of priority to offer advice, then look to incentivise action and only where there is a clear case take forward new regulatory measures

The report goes on to present planned actions to deal with different types of pollution and causes thereof those given highest priority are summarised below.

Urban Run-off -Metals and chemicals that are a by-product of road transport can run into rivers and other water sources as can faecal matter from animals. DEFRA propose undertaking research to assess to risk of this and how it can be identified locally, and working with stakeholders like local highway authorities to identify polluting outfalls and develop and promote measures to reduce road run-off such as Suitable Drainage Systems (SDS).

Light Industrial Estates - Run-off from vehicle washes, chemical storage and misconnections and drainage abuse can lead to polluted waters. DEFRA suggest continued research to better understand the issue and associated risk in order to develop cost-effective solutions.

In-situ contaminated river bed sediment - This is historic industrial and mining sediment or sediment from urban run-off that becomes deposited on river beds but can be stirred up in bad weather. DEFRA propose further research and to investigate ways to mitigate the problem.

Mine waters - These are discharges associated with abandoned mine workings that contain high concentrations of metals and other pollutants. DEFRA want to put a strategy in place to remediate mine waters.

Septic tanks & non–mains sewage systems - Foul sewage from properties that aren’t connected to the main sewerage network. DEFRA proposes a strategy to reduce the negative impact of poorly installed and maintained septic tanks. They state that different measures are likely depending on proximity to groundwater supplies.

4.2.1 Current DEFRA Initiatives

In the report, DEFRA detail some initiatives already in place to either directly or indirectly address urban diffuse water pollution. They assess how effective these initiatives are and offer examples of current good practice and new policy initiatives. These are summarised below.

Catchment-based approach - In the report DEFRA state that a catchment-based approach is central to their strategy. This would be where stakeholders including river trusts, water companies and local authorities collaborate and introduce more local level detail in planning and managing the delivery of environmental improvement. They cite the example of the Irwell catchment pilot in North West England and the Lower Lee catchment pilot in London where they aim to reduce diffuse urban pollution and involve local groups, the Environment Agency and the water and sewerage community.

Empowering Communities - Community-led groups can make a difference by improving rivers as can be seen in the Rivercare scheme above. In England the Catchment Restoration Fund was made available to support such groups leading to projects bidding for financial backing to tackle urban diffuse and water pollution issues.

DEFRA have also launched the ‘Love Your River’ campaign, which works with the National Trust, the Environment Agency, the Wildlife Trusts, Keep Britain Tidy, water companies and Waterwise. The campaign aims to educate people about the difficulties facing rivers and also to help celebrate their importance and celebrate the community of those who volunteer and honour those who give their time to help. It is hoped this will help people understand and value water and encourage them to take action.

Local Flood Risk Management - The Flood and Water Management Act 2010 gives the responsibility of managing flooding to Lead Local Flood Authorities operated either by county councils or unitary authorities of England. They are responsible for understanding the risks posed by different types of flooding and managing and reducing these. To do this successfully, coordination is required with other key stakeholders such as water companies, the Environment Agency, the highways department within an Authority, district

authorities and community groups. Between them, these bodies share understanding to plan and work together to tackle the urban diffuse water pollution that can occur as a consequence of flooding. For example they may work together to increasing the permeability of paved areas, such as public spaces or roads so that rainwater soaks into the ground, can be beneficial in reducing flood risk and keeping pollutants out of rivers and streams.

Engaging with Local Authorities to Improve Urban Rivers - Local authorities have a vital role in managing urban diffuse water pollution. An example of their successful involvement is where a number of local authorities worked with the Environment Agency and Sustainability West Midlands to raise awareness of the information and policy needs of local authorities to help tackle this issue effectively. The project catalogued the activities already being undertaken to improve water quality including the development of planning policies, the development of green infrastructure plans, the consideration of water issues when determining planning applications, the operation of local authority estates and buildings, highways maintenance operations and the consideration of water quality whilst fulfilling their highways drainage and flood risk management roles.

Feedback from the project indicated that authorities wanted more clarity on local data and priorities. They were a little unclear on their responsibilities in meeting the statutory obligations of the Water Framework Directive. Authorities also stated that they would value advice on how improving water quality could directly impact economic development and how to write planning policy that would directly influence water quality and quantity. With that in mind the project aimed to improve advice notes and provide further training in these areas.

Spatial Planning – National Planning Policy Framework - The DEFRA report states that the Government streamlined planning policy in the Planning Policy Framework introduced in 2012. This ensures that there is a presumption on favour of sustainable development allowing the economy to flourish and the environment to be protected. The framework sets out a policy approach for local authorities to develop local plans and sets a core principle that planning should contribute to conserving and enhancing the environment while reducing pollution.

The framework says that local authorities should recognise the wider benefits of ecosystem services and prevent unacceptable levels of pollution from new developments, develop policies that manage flood risk and ensure development is prioritised where necessary to reduce it, encourage the use of developed brownfield, have a strategic approach towards creating, protecting and enhancing networks of biodiversity and green infrastructure, and plan for biodiversity at a landscape scale across local authority boundaries.

Pollution from Major Roads and Motorways - The Highways Agency is responsible for the management on the motorways and trunk-roads in England and has a voluntary arrangement with the Environment Agency to undertake risk assessments of polluting highway drainage outfalls. In areas where risks are high due to heavy traffic loading or sensitive receiving waters, they will implement a programme of improvements. The Highway Agency has a design manual for roads and bridges that describes measures for mitigating the impact of road run-off pollution[4].

The Highways Agency, the Environment Agency and DEFRA continue to work together to improve scientific knowledge and identify the most polluting drainage outfalls.

Pollution from Minewaters - DEFRA has funded a programme put in place by the Environment Agency to deal with areas where abandoned mines have affected nearby water. The prioritised programme has an initial £10million of funding to provide remediation works. For example in Saltburn Gil, North East England, a closed iron stone mine deposits iron oche into the river turning it orange. The result is over a hundred tonnes of iron being discharged into the North Sea which affects tourist trade from nearby beaches. It is therefore expected that this treatment plan will lead to an overall economic benefit.

Nature Improvement Areas - DEFRA state that they are part-funding twelve natural improvement areas intended to improve ecological networks to benefit wildlife and people. The projects have been identified by local partnerships that also drive the projects. Several of these are looking to improve water quality. For example, the Dearne Valley NIA includes

[4] This can be found at www.dft.gov.uk/ha/standards/dmrb/vol0/section1.htm

a component which will protect the Cudworth Dyke from industrial pollution. The project team are working with Yorkshire Water and local volunteers to conduct feasibility studies and carry out the subsequent engineering works.

Considered Actions - As well as describing those initiatives above, the DEFRA report also includes some actions that they felt may be needed to achieve their aims of combatting water pollution. They produce a list of ten items as follows:

1. Improve the evidence base to gain a comprehensive understanding of the scale and impact of urban diffuse water pollution sources, focussing initially on urban runoff, trading estates, in-situ contaminated sediment and misconnections. Then prioritise other sources depending on their potential impact including climate change impacts. Research gathering will be reviewed regularly to take into account the latest evidence.

2. Build on the achievements from existing initiatives by organised sharing of best practice and embedding within the Catchment Based Approachestools and techniques.

3. Use a detailed monitored catchment(s) to establish a more comprehensive understanding of how urban diffuse water pollution sources impact ecosystems.

4. Gain an understanding of the physical ways in which urban diffuse water pollution could be controlled cost effectively, looking at ways to encourage uptake, gather data on long term effectiveness, find out what, if anything, stops organisations using them.

5. Review the regulatory framework which is used to control non-agricultural diffuse pollution, and set out what potential cost effective improvements, if any, could be made including any potential deregulation.

6. Establish roles and responsibilities for tackling individual sources and the level of responsibility that this entails.

7. Set out who has a role to play in making a difference, ensure they are aware of the problem, what their roles are and what they need to do.

8. Embed the work within subsequent cycles of River Basin Management Plans.

9. Set out where there are other opportunities (such as SuDS or local authority planning including Surface Water Management Plans) for multiple environmental benefits – e.g. biodiversity, flood risk management - and look to embed water quality improvements within them.

10. Understand which behavioural and community based work is the most effective for improvement of quality of life through improving urban watercourses and embed this within the catchment based approach.

5. ENHANCING BIODIVERSITY AND MANAGING ALIEN SPECIES

The Water Framework Directive (WFD) is a European instruction that has been taken into UK law. They define alien species or invasive non-native species (INNS) as 'A species, subspecies, or lower taxon introduced outside its normal past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce' (UK Technical Advisory Group On The Water Framework Directive *Guidance on the assessment of alien species pressures*, March 2013).

For the purposes of this report, the research team contacted officers from the Council's Parks Team, Natural Resources Wales, Cardiff Rivers Group, Groundwork.org.uk and Dŵr Cymru Welsh Water to ascertain which species are problematic in Cardiff's rivers. The species named by each contact were Japanese Knotweed and Himalayan Balsam, which is why this section focuses mostly on these plants. The section also includes some general advice and case studies on the killer shrimp and zebra mussel as it was reported to us that both can be found in Cardiff Bay.

5.1 General Recommended Approaches

The Non-native Species Secretariat is an administrative office that is responsible for helping to coordinate the approach to dealing with invasive non-native species in Great Britain. It reports to a programme board which represents the relevant governments and agencies of England, Scotland and Wales.

In 2008 they produced a GB Invasive Non-native Species Strategy to meet the challenge posed by invasive non-native species in Great Britain and this was updated in 2015. The published strategy has the aim of providing a strategic framework within which 'the actions of government departments, their related bodies and key stakeholders can be better co-ordinated.' The strategy includes key recommendations from the DEFRA *Review of non-native species policy: report of the working group*, 2003. These are as follows:

- The Government should designate or create a single lead co-ordinating organisation to undertake the role of co-ordinating and ensuring consistency of application of non-native species policies across Government.

- Develop comprehensive, accepted risk assessment procedures to assess the risks posed by non-native species and identifying and prioritising prevention action.

- Develop codes of conduct to help prevent introductions for all relevant sectors in a participative fashion involving all relevant stakeholders.

- Develop a targeted education and awareness strategy involving all relevant sectors.

- Revise and update existing legislation to improve handling of INNS issues.

- Establish adequate monitoring and surveillance arrangements for non-native species in GB.

- Policies should be established with respect to management and control of INNS currently present or newly-arrived in the wild, and operational capacity be developed to implement these policies.

- Stakeholders should be fully consulted and engaged in development of INNS policies and actions through a mechanism such as a consultative forum.

5.2 Himalayan Balsam

The Environment Agency provide information on Himalayan Balsam in their report on managing non-native invasive plants (The Environment Agency, *managing invasive non-native plants*, 2010). It states that originally from the East Himalayas, Himalayan Balsam and can reach 150mm long and produce purplish-pink flowers between June and October. Mature seed pods explode when touched, shooting seeds in the air, and can also be spread by water. The plants grow in dense stands that suppress the growth of native

grasses and other flora. In autumn the plants die back, leaving the banks bare of vegetation, and therefore liable to erosion.

The report also suggests control measures and that these should aim to prevent flowering. This is best achieved before June. It states that chemical control can be used near water but using herbicides containing glyphosate or 2,4-D amine. The former will also kill grasses and the latter only broad-leaved weeds. These are most effective when the plant is small and growing, typically in the spring. The report also states that cutting, strimming or pulling on a regular basis for three years will be effective and may even eradicate the plant. Cutting should be done at ground level below the lowest node to avoid reflowering and before the flowering stage in June but cutting earlier than this will promote seen production from plants that regrow. This should be repeated regularly until the growth stops, which can be after around three years. Pulling can be effective for plants with shallow roots that can then be disposed by burning or composting if seeds aren't present. Grazing by cattle and sheep can also be effective in managing the plant from April until the end of the growing season and the report states there is encouraging potential for this method of control.

The Angling Trust also offers advice on some invasive species including the Himalayan Balsam (The Angling Trust, *17 Aquatic Invasive Non Native Species: Identification and Control*, Accessed 2016). There recommendations are summarised in the following table:

Table 1 – Angling Trust Suggested Treatments for Himalayan Balsam

Treatment	Suitability	Equipment	Efficiency	Constraints
Glyphosate chemical treatment	Good for large, dense infestations at the initial stage of long-term treatment. Good sward growth reduces the risk of erosion so this	Knapsack sprayer, life jacket and other personal protective equipment as dictated by risk assessment.	Good	Requires approval from the Environment Agency and certain qualifications. Potential damage on non-targets.

	method is usually replaced by control methods with less non-target damage.			
2,4-D Amine chemical treatment	Sites with dispersed growth and/or are prone to erosion and require a selective herbicide.	Knapsack sprayer, life jacket and other personal protective equipment as dictated by risk assessment.	Good, especially if retaining a grass sward.	Requires approval from the Environment Agency and has potential for non-target damage to broad-leaf species.
Mechanical Cutting	Effective if cut below lowest node to prevent flowering	Strimmer, brushcutter, hook, flail, fork. Vehicle and trailer plus personal protective equipment as dictated by risk assessment.	Good	Requires good access and methods for disposing of waste.
Manual Pulling	Suitable if site is not subjected to seed-fall from upstream or nearby unmanaged plants. Suitable for volunteer groups	Wheelbarrows, forks, rakes, vehicle and trailer plus personal protective equipment as dictated by risk assessment.	Good	Time consuming and requires good access.

5.2.1 The Clun Himalayan Balsam Project

The Shropshire Hills Area of Outstanding Natural Beauty (AONB) report on their website about The Clun Himalayan Balsam Project. (*A Strategy for the Control of Himalayan Balsam (Impatiens glandulifera) in the Clun Catchment Shropshire,* March 2014)They report that they were able to acquire funding from Natural England to map distribution of the plant and develop a strategy for its control. There was also a pilot study looking at how to control the plant and support was provided to river officers by the Environment Agency. Methods of hand pulling, strimming and the use of herbicides are listed as presented above.

The resultant strategy lists the following aims:

- A coordinating body with responsibilities to take this strategy forward.
- A strategy to raise awareness and understanding of the Himalayan Balsam in the catchment.
- Improved collection, management and sharing of information.
- Awareness raising to ensure landowners cross-compliance responsibilities are understood.
- Developing a shared responsibility amongst Clun stakeholders and secure a commitment by land managers to undertake its control in the catchment.
- Support for those landowners working to manage Himalayan Balsam.
- A three stage approach: Prevention, early detection and then control as the final option.

- A systematic approach to control by phased targeting sites affected by Himalayan Balsam.

- On-going monitoring.

The strategy states that it is primarily aimed at management of Himalayan Balsam but could also apply to other invasive species such as giant hogweed and Japanese knotweed.

5.2.2 Mid Wales Himalayan Balsam Eradication

Natural Resources Wales issued a press release about the signs of success in getting rid of Himalayan Balsam in three rivers in mid Wales (Natural Resources Wales *Tackling Himalayan Balsam along mid Wales rivers,* November 2015). The Ystwyth valley is now largely free of Himalayan Balsam thanks to a process of pulling and cutting several times a year before any seed is produced. By working on the problem from the tops of catchments, the risk of the plant recolonising further downstream is limited. A blog[5] has been set up to show how work is progressing and allows sightings to be reported. To this end Natural Resources Wales are also working with the Welsh Government on a phone app to facilitate the identification and logging of invasive plant species.

5.2.3 Current Approaches to Himalayan Balsam Eradication in Cardiff

In email correspondence with a council Conservation Officer, they stated that there is planning to train volunteers to map both Japanese Knotweed and Himalayan Balsam that will provide spatial data to help monitoring and spraying in the long term. It is hoped that this may start next year.

5.3 Japanese Knotweed

The Environment Agency provide information on Japanese Knotweed in their report on managing non-native invasive plants (The Environment Agency, *managing invasive non-*

[5] http://himalayanBalsamwales.co.uk/blog

native plants, 2010). It states that since being brought to Britain as an ornamental plant in the mid-nineteenth century, Japanese Knotweed has cause problems, notably on roadsides, riverbanks and derelict land where it displaces native flora and can cause structural damage.

The report states that Japanese knotweed forms dense clumps with fleshy, red/green shoots and can grow to two or three metres tall with hollow green stems with red or purple flecks. Clusters of flowers bloom in late summer and the root system can extend for seven metres. The crown, located at the base of the stem, will produce new plants and dead plants takes up to three years to decompose. A waste license is required to remove Japanese knotweed from its site.

The report prescribes that knotweed should be subjected to a single clean cut near the base of the stem. Flailing or other cutting methods that produce fragments should be avoided as stems can regenerate from nodal fragments.

A cut stem can be burnt if it is crisp and brown or disposed as an inert waste. If stems have been pulled up, there will be fragments of knotweed crown at the base, which is highly regenerative.

Near water, chemical control using an approved bioactive formulation of glyphosate is the most effective treatment near water. Spraying both top and underside of leaves improves control. Chemical treatment is most effective in August and September and especially when applied to mature uncut growth. Chemicals can be injected into the stem to avoid damaging surrounding areas.

The Angling Trust also offer advice on Japanese Knotweed (The Angling Trust, 17 Aquatic Invasive Non Native Species: Identification and Control, 2016). There recommendations are summarised in Table 2:

Appendix 2

Table 2 – Angling Trust Suggested Treatments for Japanese Knotweed

Treatment	Suitability	Equipment	Efficiency	Constraints
Glyphosate chemical treatment	Good for large, dense infestations where treating mature growth will result in unacceptable levels of spray drift or where full height canes will compromise land use.	Knapsack sprayer, life jacket and other personal protective equipment as dictated by risk assessment.	Moderate	Requires approval from the Environment Agency and certain qualifications. Potential damage on non-targets.
2,4-D Amine chemical treatment	Sites with dispersed knotweed growth and/or is prone to erosion and therefore needs a selective herbicide to preserve the sward.	Knapsack sprayer, life jacket and other personal protective equipment as dictated by risk assessment.	Moderate but good if preserving a sward is a priority.	Requires approval from the Environment Agency and has potential for non-target damage to broad-leaf species.
Glyphosate applied into stem freshly cut below a node.	Smaller infestations or sites sensitive to non-targeted herbicides or areas with a grass sward in close proximity.	Knapsack sprayer, life jacket and other personal protective equipment as dictated by risk assessment.		Requires approval from the Environment Agency and certain qualifications.
Combination Treatment of	Tends to be used on development	Digger/swing shovel,	Good but likely to be of limited	Requires approval from

chemical treatment and physical disturbance of soil.	sites. May be appropriate for flood defence capital schemes in riparian areas.	dumper/tractor and trailer. Life jacket and other personal protective equipment as dictated by risk assessment.	use in riparian situations unless it's for capital schemes.	the Environment Agency. Potential damage on non-targets.
Manual cutting	Generally used to clear an area prior to chemical treatment. Not recommended as a sole course of treatment as provides potentially infectious waste. Suitable for volunteer groups.	Brushcutter, hook, flail, fork. Vehicle and trailer plus personal protective equipment as dictated by risk assessment.	Good but canes must be carefully disposed of.	Time consuming and requires good access.

The UK Government website also offers guidance on how to prevent the spread of Japanese Knotweed (UK Government *Guidance: Prevent Japanese knotweed from spreading*, 2016). They suggest that spraying with chemicals may be effective but that it usually takes three years and may require a certificate of competence in herbicides, a Control of Substances Hazardous to Health assessment, permission from Natural England on a protected site or permission from the Environment Agency.

In terms of disposing of the plant, the advice is that an environmental permit, registered waste exemption or trade effluent consent. Chemicals need to be disposed through a registered waste carrier to a permitted waste disposal facility. The advices states that before burying non-native invasive plant waste, it is necessary to check with the Environment Agency because normally it is only permissible to bury such waste on a landfill site with a suitable permit. The guidance goes on to say that Japanese knotweed

can be buried on the site where it is produced as long as it is buried to a depth of at least five metres, the plant remains are covered with material the plant can't grow through and no other types of waste are buried with it. The Environment Agency also needs to be notified a week before any plants are buried.

Waste can be burnt privately as an individual but parts of the plant may survive so should be buried or disposed off site. It is an offence to keep waste that may cause harm to the environment or to human health and a registered waste carrier and authorised or suitable disposal site must be used. The guidance is to check with the waste site in advance to ensure it has the correct permit for accepting the plant and make clear it is Japanese knotweed that is being transported.

5.3.1 Ayrshire River Trust Success

As detailed in a blog on the Ayrshire Rivers Trust website (Ayrshire Rivers Trust *Success with Japanese Knotweed*, May 2013) as part of a Controlling Priority Invasive Non-native Riparian Plants and Restoring Native Biodiversity project, the trust was awarded a contract to control Japanese Knotweed on the River Irvine. According to the blog, they sprayed 'roundup pro bioactive 450g/l when the plant was fully grown and in flower. During the winter, dead stems were cleared with assistance from a local angling club. The practice was found to be a success and the following spring saw a lot of new plant growth. Some knotweed remained but in an area that had been underwater.

It was intended for contractors to return to attend to the plants that remained and for stem injection techniques to be used to control plants growing within the flood line over the summer.

5.3.2 Japanese Knotweed in the Tyne Valley

As they report on their website (Tyne Rivers Trust *Tackling Japanese knotweed, Accessed November 2016)* in the Tyne Valley, the Tyne Rivers Trust was employed to identify key locations of risk and train volunteers in the method of stem-injection using Environment Agency approved herbicide. The process reduces the plant's ability to produce new stems

and hold leaves for photosynthesis which results in it dying. The method is described as being more labour intensive than spraying or digging with machinery but the Trust identified small sites of risk where it has proved very effective. The site has been treated for three years and volunteers return to monitor the much-reduced stems that need treating. Pesticide Application certificates have been earned from the Environment Agency by the volunteers.

5.3.3 Pembrokeshire County Council

On their website (Pembrokeshire County Council, *Japanese Knotweed*, Accessed November 2016) Pembrokeshire County Council have listed the following aims with regard to managing Japanese Knotweed:

- Raise awareness to landowners and members of the public about how invasive Japanese Knotweed is, also to stress the importance on its eradication in Pembrokeshire.

- Ensure that Japanese Knotweed where growing on the highway does not affect sight-lines and signage.

- Treat all patches which are entirely within PCC limits within available resources.

- When contacted by the public wanting to control a patch on their land, the Council will co-operate with landowners with advice on appropriate treatments. In previous years we have negotiated a treatment rate with our approved contractor for private landowners if they wish to undertake an eradication process.

- The County Council as an Authority will aim to ensure that other organisations that are working within PCC controlled land will adopt good working practices to control and prevent the spread of Japanese Knotweed.

- Whilst herbicides will be the most frequent and effective method of control, other methods will be researched and implemented and to minimise the use of chemicals

and to use the herbicide most appropriate for the site taking into account County Council Policy on the use of herbicides, health and safety (of the operator and the public) and most importantly the environment.

5.4 Invasive Non-Native Animals

In email correspondence with the Chairman of the South East Wales River Trust, they stated that Cardiff Bay currently contains killer shrimp, a more aggressive breed than the native shrimp. They also said that the Bay contains the Zebra Muscle, which is a small version of the muscle that has taken over the gravel substrate. It was their opinion that there probably isn't anything that can be done because these species are well established.

5.4.1 Killer Shrimp

The Non-Native Species Secretariat have published a briefing note (GB Non-Native Species Secretariat *Invasive Shrimp, Dikerogammarus villosus*, 2011). In it they report that a Task Group of staff from DEFRA, the Welsh Government (WG) and expert advisers from the Environment Agency, Natural England and the Countryside Council for Wales was set up to coordinate a response plan and manage its delivery. The proposed actions include containment of known populations, promoting bio-security measures, surveillance and monitoring, managing the risks at high value nature conservation sites, and commissioning and supporting key research to improve our understanding of the shrimp and how best to manage its impact.

According to the briefing paper, containment action has been taken since the creation of the Task Group. Site owners, operators and user groups have developed risk assessments and implemented bio-security measures such as jet washing. They have also implemented other containment actions like barriers and are supported by the local Environment Agency, Natural England and Countryside Council for Wales. There are clear signs warning about the shrimp and active promotion among users and operators.

The paper states how the Environment Agency has developed a monitoring programme across English and Welsh water bodies that includes site-specific monitoring where killer

shrimp are known to be and at routine monitoring locations. Different techniques are used such as specially designed traps at vulnerable sites and kick sampling elsewhere.

According to the paper, Natural England and the Countryside Council for Wales are promoting bio-security awareness among owners and recreational users of sites that are designated as having nature conservation importance. Local staff are on hand to provide advice and guidance to help reduce the risk of introducing species like the killer shrimp.

The Scientific and Technical Advice Group (STAG) has provided expert advice and maintains an overview of research activity. They report that no significant control of the species has been achieved on the continent meaning this group is breaking new ground.

A study funded by the Esmee Fairbairn Foundation and Natural England investigating the implications for biodiversity of invasion by D.villosus, including whether the predatory impact and prey range as observed in Europe would be similar in the UK; whether the shrimp may carry parasites or be affected by parasites in the UK; and the factors affecting its potential spread. This is being led by Cambridge University, supported by the University of Leeds and Queen's University, Belfast.

DEFRA has commissioned research into suitable disinfectant substances that might be usable to enhance the effectiveness of bio-security measures whilst also being safe and practical for use in the field.

There are also proposals for an investigation into what may be viable means for achieving significant control of killer shrimp populations. A study funded by the Defra Water Framework Directive will help better understand the introduction pathway for species like the shrimp and zebra mussel.

The prevalence of the killer shrimp has triggered both species-specific and more generic awareness. One campaign that is a result of this is the "Stop the Spread – Check, Clean Dry" campaign that's widely supported by different bodies. The paper states that there have been several public reports of suspected detections which have been investigated.

In addition, recreational bodies, NGOs and other relevant organisations are also now raising awareness of the issues on invasive non-native species among their memberships

In Wales, EAW has been pro-actively working with the media (e.g. BBC & HTV) and others to promote key messages on bio-security measures and monitoring work to help maintain awareness and ensure these messages reach the widest possible audience.

5.4.2 The Zebra Mussel

According to the non-native invasive species secretariat（GB Non-Native Species Secretariat *Zebra Mussel, Dreissena polymorpha*, 2011) , zebra mussels are found in rivers, canals and lakes and can block pipe-work and affect lock gates as well as smother native species and take nutrients from the water.

The secretariat website also links to a Northern Ireland strategy for managing zebra mussels (Zebra Mussel Management Strategy For Northern Ireland 2004 – 2010, 2005). The cornerstones of this strategy are the following objectives and related actions:

Table 3 – Zebra Mussel Management Strategy Objectives for Zebra Mussels in Northern Ireland

Objective	**Actions**
To raise awareness among the public and target groups in order to encourage them to take action to minimise the spread of the zebra mussel.	Prepare a single, updated leaflet for water users containing advice on preventing the spread of the mussel, a key contact if the zebra mussel is sighted in a new lake and reference to the web-site for further information. Prepare lake specific posters for Lough Neagh and Lough Melvin. Slipway signs should be placed at the main launching points on vulnerable lakes. Develop an annual electronic newsletter and compile an email list for its distribution.

	Develop a zebra mussel web-site, which should include facilities for reporting new sightings and subscribing to the annual newsletter. Carry out an annual press release campaign at the start of the main boating and angling season. The chair of the Zebra Mussel Control Group (ZMCG) or their nominee to respond to press enquiries. Education on invasive species and their implications should be retained and improved within school curricula and higher education centres.
Amend and co-ordinate appropriate policy and legislation.	Amend the Wildlife (NI) Order (1985), Article 15, to enable prosecution of intentional introductions of species that are non-native but that are already present in Northern Ireland.
Identify sectors involved in the spread of zebra mussels and characterise the necessary requirements for each sector to ensure their activities are not responsible for the further spread of zebra mussels in Northern Ireland.	Identify sectors that have the potential to spread zebra mussels (marina /slipway managers, boaters, anglers, fisheries managers, environmental agencies and researchers, the tourism sector, boat importers and sand abstractors). Develop and maintain a list of contacts for each sector. Identify the activities of each sector that may contribute to the transfer of zebra mussels and categorise these activities as high, moderate or low risk. Identify which sectors require basic information or training about invasive species issues and how to prevent the spread of zebra mussels. Identify whether any sectors require specific codes of practice for their activities or development of new legislation. If codes of practice are required they should be developed in consultation with

	stakeholders and north south co-operation.
Continue research on the spread, impacts and the level of awareness of the zebra mussel in Northern Ireland. Ensure research is made widely available.	Maintain the level of expertise on zebra mussels in Northern Ireland. Implement a structured surveillance programme of the most vulnerable lakes. Continue research into the ecological and economic impacts of the zebra mussel in Northern Ireland. Complete a risk assessment of Water Service facilities that are located on lakes that have been identified as vulnerable and develop a contingency plan for action if zebra mussel infestation of facilities occurs. Continue to disseminate findings of research in scientific literature and make provisions to inform the general public on important findings. Review the effectiveness of the zebra mussel education and awareness programme. Repeat surveys of the level of awareness of the zebra mussel among important lake user groups after three years.
Develop contingency protocols for immediate response if new lake invasions are reported.	Appoint a named section within an agency as responsible for rapid confirmation of a reported zebra mussel sighting. Follow the general protocol for responding to a report of zebra mussel spread. Prepare a generic press release that can be sent out immediately once a new invasion is confirmed. Compile and maintain a contact list of appropriate government agencies that will need to be informed.

	Compile and maintain a contact list of appropriate government agencies in the Republic that will need to be informed, in those cases where a lake is located in both jurisdictions. Compile and maintain a contact list of stakeholders for Lough Neagh and Lough Melvin.
Develop a mechanism to co-ordinate action, policy and information sharing on an all island basis.	Initiate liaison with the Environmental Protection Agency and National Parks and Wildlife Service for a drive towards harmonisation of legislation between the two jurisdictions.

A news story from the Star Tribune in America (Star Tribune, *Treatments on Christmas Lake kill off zebra mussels*, April 2015) reports that researchers had some success although it says this had not been duplicated elsewhere in America. They used 'Zequanox' which is a product made from dead bacteria that kill zebra mussels when they eat it.

The Department of Natural Resources worked alongside with the Minnehaha Creek Watershed District, city of Shorewood and University of Minnesota researchers and obtained special federal emergency permission to use potash and copper treatments along with the Zequanox.

The infestation had been discovered as part of the watershed district's early detection program. Two members of staff conducted searches of the shoreline and surveys of the lake that allowed early detection.

The reports cites officials who said the treatments are too difficult and costly for larger lakes but could be useful in future isolated infestations of zebra mussels.

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